The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices

by

DAMTEW WOLDE BERKU

Submitted in accordance with the requirements for the degree of

DOCTOR OF PHILOSOPHY

in the subject

EDUCATION

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: Prof H M van der MERWE

AUGUST 2019

DECLARATION

Name: Damtew Wolde Berku

Student number: 58546596

Degree: PhD in Education (Education Management)

I declare that 'The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices' is my own work and that all the sources I have used or quoted have been indicated or acknowledged by means of complete references.

I further declare that I submitted the thesis to originality checking software and that it falls within the accepted parameters for originality.

SIGNATURE

27/05/2019

DATE

DECLARATION BY SUPERVISOR ON ORIGINALITY REPORT

I, Prof HM van der Merwe, declare that I have considered the originality software checking report submitted by D.W. Berku. I confirm that the thesis meets an acceptable standard of originality.

23 July 2019

Prof HM van der Merwe

Date

ACKNOWLEDGEMENTS

First, I would like to thank the Almighty God who allows me to realize my dream.

I would then like to express my deepest gratitude to my supervisor, Professor HM van der Merwe, for her unreserved professional advice, critical comments and strong support, without which this thesis might not have been completed.

I also would like to thank Dr. Wossenu Yimam and Dr. Girma Lemma for validating the instruments, and Dr. Dion van Zyl, Dr. Dessalegn Chalchisa and Dr. Berhanu Abera for their constructive comments in improving the instruments.

Special thanks also go to the participants of the study, and Ato Solomon Wolde and Ato Yohannes Horamo for their demonstrative support during data collection.

I would like to thank Mr. Brian Carlson for editing the manuscript and Mrs. M Botha for her technical support.

I owe special thanks to the Debre Berhan University and the University of South Africa for their financial support.

Finally, yet importantly, I would like to express my special thanks to my wife, Etetu Dagne, for her candid support and encouragement.

ABSTRACT

An important function of higher education institutions, including the ones in Ethiopia, is leading and managing research and innovation at policy and practice level. Research and innovation leaders at an institution's university, college and project level should manage and lead research and innovation activities to be aligned with local community problems, internal problems, the problems of industry and the socio-economic challenges of the country. To manage and lead research and innovation projects effectively, these leaders should be competent in administrative, adaptive and enabling leadership that relate to complexity leadership theory embedded in knowledge-based economies.

The main aim of the study was to understand the competency of research and innovation management and leadership at policy and practice level at higher education institutions in Ethiopia. A literature study and an empirical investigation were carried out with the empirical investigation consisting of a mixed-methods research approach. Data were collected using document analysis, semi- structured individual interviewing and a structured questionnaire. Four Ethiopian universities served as research sites representing first-, second- and third-generation institutions in Ethiopia. Participants included 358 academics who completed the structured questionnaire. Individual interviews were conducted with 12 research leaders at university level and 11 each at college and project level. Individual interviews were also conducted with 11 co-investigators, 11 community leaders, 6 industry managers, and 2 officials at federal level.

Key findings revealed that the research policies of the four research sites were not formulated in line with the national Science, Technology and Innovation Policy of Ethiopia, and the framework for Ethiopian higher education research and technology transfer policy document. Research leaders at university, college and project level were not competent in research and innovation project management and leadership to be aligned to problems of the local community, internal institutional problems, industry and the country. The contributions of research and innovation projects in producing relevant knowledge, appropriate technologies, and competent human capital were found to be insignificant. To improve the research and innovation management and leadership capacity at Ethiopian higher education institutions, a model was developed that is focused on administrative, adaptive and enabling leadership for research leaders at university, college and project level.

Keywords: adaptive leadership; administrative leadership**;** enabling leadership; higher education institutions; innovation project leadership and management research and innovation policy; research policy; research project leadership and management; science, technology and innovation policy.

TABLE OF CONTENTS

List of tables

List of figures

List of appendices

Abbreviations and acronyms

ALL- Activity Led Learning

CDRI - Cambodia Development Resource Institute

EquATE-the Equal Acclaim for Teaching Excellence

EU -The European Union

FDRE - Federal Democratic Republic of Ethiopia

CDRI- Cambodia Development Resource Institute

HERANA- the Higher Education Research and Advocacy Network in Africa

ICT - Information and Communication Technology

MInT- Ministry of Innovation and Technology

MoE- Ministry of Education

MoSHE- Ministry of Science and Higher Education

MoST- Ministry of Science and Technology

NEPAD -New Partnership for Africa's Development

OECD - Organisation for Economic Cooperation and Development

STI policy-Science, Technology and Innovation policy

CHAPTER 1
ORIENTATION TO THE STUDY

1.1 INTRODUCTION

Worldwide higher education institutions of the 21st century should carry out three main and interrelated functions: teaching, research and community engagement. Besides teaching and providing service to the community, higher education institutions should produce, transfer, and apply knowledge to solve the problems of their local communities and to make their nations' citizens competent and all-rounded through socio-economic development based on innovation and technological advancement. These activities are required from the 21st century era of knowledge-based economies. In doing so, developed and some developing countries, have different institutions of higher education for the different functions of higher education in order to focus on one main function only. Countries have therefore established teaching and research-intensive universities separately so that the research-intensive universities can mainly engage in producing new knowledge that leads to innovation in science and technology. For instance, the South Korea government developed a programme, the Brain Korea 21 project, aimed at fostering world-class research universities to produce new knowledge and technology, and to build the capacity of other universities in the country (Kang, 2015:173). The Chinese government also embarked on an initiative called the Project 211 initiative to develop the research capacity of the country by establishing a total of 100 world-class higher education institutions so that these institutions can provide skilled manpower to be competent to compete effectively in the world markets of the 21st century (Ma, 2003:18).

In developing countries like Ethiopia, an expansion of higher education institutions took place with the mission of leading and managing the three functions of higher education, namely teaching, research, and community engagement in an interrelated and integrated way. The function of these higher education institutions is to prepare competent graduates, to undertake relevant research and to transfer knowledge and skills to the community (Federal Democratic Republic of Ethiopia [FDRE], 2009:4979; Yizengaw, 2004:12). Among the three functions of higher education, research is given a key role to fulfil insofar as to improve the quality of teaching and learning in the institutions through research-based teaching (FDRE, 1994:15) in order to ensure real-world societal improvement (FDRE, 1994:27).

Even though the current Ethiopian education and training policy and higher education proclamation emphasises the role of research to improve the quality of teaching to solve the problems of the local community and to provide quality community engagement (FDRE, 1994:5; FDRE, 2009:4990), there are many problems in the curriculum design and development. There are also problems in the actual application of teaching and learning at higher education institutions. The problems relate mainly to the beliefs and attitudes academia have about the curriculum and their own teaching. The academics do not research their own practice for change and improvement even though they are the experts who design and develop the curriculum, and who are the experimenters in the classroom (Areaya, Shibeshi & Tefera, 2011:63; Jebessa, 2007:1).

Because of this lack of reflection, there is no convincing evidence that the research studies done so far in the Ethiopian higher education institutions have produced new knowledge and have innovated new ideas and new ways to solve contextually based societal challenges and problems relating to their own situations. In this regard, Yizengaw (2004:7) studied the status, challenges, and contributions of the Ethiopian higher education system to labour force development and found that though there are some studies conducted in a few of the higher education institutions, these studies did not have the capacity to solve their own institutional problems, or the immediate societal or national problems. For research and innovation to produce new knowledge that contributes to improve the functioning of the specific institution, the community, or the country, the research culture of the institution and the capacity of each individual researcher should be developed optimally. This demands competent and quality research and innovation leadership and management at each higher education institution that is aligned to the research and innovation policies of the country (Debowski, 2010:221; Kowang, Long & Rasli, 2015:33; Lasambouw, 2015:13; Olsson & Meek, 2013:11). The focus of this study is therefore on the leadership and management of research and innovation practices at higher education institutions in Ethiopia and on the way in which these practices that are aligned to institutional and national policies contribute to improved human competency.

1.2 BACKGROUND TO THE STUDY

Research and innovation policies are the backbone of higher education institutions and they lead research and innovation activities at institutional and at project level functioning. Leaders and managers of research and innovation at higher education institutions are fully conversant

with the research and innovation policies at their institutions that are aligned to the research and innovation policies of their countries. This implies certain competencies for the research and innovation leaders at the different levels of institutional operation. These qualities and competencies pertain to knowledge and skills regarding teaching, producing new knowledge, and using technology to solve institutional problems, and the problems of the local community, while improving global competitiveness relating to knowledge-based functioning.

1.2.1 Theoretical orientation

Leadership theories that guide the practices of leadership and management in different contexts relate to trait, behaviour, contingency, influence, and relational theories (Daft, 2011:19). Trait leadership theory emphasises the leader as being intelligent, honest, self-confident, and energetic which differentiates him or her from followers and which confirms his or her successfulness (Daft, 2011:20). As opposed to trait theory, behavioural leadership theory emphasises leaders' actions representing a change of focus from which leaders are to what leaders do. As traits or behaviour on their own do not define a leader as effective and successful, contingency leadership theory argues that the success of a leader depends on the situation or conditions in the organisation. These conditions pertain to the characteristics of followers, the characteristics of the work environment, follower's tasks, and the specific external environment (Daft, 2011:40). The fact that the success of a leader depends on the specific task, the specific organisational structure, the specific context, and the specific environment, the implication is that the specific situation directs the specific leadership and management action with no best way of leading an organisation in all circumstances (Daft, 2011:20).

In addition to the traits and behaviour of leaders and the specific situation in the specific organisation, the relationship between leaders and their followers also determine the success of leadership pertaining to relational theories of leadership such as transactional and transformational leadership. Transactional leaders know their followers' needs and desires and lead to fulfil these needs and expectations by rewarding followers based on performances. Transformational leadership focuses on needed change in both their workers and the organisation by encouraging innovation in services, products, and technologies (Daft, 2011:320). As is the case with all organisations, theories of leadership guide effective practices in complex organisations such as higher education institutions (Bush, 2007:402). However, based on a shared leadership approach, leadership in higher education institutions is distributed

to departmental levels such as academic departments, research groups, the administration departments and academic support staff departments (Shattock, 2003:92). These decentralised leadership actions contribute to transformational leadership in the sense of vested power to manage and lead research at project level (Elkins & Keller, 2003:597; Shattock, 2003:92).

Recent debates emphasise that leadership theories that were developed for industrial period functioning are not applicable to 21st century knowledge-based functioning (Uhl-Bien, Marion & McKelvey, 2007:298). The argument is for complexity leadership theory that pertains to the enabling of learning by means of creative and adaptive capacity to engage with the complex systems of adaptive dynamism of knowledge-based organisational functioning (Uhl-Bein *et al*., 2007:298). Complex leadership theory focuses on identifying and exploring the strategies and behaviours that foster organisational and sub-unit creativity, learning and adaptability (Uhl- Bein *et al*., 2007:299). With reference to higher education institutions, complex leadership theory enables researchers and students to study the complex relationships in leading and managing research and innovation in their own established systems in order to interconnect these research and innovation efforts to institutional and national level research and innovation for the benefit of the immediate communities and the extended society. These enabling capacities result in producing knowledge and translating the produced knowledge into the economy for the sake of societal improvement.

Complexity leadership theory guides this study. This theory helps to understand and explain administration leadership, enabling leadership and adaptive leadership of research and innovation in higher education institutions. This requires undertaking complex tasks among the government bodies at different levels, the communities, and industries around the institutions, and the institutions. This also necessitates complex interaction between and among researchers and research team leaders at project level, and leaders and managers of research and innovation within and outside the institutions while developing and implementing research and innovation projects, mobilising resources and utilising the outcomes to address the problems of the community and a nation at large.

1.2.2 Research and innovation policies at higher education institutions

Research and innovation policies of higher education institutions are derived from national public policies as these policies pertain to matters such as education, agriculture, health, science

and technology and are developed in line with the research and innovation policy of the specific country (Olsson & Meek, 2013:8; Yizengaw, 2005:4). Olsson and Meek (2013:8) point out that the research and innovation policies of contemporary times differ from those of the past generation science and technology policies insofar as that the contemporary policies are focused on meeting the needs of low and middle-income countries whereas past policies were focused more on high-income country activity. In this regard contemporary research and innovation policies emphasise the need for universities and other public research institutions to focus on research that fulfils the needs of the community and the society at large. By creating public-private partnerships, higher education research is connected to the economy with mutual benefit for both constituencies (Olsson & Meek, 2013: 8).

The difference between science and technology policy, and research and innovation policy is the addressing of the socio-economic development of low and middle income countries. For higher education institutions of these countries, the main research focus is on the problems of the local community (Olsson & Meek, 2013:8). In order to address the context-specific problems, higher education institutions establish partnerships with private organisations to commercialise research findings and to contribute to the socio-economic development of the specific society. This is made possible by a well-established operational system that prompts interrelated interactions and coordination between different stakeholders to produce new knowledge, and technologies for functional application to their own context (Jongbloed, Enders & Salerno, 2008:313*)*. However, not choosing the right research agenda for the specific community, not creating constructive partnerships between the public and private organisations, and not establishing a system that helps different bodies to work together for the public good are problems that are not anticipated or observed at policy level. These problems are experienced as the major problems of higher education institutions when implementing their research and innovation policies at grass-root level (Yizengaw, 2008:11).

There are close connections between policy, management, and implementation at universities (Shattock, 2003:178). This relationship implies that the specific higher education institution, as an autonomous entity, develops its research and innovation policy to be aligned to central policy requirements. The institution leads and manages the implementation of its own policy. For instance, the research policy of Segu University in Ethiopia is developed in line with its internal policy like legislation, and higher education proclamation at national level (Segnu University, 2011:4). Even if the national legislation focuses only on the teaching function of

the institutions, there is a harmonized academic policy for Ethiopian public higher education institutions (Harmonized Academic Policy of Ethiopian Public Higher Education Institutions, 2013) which universities do not necessarily use as a reference for their internal research and innovation policy.

In this regard, the individual institution monitors and reviews its policy implementation. The individual institution also reviews and improves its policy based on shortcomings observed during implementation and it ensures constant alignment with the current developmental needs of the specific community. Olsson and Meek's (2013:23) comparative analysis of the effectiveness of research and innovation management at policy and institutional level in Cambodia, Malaysia, Thailand, and Vietnam, for example, shows that the governments of the four countries have a strong commitment to the importance of research and innovation at policy level. However, deficiencies in knowledge and skills competency are still experienced in these four societies that influence effective research and innovation management at the applicable higher education institutions. Ogbodo, Efanga and Ikpe (2013) assessed the policies and practices of knowledge production in higher education institutions in Nigeria. They identified that although the higher education research policy of the country gave the higher education institutions of Nigeria the role to produce knowledge that can contribute to the socio-economic development of the country, the general practice in the different institutions was not focused on knowledge production. The practice was focused mainly on knowledge recycling and the transfer of knowledge that was produced by others in other systems of functioning (Ogbodo *et al*., 2013:11). These two studies point to a potentially negative phenomenon, namely that of not addressing contextual needs which warrants empirical investigation in order to contribute to better understanding and possible solutions.

In South Africa, Mashau, Mulaudzi, Kone and Mutshaeni (2014**:**523) emphasise that since South African universities are producing, the present policies and Acts of the country should guide transferring and applying knowledge, the leadership of the institutions. Similarly, the National Development Plan Policy of Uganda and its national research policy emphasises the importance of research and innovation in higher education and other research institutions for its all rounded socio-economic development and transformation. As a result, universities in Uganda have to produce advanced knowledge and innovation through research and adapt to local contexts and they have to develop technological capacity needed to address local problems (Jowi, Obamba, Sehoole, Alabi, Oanda & Barifaijo, 2013:122). In the Ethiopian

context, higher education policies are also developed in line with national policies and strategies (Yizengaw, 2005:4-6). This implies that the research and innovation policy of the higher education institutions in Ethiopia are derived from higher education proclamations, the national education and training policy, the national research/science, technology and innovation policy, and national poverty reduction and other development policies of the country. It is not clear, however, how the higher education institutions of Ethiopia are leading and managing their research and innovation activities according to national research and innovation policies and guidelines.

Apart from the African context, Lasambouw (2015) identifies factors in Indonesia that influence the performance of research management in Vocational Higher Education. These factors pertain to the accuracy of the research policy, the completeness of the research programmes and the sufficiency of research funding. Additional factors relate to the thoroughness of research processes, the promptness of monitoring and evaluation of research programmes and the adequacy of researcher competencies. The availability of research facilities, the effectiveness of Information and Communication Technology, and the success with dissemination of research results is factors that hinder research management performance (Lasambouw, 2015:13). The importance of research leadership in higher education institutions as a crucial component of research endeavour is studied limitedly. The inadequacy of developing research and innovation policies at higher education institutions to be in line with their countries' national research and innovation policies using qualitative and quantitative data is not sufficiently disclosed in literature. A well-developed national research and innovation policy resulting in successful implementation at institutional level for improved well-being for the country is contingent on competent research and innovation leaders and managers at higher education institutions.

1.2.3 Leading and managing research and innovation competencies at higher education institutions

Competent research and innovation leaders and managers at higher education institutions lead and manage their institutions on the macro level to create new knowledge and new technologies to solve the problems of their local communities and to make their nations competent to function in a knowledge-based socio-economic environment (Abari, Oyetola & Okunuga, 2014:2). These leaders also lead and manage their academic communities on the micro level.

The management and leadership on the micro level pertains to ensuring academics reflect on their own teaching and their students' learning by constantly questioning the status quo in relation to curriculum design and development, their assessment practices, and the evaluation of required learning. The leaders also question the relevance of programmes to labour market requirements to ensure the sustained production of graduates competently prepared for the labour market, and the production of researchers and innovators competently prepared for endeavour at their own institutions (Abari *et al*., 2014:5).

Galland, Mccutcheon and Chronister (2008:15) report on the development of research leadership and management skills of post-doctoral students at the Laboratory Management Institute, at the University of California. The postdoctoral scholars, an often neglected but essential group to the academic research enterprise, were provided with a forum to share their experiences to grow professionally (Galland *et al.*, 2008:51). Although it was clear that these postdoctoral scholars developed professionally, it was not clearly distinguished what the research leadership and management skills were that the students had had before they participated in the programme for skills development and the specific skills they developed after engaging in the programme. The implication is that even post-doctoral students do not necessarily develop required research leadership and management competencies satisfactorily.

The competencies that research leaders and managers should have include aspects such as knowledge of the specific university and its research strategy, policy and protocols. These competencies also include comprehensive knowledge of research projects, knowledge and skills about risk management and quality assurance that include thorough knowledge of national performance indicators and the meaning of these indicators (Gallannd *et al*., 2008:52). Research leaders should also be competent in motivating, inspiring, enabling, setting direction, communicating with research team leaders and researchers, and producing change in their institutions. Research managers should have knowledge and skills of financial management, human resource management, staff recruitment and selection management, and the assessment of performance and productivity (Debowski, 2010:218). The management of conflict resolution, engagement in mentorship and capacity building endeavours and marketing and sponsorship of the research group and the outcomes of the research are all functions that are carried out by research managers. Relationship management as these relationships pertain to industry engagement and philanthropy initiatives are important competencies required from the research manager (Olsson & Meek, 2013:44).

The research function of academia is the main source of knowledge and innovation at national, regional, and international levels (Meek, Teichler & Kearney, 2009:11). As university-based research has importance to innovation (Atkinson & Stewart 2011:1), the leaders are expected to lead and manage innovation. To do so, the leaders should have innovation management competencies including mentorship of innovation and incentives for the innovative employees and should incorporate innovative behaviour in the day-to-day tasks of the employees (Kuratko, Goldshy & Hornsby, 2012:73). The leaders should also have innovation leadership competencies relating to clearly defining specific challenges, absorbing uncertainty, defining what is accepted and what is not, and clearing obstacles in the process of innovation (Kurakto *et al*., 2012:18). To bring meaningful change in higher education, academic leaders have to develop and create a culture of innovation (Buller, 2015:151). Although not necessarily having strong leadership that facilitates and leads different activities for the change that innovation requires (Casas & Stojanovic, 2013:249), universities in general understand the significance of research-based innovation.

In order to successfully lead and manage research and innovation at higher education institutions, the leaders of these portfolios at their specific institutions should understand the main research and innovation policy goals of their national governments (Olsson & Meek, 2013:11). As the portfolio of leadership and management of research and innovation is a relatively recent area at higher education institutions of developing countries, people in charge of this portfolio need institutional governance knowledge with an awareness of the importance of a research and innovation setting in order to establish a research culture (Olsson & Meek, 2013:12). The competence of establishing a structure for research and innovation and knowing the internal and external environment to respond to societal needs with the research that is carried out represents the foundation for leading and managing research and innovation at higher education institutions in developing countries. Developing a culture and capacity for research at their different institutions of higher education and maintaining good quality research and innovation to contribute to quality teaching and learning and the solving of societal problems on local and national level, is challenging but constitutes the most rewarding responsibility of leaders of institutional research (Abari *et al*., 2014:7). This requires from leaders to employ administrative, enabling, and adaptive leadership of complexity leadership theory, because higher education institutions are complex systems demanding from leadership and management the capacity to engage successfully with complex tasks such as managing research and innovation endeavour constructively.

With reference to the research culture of a higher education institution in Mexico, Méndez and Cruz (2014) found that conducting research was perceived to be just another component of the workload resulting in an increased load of work to be done daily. There was a lack of genuine interest in knowledge for the sake of improved learning resulting in advanced living and how these escalating advantages can benefit society in general (Méndez & Cruz, 2014:147). The indication was that leaders of research and innovation at Mexican institutions of higher education in general did not cultivate a culture of doing research in order to solve their own teaching and learning problems with a ripple effect of improvement for the community and the country at large. This lack of inculcating a culture for research at the Mexican higher education institution correlates with the findings of Olsson and Meek (2013:20) on the main challenge for all public universities in Cambodia, Malaysia, Thailand, and Vietnam, namely that of developing a convincing culture for the carrying out of research.

Asamoha and Mackin (2015:8) identify the main inefficiency of higher education institutions in sub-Sahara as the inadequateness of a research engagement culture that points to a disconnection between research by academics and industrial activity functioning. Academics as researchers at higher education institutions are obliged to lead and manage researching their own teaching and solving their own teaching and learning-related problems to prepare their graduates for competent participation in the labour market and for competent participation as researchers in their own institutions. In this regard, Lasambouw (2015:13) states that the purpose of conducting research is not merely for the sake of conducting research, but for the sake of implementation of the three duties of higher education jointly, namely to strengthen teaching and learning outsets through continuous research while providing high quality human resources as a community engagement endeavour. With reference to alleviating acute poverty as this poverty relates to developing countries, Meek *et al*. (2009:20) argue that poor countries should develop their own research and innovation systems and community of capacity to be able to transfer the knowledge and technologies produced and developed in developed countries to their own context. Poor countries need to be competent to lead and manage research and innovation practices in their own context to overcome their own socio-economic problems.

Leaders of higher education institutions should encourage their academic staff to engage in research for the sake of producing new knowledge and new technology, and innovative ideas to solve local community and national societal problems (Meek *et al*., 2009). Academic staff

should be encouraged to research their own practices of teaching and learning so that they can produce functional knowledge for improved teaching and learning for their own contexts and for that of the contexts of other scholars sharing similar teaching and learning environments (Jenkins, Breen, Lindsay & Brew, 2003:6). Focussing on the own teaching and learning environment does not require substantial funds like research that is carried out in laboratories and in specific specialised fields of conduct to produce new knowledge and know-how on specific actions. However, what is researched, and how it is researched still demand leaders to have leadership qualities like constantly engage in self-assessment, the accurate identification of an inadequacy in the existing knowledge pool and the setting of functional goals and directions (Meek *et al*., 2009). Additional leadership qualities pertain to establishing a culture of classroom research, and the passionate leading and inspiring of academic staff for changing and improving their own teaching through self-endeavour and constantly acknowledging these attempts of successful staff.

In order for leaders of research and innovation at higher education institutions to lead and manage research activity in laboratories and on site, they need to establish networking with other national and international higher education institutions, and to manage talent and build capacity amongst their research staff (Yizengaw, 2008). In this regard, managers should establish partnerships with industry, private organisations, and funding agencies to mobilise resources and experts, which, according to Yizengaw (2008:10) is a challenge for higher education institutions in Africa where leaders of higher education institutions are not adequately competent for these tasks. These managers lack competency in strategic planning, in managing research, and human and financial resources, in managing the performance of academics, and in establishing partnerships and networking with individuals and with organisations. These leaders also lack the competency of identifying areas for research and innovation, and leading these areas which, according to Yizengaw (2008:11) is the result of generally "*weak research and innovation capacities*".

Linked to Yizengaw's (2008) opinion on research leaders in African countries, Debowski (2010:214) explains that universities in general may assume that researchers are all readily prepared to act as research leaders after completing their doctoral studies. However, there exist significant deficiencies with regard to team skills, seeking and obtaining grants and general leadership capabilities for project management amongst PhD graduates (Debowski, 2010:214). The problem is that leaders at higher education institutions do not assess the research and

innovation leadership and management capacities of research and innovation team leaders and coordinators at their institutions before delegating research management responsibility. Research leaders should be selected based on their research skills and knowledge, which, if determined as inadequate, should be countered by continuous short-term training. However, Saltmarsh, Sutherland-Smith and Randell-Moon (2011:295) concur with Debowski (2010:214) that research leaders are not assigned based on their research leadership competencies, and there is no clear understanding of what research leadership is with a significant absence of induction and training programmes to prepare research leaders for competent leadership and management of research endeavour.

1.2.4 Leading and managing research and innovation projects at higher education institutions

The contributions of research and innovation projects at higher education institutions depend on the quality and competencies of leaders' leadership and management skills within the projects. The leaders of research and innovation at institutional level are of significance as their competencies to lead research and innovation projects are determined at the phase of project identification. These leaders build the right team, and they develop quality project proposals to satisfy the interest of funding agencies, and the funding personnel of their own institutions to ensure they are allocated an adequate budget. These leaders also secure the required material resources. In this regard, Debowski (2010:214) emphasises that the research leader firstly maintains an outstanding record of accomplishment across the traditional measures of excellent performance that serves as a major magnet for funding, sponsorship, and on-going recognition of the value of the research project.

For research and innovation projects to contribute functionally to societal development, the successes of these contributions are contingent on the competencies of project leaders as these competencies relate to managing and leading the researchers, the research and innovation aims and goals, and the other resources, such as financing of the specific research project. According to Olsson and Meek (2013:8), research managers have financially related knowledge and skills pertaining to managing funds, liaising with funding bodies, and planning research projects in terms of the steps of implementation, monitoring, and evaluation of research project activities. Research managers should also have knowledge and skills about research publication, research dissemination and commercialisation of the research results for optimal impact. To accomplish

these duties and responsibilities successfully, research managers should be competent to manage research endeavours comprehensively, namely managing and leading human, financial, and material resources simultaneously (Olsson & Meek, 2013:8).

The implementation phase of the research and innovation projects is the most crucial stage for research managers to manage their teams, the required finances, and the other resources needed for achieving the objectives of research projects. Leadership during the implementation phase requires that leaders motivate, inspire, and encourage their team members for the research to be carried out (Cunningham, O'Reilly, O'Kane & Mangematin, 2014:107). Throughout the implementation of the research projects, research managers resolve conflicts, manage the time and performance of each member, continuously monitor progress, and take decisions when the need arises. In this regard, Debowski (2010:218) underlines that the research managers and leaders should possess considerable and comprehensive knowledge and capabilities to be able to manage and lead the research project successfully. Depending on the specific research project, facility and laboratory management and collaborative and productive research network management as this networking relates to members working in other disciplines, are important. Research managers should also monitor the progress and the results of their research projects and they facilitate the utilisation and application of the research findings so that these findings result in the creation of wealth and improved well-being for their communities and nations (Debowski, 2010:218).

Eventually the research project managers have to evaluate the results and the contributions of the projects in collaboration with leaders and managers of their institutions, the future beneficiaries of the projects and key stakeholders at different levels. All these phases of a research project demand that leaders and managers are equipped with the specific competencies of research and innovation project management and with overall leadership qualities and competencies as required within higher education institution functioning. However, Cunningham *et al*. (2014:103) identify obstacles hindering research leaders at project level to obtain public funding because of performing as research project administrators rather than research leaders, which results in a lack of support for professional development from concerned bodies, and a lack of partnership with industries.

In summary, determining whether higher education institutions lead and manage the research and innovation carried out at their institutions in line with their countries research and

innovation policies, and determining the throughput of these studies in terms of research design and accompanying research activities is important. It is also important to determine whether the higher education institutions lead their research and innovation projects to improve the quality of their own teaching and learning while contributing to community development and to the development of the whole nation. Therefore, leading and managing research and innovation in higher education institutions, particularly in developing countries like Ethiopia needs in-depth studying.

1.3 MOTIVATION FOR THE STUDY

Muresan and Gogu (2012:3681) state that the tertiary education sector redefines its role to play a major part in research and innovation, as promoters of a research and innovation culture and as contributors in finding solutions to tackle major challenges and to bridge the gap between political and economic issues. From this statement by Muresan and Gogu (2012), the main role of higher education institutions as leaders and managers of research and innovation is to solve community problems and problems of the nation but also to prepare competent graduates to fit the needs and requirements of public and private organisations. In so doing, developed countries demarcate some of their higher education institutions to focus on research and innovation only as their major function whereas with developing countries their higher education institutions fulfil all three functions of a university, namely tuition, research and community engagement in the same institution of higher education. The latter situation applies to Ethiopia.

In Ethiopian higher education institutions, every academic member of staff should teach, serve the community, and undertake problem-solving research studies to transfer knowledge and skills of such a kind to be beneficial to the country. It is stated as a basic requirement that research studies should ensure that their own teaching is researched and studied and is continuously updated with new developments (FDRE, 2009:4996). As a member of the academic staff of one of the higher education institutions in Ethiopia and based on his personal experience as an academic and researcher, the researcher awares of inefficiencies in leading and managing the academics in their research and innovation endeavours. There are also inadequacies in leading and managing the university in line with its research policy (Segu University, 2011) and the higher education proclamation (FDRE, 2009) that was derived from the national education and training policy (FDRE, 1994). This motivated the researcher to

embark on this study to determine the extent of these shortcomings in order to provide guidelines for improvement.

Year after year, at the University where the researcher is employed, a budget is allocated for research for each college. Academics have been carrying out research in teams; however, nobody knows whether the research studies conducted have been focused on solving the problems of the institution, the local community, industry or the country at large. Nobody knows whether the conducted research included innovative new ideas on ways of teaching and using technology to solve one's own teaching problems or societal problems at large. It is not clear whether conducted research entails innovative ideas for private and public organisations to align them better to knowledge-based operations. This problem of a lack of clarity on what has been researched for the sake of institutional, societal, and national improvement is also encountered at other higher education institutions in Ethiopia (Yizengaw, 2004:7). This situation prompted the researcher to understand the extent to which the leading and managing of research and innovation at higher education institutions in Ethiopia is in line with the policies formulated at each specific institution, the Ethiopian country, and the global trend of world market competition. This understanding will enable the researcher to develop a model for the functional leadership and management of meaningful research and innovation at higher education institutions within the specific context.

1.4 PROBLEM STATEMENT

The Ethiopian research managers are not managing the research and innovation function of higher education institutions in Ethiopia in line with the roles defined by the most recent documents on higher education policies and proclamations such as the Science, Technology and Innovation (STI) policy, and the framework for higher education research and technology transfer (Muresan & Gogu, 2012; Yizengaw, 2008). Research in higher education institutions in Ethiopia has the triple role of addressing their own internal teaching problems, the problems of the local community and those of the country at large (FDRE, 1994:15; FDRE, 2009:4996; Muresan & Gogu, 2012:3681). However, the Ministry of Education (2016:25) disclosed that the research and innovation activities of the institutions do not address their own teaching problems, the problems of the local communities, industry and the socio-economic development of the country. To achieve the research roles given to the institutions to make the country competent in advancement of science, technology and innovation in the current

knowledge-based era, the institutions should have competent research and innovation managers at project, college and institutional level. The research managers should manage research project development, project implementation and the application of the research outcomes as directed by the demands for innovation for the sake of betterment (Ivey, 2015:1). However, studies show that there is poor research and innovation management and leadership in Ethiopian higher education institutions (Yizengaw, 2008:10).

The research and innovation leadership and management of the institutions have been performed by academics who were teaching in the institutions and who were then appointed as vice presidents for community engagement, as research directors, as community engagement directors and technology transfer directors at institutional level; as research, community engagement and postgraduate coordinators at college level, and as principal investigators at project level. These positions require knowledge and skills in strategic planning, and the management and leadership of research and innovation projects at project, college and university level as the appointed individuals are responsible for fulfilling both a leadership and a management role. These requirements demand that the leaders be good at the leadership of research and innovation projects in specific contexts by facilitating dynamic interactions among stakeholders who engage in the research and innovation activities of the institutions to learn, innovate, take action and adapt to specific situations.

In order to make their research and innovation management and leadership activities fruitful, the research leaders should facilitate the required human, material and financial resources, and the interaction among stakeholders through networking, and share the outcomes of their endeavours within and outside their institutions to bring required change and improvement. However, studies depict that the institutions face shortages of resources and infrastructure to produce relevant research outcomes (Yizengaw, 2004:7). The result is that the contribution of Ethiopian universities to the development of their country, particularly as this development relates to producing large numbers of skilled human resources that are required for societal development and for undertaking relevant and quality research, is not significant (Yizengaw, 2004:5).

Against this background, the main research question is formulated as follows:

- How can higher education institutions lead and manage their research and innovation activities to be in line with national science, technology and innovation policy and within a framework for higher education research and technology transfer?

In order to find answers to the main research question the following five sub-questions are formulated so that the answers to these sub-questions can contribute to an answering of the main research question.

1. What leadership theories can be used to explain the position of higher education institutions in the leadership and management of research and innovation for societal development?
2. What is known about leadership and management of research and innovation in higher education institutions for the sake of improving institutional teaching, solving problems of local communities, and producing new knowledge, ideas, and technologies for national benefit?
3. How do leaders lead and manage research and innovation policies and practices at project, college, and institutional level to attain research and innovation goals?
4. To what extent do research and innovation goals solve higher education institutions' own problems and the problems of the community, the industry and the nation?
5. How can institutional research and innovation policies be developed to be in line with national science, technology, and innovation policy, and the higher education research and technology transfer framework?

1.5 AIMS AND OBJECTIVES OF THE STUDY

Contemporary times characterised by knowledge-based societies demand from higher education institutions to produce new knowledge and invent new technologies through research and innovation projects to improve the own quality of teaching and learning in order to solve problems of the community, and to make the nation competent in the world market (par 1.2). This requires specific competencies from leaders of research and innovation at higher education institutions at project level and at institution level in general to ensure alignment with institutional and national policies. The quality of leadership and management of research and innovation in developing countries such as Ethiopia is not well researched. The main aim of this study is to understand the leadership and management of research and innovation policies and practices at higher education institutions as this leadership and management occur

within a developing society in order to develop a model for effective functioning contributing to institutional, community and national benefit. The objectives of this study therefore relate to the following:

1. To elicit applicable leadership theories as a basis for the leading and management of research and innovation at higher education institutions for the sake of societal uplift.
2. To determine what is already known about the leadership and management of research and innovation policies and practices at higher education institutions to solve their own problems, the problems of their communities and the problems of their nation.
3. To understand how leaders lead and manage research and innovation policies and practices at project, college, and institutional level to attain research and innovation goals.
4. To evaluate whether the research and innovation policies of the institutions are developed in line with the national framework for higher education research and technology transfer, and science, technology and innovation policy.
5. To develop a model for leadership and management of research and innovation policies of higher education institutions to solve their own problems and that of their communities and the nation.

1.6 RESEARCH METHODOLOGY AND RESEARCH DESIGN

The study consists of two parts, namely a literature study and an empirical study. The literature study focuses on critically reviewing, analysing, and interpreting research carried out on leading and managing research and innovation at higher education institutions. These reviews are focused on the leading and management of research and innovation at higher education institutions in developed societies, followed by a review of the literature on research and innovation conduct in developing societies. The carrying out of a literature review is motivated by identifying gaps in the literature as these gaps relate to leading and managing research and innovation endeavour in developing societies in order to contribute to the pool of knowledge on leading and managing research endeavour by addressing these gaps with the empirical investigation.

1.6.1 Research paradigm and research design of the study

With reference to research paradigm, the three traditional research paradigms, namely positivist, interpretivist and critical are understood by Creswell (2009:6) to represent worldviews relating to post-positivism, constructivism, advocacy/participatory, and pragmatism. According to Creswell (2009:6), these worldviews are preferred based on specialization areas of students, the views of their advisers, and past research experiences. A worldview as research paradigm forces the individual researcher to choose a research approach that is either quantitative or qualitative, or a mixed-methods research approach (Creswell, 2009:6). To choose the best research approach for the specific study, researchers should be conversant with the underlying assumptions (ontological and epistemological perceptions) of each worldview.

Positivists advocate a quantitative research approach and believe that reality is objective, and researchers should discover this reality through confirmative methods. Constructivists who advocate a qualitative research approach believe that reality is subjective and multiple, depending on the specific context which demands from researchers inventing distinctively in these different realities (Creswell, 2009:6). Pragmatists who advocate a mixed-methods research approach believe that the truth is what is understood as reality for the specific time and the specific context (Creswell, 2009:10). This truth is not based on a duality between reality independent of the mind or within the mind but should be understood as a comprehensive phenomenon. Thus, with a mixed-methods research approach, researchers use both quantitative and qualitative methods to collect data in order to answer the research question as comprehensively as possible (Creswell, 2009:11).

For this study, mixed-methods research was chosen due to the nature of the problem. This approach of understanding and explaining reality comprehensively is relevant for the social sciences and for the applied social sciences such as education management and leadership. Problems that are difficult to understand such as leading and managing research and innovation to be in line with policies at higher education institutions and their respective national levels are best researched through a mixed-methods research approach. Consequently, a mixed-methods research approach is the most appropriate approach to use to understand and explain complex problems situated in complex political and social contexts (Creswell, 2009:11; 2012:535; Weaver-Hightower, 2014:133). A mixed-methods research approach is therefore important for a clear understanding and explanation of policies and the influence of these policies on practice. The personal context like personal quality, behaviour, and competencies

in leading and managing people and financial resources as these activities pertain to carrying out research at higher education institutions cannot be understood properly by employing either a quantitative or a qualitative research approach; both approaches need to be used. Further, as quantitative and qualitative research approaches each has its own strengths, and as the strengths of both approaches are used to counter the weaknesses of the other, it is advisable to use both research approaches in order to increase the quality of the intended research conduct (Creswell, 2012:535; Johnson & Christensen, 2008:51; Punch, 2005:235).

With reference to research design, a mixed-methods research design is classified to be related to the concurrent and sequential collection of quantitative and qualitative data at the same time with, or without an emphasis on either the quantitatively or qualitatively collected data. Some mixed-methods research designs give equal emphasis to both types of data collection at the same time (Creswell, 2009:206; Johnson & Christensen, 2008:446). For this study, a convergent parallel mixed-methods design is used and both types of data are collected concurrently, and both sets of data are given equal emphasis. The rationale was to understand and triangulate by means of seeking corroboration between qualitatively and quantitatively collected data, and to arrange for the complementing of each other by means of seeking elaboration and clarification of results by considering the findings deduced from data analysis of both types of data collection (Bryman, 2006:105; Johnson & Christensen, 2008:451; Onwuegbuzie & Collins, 2007:292). The research paradigm and research design for this study is elaborated on in paragraphs 4.4, 4.5 and 4.6.

1.6.2 Selection of research sites and participants

Regarding the population for the study and the selection of sites, Ethiopia has undergone an expansion of its higher education institutions for the period 2000 to 2015. This expansion represents an increase from eight higher education institutions in 2001 to 21 institutions in 2007 and 33 higher education institutions in 2012. These institutions are called first, second and third generation institutions based on the time of their establishment. Since 2015, ten additional universities were inaugurated which have all started teaching in 2017/2018. Ethiopia has now 45 higher education institutions spread over the whole country, as there are some institutions that were upgraded from university college status to university status.

By adopting the experiences of China and South Korea to specialise in higher education provisioning according to the three functions of higher education institutions namely tuition, research and community engagement, the Ethiopian Federal Ministry of Education established two Science and Technology Universities, namely Adama Science and Technology University and Addis Ababa Science and Technology University representing third-generation institutions. The aim is to establish technology universities in the country that adhere to standards accepted globally. These technology universities report to the Ethiopian Ministry of Science and Technology. Students' entry to these universities is competitive and selective using entry requirement examinations. The budget for research and for the other operational functions of these universities is different from other higher education institutions in the country and is allocated by the Ministry of Science and Technology to whom these universities are accountable. The Ethiopian Ministry of Education funds the other higher education institutions in Ethiopia. The implication is that there are two categories of higher education institutions in Ethiopia, namely the Science and Technology institutions and the general universities that offer tuition in diversified disciplines. When ranking universities according to their generation, the assessment criteria used by the Ethiopian Ministry of Education are inconsistent varying from year to year. The researcher therefore decided not to select higher education institutions based on their rankings, as their rankings do not necessarily reflect their genuine research performance.

The Science and Technology University, Thgnstu University, represents a higher education institution that is selected as research site based on its location in a big city in an industrial zone. Among the third- generation higher education institutions, Thgnu University is chosen randomly, and among the first-generation higher education institutions Fignu University is chosen randomly. Among the second-generation higher education institutions, Segnu University is chosen randomly. The new universities that started teaching in 2017 and 2018 are not included as research sites as they are still in an establishment phase. As the aim of the study is to understand the specific context and not to generalise, only four higher education institutions are chosen to serve as research sites for data collection. Regarding site selection with a mixed-methods research approach, a researcher should consider not only variables but also specific cases for meaningful data collection (Punch & Qancea, 2014:342).

Participants for the study on leadership and management of research and innovation at higher education institutions comprised the following representations: researchers at the selected

research sites; research and community engagement coordinators; vice presidents for research and community engagement; research directors and directors for linkage of industry-university endeavour. Research and innovation policy managers in the Ministry of Education and the Ministry of Science and Technology, community leaders at zone level, and industry managers around the four universities are also selected as participants for this study. When choosing participants for data collection based on a mixed-methods research approach, the researcher should consider timing in the sense of concurrently and sequentially collecting data via quantitative and qualitative data collection techniques as these two types of data collection are carried out with the same participants. For this study, concurrent timing arrangements are considered to collect quantitative and qualitative data in a meaningfully functional way (Collins, Onwuegbuzie & Jiao, 2006:94; 2007:276; Johnson & Christensen, 2008:246). Detailed information about participants for this study appears in paragraph 4.7.1.

Apart from participants, the research and innovation policy documents of the selected higher education institutions, and the five-year annual reports of the institutions pertaining to research and innovation are also used as sources to collect data.

1.6.3 Data collection methods

In order to answer the research questions and achieve the aims of the study, a structured questionnaire, semi-structured individual interviewing and document analysis were the main data collection methods.

1.6.3.1 Structured questionnaire

A structured questionnaire was used to collect data of a quantitative nature. It contained different paragraphs in line with the research questions. Within each paragraph of the questionnaire, closed-ended questions represented most questions with some open-ended questions to elicit additional qualitative data. The questions were developed to collect data on ways of implementing institutional and national policies by leading and managing a research and innovation project, leading a research team, managing the finances and other resources of a research project, monitoring the progress of the research, and managing conflict that might appear during the carrying out of the research and innovation projects.

Once the questionnaires were developed, commented on, validated, tested, and improved, the researcher himself to ensure thorough data collection arrangements administered them. In this regard Punch (2005:100) and Punch and Qancea (2014:301) advise researchers on how to administer data collection instruments to ensure the optimal collection of data. Measures of thorough pertain to confirming that participants are approached professionally and controlling the data collection process in a dedicatedly conscientious manner. A structured questionnaire is functional to measure different characteristics and to collect data that provide information on the past, the present, and the future (Johnson & Christensen, 2008:170). Cohen, Manion and Morrison (2007:344) confirm the significance of administering questionnaires thoroughly relating to addressing all uncertainties within the questionnaire, ensuring good return rates, and ensuring that all the questions are answered.

1.6.3.2 Interviewing

Qualitative data was collected using semi-structured individual interviewing with concerned bodies for research and innovation policy formulation and implementation at the Ethiopian Ministry of Education, Science and Technology. Individual interviews were also conducted with vice presidents for research and community engagement of the selected institutions, selected research coordinators, principal researchers, co-researchers, research directors, and directors responsible for linkages between industry and university. Further, selected local community leaders at zone level and industry managers were interviewed so that the interviews with the different categories of representation provide scope for crosschecking the data from the selected institutions about their contributions in solving their own problems and that of the community, the university, industry and the country. Different interview guides directed the different interviews with individual members of the distinctive groups. Individual interviewing was significant to clarify questions and responses from both the interviewer's and interviewees' side and to establish a relationship of trust to collect meaningful data (Johnson & Christensen, 2008:203). It is important to construct reality to understand people in order to collect qualitative data for a deep understanding of the phenomenon of study (Cohen *et al*., 2007:352; Punch, 2005:168; Punch & Qancea, 2014:182).

1.6.3.3 Document analysis

The research and innovation policies of the selected higher education institutions, the national STI policy and the framework for higher education research and technology transfer guide

formed part of the documents analysed for this study. In addition, the annual performance reports relating to research and innovation activities of each selected higher education institution were analysed. Documents are rich sources of data for education and social research (Punch, 2005:184; Punch & Qancea, 2014:251). Documents have different uses relating to providing data on the context within which research participants operate, providing supplementary research data, providing a means of tracking change and development, and verifying or corroborating evidence from other sources (Bowen, 2009:29). Many public and institutional documents have important information to provide for a better understanding of the phenomenon of study (Cohen *et al*., 2007:201).

In order to collect quantitative data from annual reports of the universities on the research and innovation project implementation achievements, a checklist was developed as document analysis to consider the plans and achievements of each higher education institution (Appendix H). According to Lodico, Spaulding and Voegtle (2006:113), researchers can adopt, adapt or develop their own checklist that helps them to collect data to answer their research questions. This checklist arrangement is elaborated on in paragraph 4.8.3.

1.6.4 Data analysis methods

The quantitatively and qualitatively collected data were analysed separately according to data analysis methods applicable to each research approach (Creswell, 2012:551).

1.6.4.1 Quantitative data analysis

The quantitatively collected data were analysed using percentages to describe and clarify specific aspects of the study.

1.6.4.2 Qualitative data analysis

The qualitatively collected data were analysed by means of qualitative content analysis, which included transcribing the recorded data, the reading of each transcription several times, the coding of text and the identifying of categories in order to build themes, patterns, and

interpretations engendering research findings (Johnson & Christensen, 2008:531; Punch, 2005:197; Punch & Qancea, 2014:223).

Finally, the analysed data was consolidated by integrating the qualitatively analysed data into the quantitatively analysed data for a comprehensive understanding of the phenomenon of study, namely the leadership and management of research and innovation practices at higher education institutions. Onwuegbuzie and Leech (2006:490) recommend the following stages when analysing quantitative and qualitative data with a mixed-methods research approach: data reduction, data display, data transformation, data correlation, data consolidation, data comparison, and data integration. Hence, the researcher considered the data display, the data consolidation, the data comparison, and the data integration stages in the analysing of the collected data to be in line with the aims of the study on leadership and management of research and innovation activities at higher education institutions.

1.6.4 Reliability and validity of instruments

1.6.5.1 Validity and reliability of the structured questionnaire

In order to collect consistent and relevant data, the reliability and validity of data collection instruments are important. As suggested by Creswell (2012:157), a researcher has three options, namely adopting the research instruments of other researchers, adapting the research instruments of others, or developing one's own instruments. The researcher chose the option of developing his own instrument and took action accordingly as there are no developed instruments that are in line with his research questions. After developing the questionnaire from the literature, content validity was checked by experts (Johnson & Christensen, 2008:152; Punch & Qancea, 2014:298). The researcher checked the reliability of the questionnaire for internal consistency by using Cronbach Alpha after piloting the questionnaire in a similar context. Based on the data from the pilot study, the researcher reformulated and rejected ambiguous and unclear items, administered the questionnaires himself consistently, and considered the psychological make-up of participants as recommended by Creswell (2012:159). It is important to consider the psychological make-up of participants because they might not answer the questions properly and genuinely if they are troubled which might jeopardise meaningful data collection (Creswell, 2012:159).

1.6.5.2 Validity and reliability of interviews

As with the questionnaires, experts checked the content validity of the interview questions. The researcher requested participants to confirm that interview transcriptions are true representations of what transpired during interviewing (Creswell, 2012:163). In order to enhance interview reliability, the researcher used interview protocol to obtain the consent of participants as advised by Creswell (2012:225). Also, as discussed in paragraph 1.6.2, the selection of participants as an integrated research sample for collecting both quantitative and qualitative data is a reliable way of validating data collected via mixed-methods research procedures (Johnson & Christensen, 2008:284).

1.6.6 Ethical considerations

When conducting research, specific ethical considerations apply. Researchers should consider ethical issues throughout the research process, from problem identification to writing and disseminating the research findings. Creswell (2009:88), Johnson and Christensen (2008:105), Punch (2005:276) and Punch and Qancea (2014:59) discuss ethical considerations as choosing a problem that is important and meaningful to the participants, reaching consensus and signing consent forms representing the rights of participants before data is collected. Reporting the data anonymously and interpreting data correctly during data analysis, and writing the research report without suppressing, falsifying, or inventing findings to adhere to preconceived opinions of the researcher are also crucial aspects relating to ethical considerations with the conducting of research. To ensure clear understanding and full adherence to all aspects relating to ethical considerations, the researcher applied for ethical clearance from the research ethics committee of the College of Education at the University of South Africa before embarking on data collection.

1.7 CONCEPT CLARIFICATION

The concepts that need to be clarified for this study on leadership and management of research and innovation endeavour at higher education institutions include the concepts of leadership and management, research and innovation, and policy and practice. These concepts are explained next.

1.7.1 Leadership and management

Leadership and management are explained as two different concepts present in the same phenomenon. For instance, Bush (2007:392) explains that leadership encapsulates different activities in that leadership focuses on leading by setting goals, motivating and being a model for others whereas management focuses on maintaining efficiency and effectiveness of an organisation by planning, coordinating, and controlling activities to ensure goals are realised. Both the actions of leading and managing are important and inseparably part of the nature of a leading-manager. McCaffery (2010:81) also explains leadership and management as inseparable actions, especially as these actions relate to having the skills and knowledge of leading and managing aspects such as policymaking, policy implementation, and policy administration.

Leaders and managers of higher education institutions should have both leadership and management qualities in order to manage the three functions of tuition, research, and community engagement holistically and individually. However, as the institutions of higher education are increasingly expected to fulfil a key role in knowledge production and acting as centres of research and innovation, the leaders on all levels of functioning at higher education institutions should have the capacity and competency of leading and managing research and innovation actions. This research and innovation actions apply to improving functioning on institutional and national level.

1.7.2 Research and innovation

Research represents a systematic study of an issue, a phenomenon, or a problem. For instance, Creswell (2012:3) defines research as a process of steps used to collect and analyse information in order to increase the understanding of a specific topic or issue. However, the simplistic understanding of an issue or a topic for the mere fact of understanding the issue is not enough. Understanding an issue should also include the potential of solving problems related to that issue. In solving problems, the ability of producing new knowledge and applying new technologies to address shortcomings regarding knowledge and technology are important. This competency should lead to innovation to improve capacity and productivity in the dispensation of knowledge-based functioning. As this kind of knowledge and innovation demands quality and competent graduates from higher education institutions, researchers in higher education

institutions should sustain expert teaching and equip their students with the necessary skills of enquiry to solve problems through innovating new ideas, new ways of doing and applying new technologies (Andolfi, 2016:66). These necessitate competent research leadership and management.

With reference to innovation, Savrul and Incekara (2015:388) define it as the process by which knowledge is applied for economic and social benefits. Considered within a higher education context the implication is that innovation should help higher education institutions to change the knowledge they produce into wealth so as to improve the life of people within national and global contexts. However, innovation does not only mean producing high-tech technologies, but it also pertains to improving the day-to-day activity and life of people in developing societies by developing new ways of doing and living. Innovation also includes improvement in areas such as logistics, and the distribution and marketing of sales and services (Savrul & Incekara, 2015:389). The leaders of research and innovation at higher education institutions should possess skills and knowledge of managing and leading research, that lead to innovation as this innovation relates to research-based betterment.

1.7.3 Policy and practice

Policy refers to implicit decisions and the implementation of those decisions to bring change and improvement by solving problems that hinder development. Birkland (2011:8), Kraft and Furlong (2010:5), and Schultz (2004:331) define policy as the purposive course of action that an individual or group of individuals or institutions consistently follow in dealing with a problem. Different policies are derived from national public policies. Regarding the higher education context, examples of policies derived from national policy are, for instance, education and training policies, and higher education policies. Within each higher education institution, there are policies such as a research and innovation policy to guide the institution, or a functional unit, or a group of individuals, or only one individual to perform their duties and responsibilities effectively and appropriately (Kuhlmann, 2003:132; Jowi *et al*., 2013:130). For instance, in Ethiopia, the main source for research and innovation policies of higher education institutions are national policies such as the STI policy, the framework for higher education research and technology transfer, higher education proclamations, and the education and training policy. As said in paragraph 1.2, the national harmonized academic policy of Ethiopian public higher education institutions does not include research and innovation issues

in its formulations resulting in higher education institutions not referring to this policy when developing and implementing their research and innovation policy endeavours.

If policy goals and objectives are not practically implemented, it does not result in intended change focussed on improved problem solving. This implies that practice determines the successful implementation of a policy at national and institutional level. Practice serves as the basis for improving policy (Moran, Rein & Goodin, 2006:211). This functional interactive relationship between practice and policy is contingent on the quality of leadership and management and the competencies of these leader-managers to understand national policy and their commitment to implement this policy in order to lead and manage successful change for the sake of societal development.

1.8 ORGANISATION OF THE THESIS

The thesis is organised according to the following chapters.

Chapter 1 deals with the orientation to study. It conceptualises the overall study by describing theories of leadership, reviewing the relevant literature briefly, formulating the research problem with aligned research aims, explaining the main concepts, and highlighting the organisation of the thesis.

Chapter 2 presents the theoretical framework of the study and different conceptual models that are related to the leadership and management of research and innovation at higher education institutions.

Chapter 3 discusses the literature on what is already known about the leadership and management of research and innovation at higher education institutions. In this regard, the focus is on alignment between national and institutional policy formulation in order for higher education institutions to solve their own problems, the problems of the community and the problems of the nation.

Chapter 4 discusses the research methodology and research design for the empirical study. It discusses the paradigms of the three main research approaches (quantitative, qualitative and mixed-methods). Chapter 4 also focuses on justifying the rationale for choosing one research

approach from the other, who the participants and data sources are, the data collection instruments, reliability and validity of the instruments, methods of data analysis, and ethics that were considered during the whole study.

Chapter 5 presents research findings from the empirical investigation relating to the analysis of data collected from the first- and second-generation universities.

Chapter 6 provides research findings from the empirical investigation relating to the analysis of data collected from the third-generation universities.

Chapter 7 compares the research findings collected from the four research sites. This is followed by an integrated discussion of the research findings from the empirical investigation and the literature study.

Chapter 8 presents the summary, conclusions and recommendations for improved practice relating to leadership and management of research and innovation endeavour at higher education institutions as these actions pertain to implementation of policy that is based on national and institutional policy alignments.

1.9 SUMMARY

Higher education is the engine for the all-rounded socio-economic development of a nation to function effectively within a knowledge-based societal dispensation. In this regard, higher education institutions perform their duties and responsibilities by leading their three functions relating to teaching, research, and community engagement in an interlocking manner. However, it is argued that higher education institutions should give priority to research and innovation to have quality teaching and quality graduates in order to conduct quality research to solve societal problems. Higher education institutions are expected to produce scientific knowledge and apply new technologies in order to innovate with new ideas and ways of doing to contribute to national development and bargaining competency on world market stages. There are inadequacies in leading and managing research and innovation according to national and institutional policies in developing countries like Ethiopia. A study to determine the problems relating to the management of research and innovation at higher education

institutions and a model for the constructive management and leadership of this endeavour is perceived as meaningful research.

CHAPTER 2
THEORETICAL UNDERPINNINGS FOR THE ACTION OF LEADERSHIP AND MANAGEMENT OF RESEARCH AND INNOVATION AT HIGHER EDUCATION INSTITUTIONS

2.1 INTRODUCTION

While the first chapter focussed on the theoretical orientation of the study, this chapter elaborates on its theoretical underpinnings. It discusses different concepts that are related to research and innovation, research leadership and management, innovation leadership and management, and project leadership and management. It also discusses complexity leadership theory that is appropriate for leading and managing research and innovation at higher education institutions.

Leading and managing research and innovation is a complex task but also a rewarding endeavour for knowledge producing organisations like higher education institutions. The reward for higher education institutions pertains to producing competent and quality human capital, which for the local community can contribute to solving socio-economic problems, and for the nation contributing to improved competency in economic and technological advancement (Bonaccorsi, Daraio & Geuna, 2010:3). To gain such socio-economic rewards, the research function of higher education institutions should be led effectively at basic and at applied level to produce new and advanced knowledge and technologies, and to address real problems of the community and the institution. Producing new knowledge and technology should be used to improve products and services as a core function of innovation (Ambos, Mäkelä, Birkinshaw & D'Este, 2008:1425).

As the main source of innovation at higher education institutions and for its stakeholders is the advanced knowledge produced by research activity, leadership and management of research and innovation at higher education institutions should ensure alignment between policy formulation and policy implementation in practice (Cai, 2017). This can be successfully performed by establishing relationships among industry, government and the institutions. To manage and lead research and innovation, especially at practice level, higher education institutions should employ effective leadership and management at project level that contribute

to successful planning, implementation and outcomes of research and innovation activities (Nooteboom & Stam, 2008).

Research and innovation policies and practices are complex systems and Higher education institutions that produce and implement these policies are complex organisations (Roll-Hansen, 2009:3). Leading and managing research and innovation in such complex contexts requires reference to complexity leadership theory to lead complex and dynamic interaction within and outside higher education institutions in achieving their responsibility of being engines for knowledge and skills production in a knowledge-based dispensation. Studying matter through the theoretical lens of complexity leadership theory is best achieved when linked with a combined positivist and interpretivist research paradigm accompanied by a mixed-methods research approach (Chapter 4).

2.2 THE CONCEPT OF RESEARCH AND INNOCATION

The concept of research and innovation is understood in many ways as is evident from the vast number of different interpretations from different authors.

2.2.1 The concept of research

Scholars explain the concept of research in different ways. For Ho (2007:3), research is an intellectual activity to produce something new or new knowledge. Feldman and Stewart (2007:3) define research as a process of investigation either to generate theory or to solve practical problems in different contexts. According to the Association for the Development of Education in Africa (2016:1), research is the heart of knowledge creation, and it is an important source of knowledge production and innovation for higher education institutions. According to the Cambodia Development Resource Institute [CDRI] (2013:9), research is a rigorous and systematic enquiry in order to validate and refine existing knowledge and to generate new knowledge. However, research should not be carried out only for the purpose of validation or generation of new knowledge or theory but should also improve practice and solve real life problems at classroom, department, college, institution, community, regional, national and global level (Sousa, 2011:65).

The concept of research comprises applied research, basic research and technological development each having a different nature and purpose (Roll-Hansen, 2009:2). In industry, research and development is usually an individual department or unit that leads and manages basic research, applied research and technological development in collaboration with universities and other research institutions. The production of new knowledge is then a base for both applied research and technological development in both industries and universities. Hence, as research is one of the main functions of higher education institutions, it is motivated by pursuing advance science, technology and innovation to address local problems and improving the nation's competency globally through focusing on both basic and applied research, and technological development (Swanger, 2016:25).

2.2.2 Types of research

With reference to the division of research in basic and applied research, the intent of basic research is to explain phenomena and to formulate and produce theory, whereas the goal of applied research is to address real problems (Ary, Jacobs & Sorensen, 2010:34). Similarly, Lodico, Spaulding and Voegtle (2010:11-12) understand basic research as testing, refining, modifying and developing theory with applied research examining the applicability of educational theory and principles.

According to Brennan *et al*. (2004:7) and with reference to the education context, there are three different kinds of research. The first kind is basic research that focuses on understanding educational phenomena. The second kind is decision-oriented research that is conducted to identify best practices and guide policy decision. The third kind of research depicts research-based innovation, which represents a key for change and improvement in a knowledge-based arrangement. Along the same lines, the Organisation for Economic Cooperation and Development [OECD] categorises research into basic, applied, and research-based innovation with research-based innovation representing research that leads to innovation (OECD, 2008:67). Hood (2003:2) divides research into three types, namely basic, applied and development research concurring with all the other authors' definitions for research namely that basic and applied research focuses on theory development and problem-solving respectively whereas development research pertains to the application of knowledge produced in research to develop important tools, systems and methods.

In developed countries like the United States of America where there are top world-class universities, there are research universities, research institutions, private firms and industries that engage in basic and applied research and development that have been contributing to knowledge production, dissemination and application. Hughes (2011:25) asked academics about the type of research they engage in and found that it was applied, or basic research based on user interest. According to Bentley, Gulbrandsen and Kyvik (2015:703), although basic research is assumed as the main business of academics in research universities, they engage in more applied than basic research. Research, whether basic or applied, is at its infancy stage in developing countries like Ethiopia where higher education institutions have been performing their research function together with their teaching and community engagement functions with teaching taking priority.

2.2.3 Modes of knowledge production in higher education

Knowledge is produced in different modes in higher education institutions. According to Carayannis and Campbell (2011:330), there are three different modes of knowledge production in higher education, namely mode 1, mode 2 and mode 3.

Mode1 knowledge production relates to conducting basic research within a disciplinary-based arrangement in higher education institutions (Carayannis & Campbell, 2011:329). In their research function endeavours, the institutions and their academics engage in research activities in line with their specific specialisation at department or college level with their goals focused on career promotion and financial gain for personal satisfaction. Mode 1 as a model of knowledge production in science, is based on experimental science in line with each discipline and the interests of scientists and academics at the specific university (Gibbons, 2008:2; Hessels & Van Lente, 2008:741; Nowotny, Scott & Gibbons, 2003:179). With model knowledge production, academics link teaching, research and community engagement (Sousa, 2011:64).

Due to the development of a knowledge-based dispensation, mode1 knowledge production is substituted by model 2 knowledge production, which emphasises interdisciplinary and collaborative research to address the needs and problems of different organisations and to contribute to socio-economic development (Woelert & Millar, 2013:760). The change of knowledge production from mode 1 to mode 2 as observed in the humanities and natural

sciences emphasises the production of knowledge that can be applied to solve problems guided by certain principles (Musson, 2006:32). These principles include the following: Knowledge is produced that can be applied in a certain context; knowledge is produced across different disciplines and in collaboration with different institutions; the institutions and the researchers are responsible for the effect of the knowledge produced in the local community and societies at large; institutions and their researchers have to assess and evaluate the process of the knowledge production and its effects and they have to control the quality of the knowledge production (Carayannis & Campbell, 2011:329; Gibbons, 2008:3). These principles represent the characteristics of mode 2 knowledge production with mode 2 knowledge production also depicting typical features. These features pertain that knowledge is produced within the context of application and the production of knowledge is trans-disciplinary and is produced in different sites. In addition, the knowledge is highly reflexive, produced through dialogue between the research and the researched and the quality of the knowledge that is produced is controlled by using different criteria of quality assurance in line with the context of users and funders (Gibbons, 2008:2; Hessels & Van Lente, 2008:741; Nowotny *et al*., 2003:186). In mode 2 knowledge production, academics conduct research that is focused on solving real societal problems collaboratively and in an interdisciplinary way of conduct (Sousa, 2011:64).

Mode 3 knowledge productions extends the mode 1 and 2 ways of knowledge production to create, disseminate and apply new knowledge to improve practice, services, products and methods at higher education institutions, in industries, in local communities and societies. Mode 3 knowledge productions typically utilises new knowledge for change and improvement through establishing networks at policy and practice level for the knowledge-based dispensation of the twenty first century (Carayannis & Campbell, 2011:329). It emphasises basic research for application (Campbell & Carayannis, 2016:11). As innovation is the key for a knowledge-based economy and society (Savrul & Incekara, 2015:389), mode 3 of knowledge production intensifies the role of higher education institutions to not only produce new and advanced knowledge but to apply the new knowledge to address local economic and social problems, to improve the services and products of industries and firms, and to make nations technologically competent by producing human capital that is creative and innovative.

Generally, higher education institutions employ mode 1, 2 and 3 knowledge production with mode 1 and 2 pertaining to the day-to-day activities of higher education institutions while mode 3 knowledge production is employed with collaboration among institutions, the government

and industries to produce advanced and innovative knowledge for application in the name of betterment of the current situation and conditions (Campbell & Carayannis, 2016:10).

2.2.4 The concept of innovation

Savrul and Incekara (2015:388) define innovation as the process of changing knowledge into social and economic development. According to the Balanced Scorecard Institute (2011:1), innovation is defined as the process of developing and relating ideas, and evaluating, selecting, developing, and implementing new knowledge for improved products, services, and programme functioning. In this regard, innovation represents producing new ideas and products based on employing advanced technology (Holzbaur, 2005:50).

Different authors' definitions for innovation concur on similarities while also including additional perspectives on the act of innovation. Brennan, Broek, Durazzi, Kamphuis, Ranga and Ryan (2014:35) define innovation as relating to significantly improved products and processes for advance organisational methods and organisational functioning. Innovation is then perceived as the act and process of producing new ideas and devices based on present research, knowledge and practice to solve real problems and to commercialise advanced actions (Morris & Setser, 2015:8). Innovation represents then new ideas, methods and strategies that are adopted by individuals and their institutions to lead to new practices based on utilising ideas that are novel and useful (Zhu & Engels, 2014:139). Innovation produces then new things by applying new knowledge and technology to provide solutions for the needs and problems of societies and businesses in those societies (Ho, 2007:2).

Innovation as the result of research that is commercialized and available to the economy and society is not necessarily novel and 'ground-breaking' but is still significant in representing creativity to improve ideas, processes, services, products and technology engendering improved functioning and outcomes (Kowang *et al*., 2015:33). In this regard, research endeavour is a crucial element of innovation actions and a key element for higher education innovation to produce advanced scientific knowledge and utilize this knowledge to address internal problems and local community problems (Department for Business Innovation and Skills, 2014:29). Research at higher education institutions serves as basis for innovation in the institution and in industries even though innovation encompasses uncertainty and disequilibrium (Carayannis & Campbell, 2011:350).

2.2.4.1 Types of innovation

There are different types of innovations that emanate from different sources. One type of innovation is based on scientific knowledge from research and the development of an organisation and the other type is based on the ability to adapt from external sources. Some types of innovation result in entirely new products and services whereas other types upgrade the existing products and services (Department for Business Innovation and Skills, 2014:9). According to Carayannis, Samara and Bakouros (2015:39), there are three different groups of innovation. The first group of innovation is classified based on object representing product, service and process innovation with products and services relating to the production of new products and services and process innovation focusing on introducing new elements in the production process. The second group of innovation pertains to the sector where innovation takes place incorporating organisational and technological innovations with organisational innovation introducing new systems and processes of administration and technological innovation involving changing the products by creating, improving and expanding procedures. This group of innovation transfer new ideas into new products and services in the process of product production and the process of providing services by an enterprise (Carayannis *et al*., 2015:39). Incremental and radical innovations represent the third group of innovation based on its intensity and scope of innovation. Incremental innovation focuses on gradual change to the existing practice through small deviations with radical innovation focusing on basic changes to a product or service by introducing totally new deviations (Carayannis *et al*., 2015:40).

Kuratko *et al*. (2012:7) classify innovation into three types, namely product, process and service innovation. Product innovation refers to making beneficial changes to physical products whereas process innovation results in beneficial change to the processes that produce products and services, and service innovation focussing on beneficial changes to the services that customers use.

The different types of innovation imply different methods of innovation.

2.2.4.2 Methods of innovation

According to Kuratko *et al*. (2012:7), the methods of innovation are invention, extension, duplication and synthesis. Invention is the creation of a new product, service or process that is

considered revolutionary. Extension is expansion of a product, service or process already in existence. Duplication is replication of an existing product, service or process adding the entrepreneur's own creativity to enhance matter. Synthesis is the combination of existing concepts and factors into a new formulation.

Apart from the different methods of innovation, there are different sources of innovation.

2.2.4.3 Sources of innovation

There are two basic sources of innovation. The first source of information relates to a 'knowledge push' in the sense that innovation is derived from research and development at an organisation, with these actions related to a significant record of accomplishment (Bessant & Tidd, 2015:164). This should be the main source of innovation at higher education institutions with research one of its three functions to address problems internally and externally. The second source of information relates to a 'pull of need' approach based on the needs of the institution, industry or nation (Bessant & Tidd, 2015:167).

Considering a knowledge-based era, the sources of innovation at higher education institutions represent both 'knowledge push' and 'need pull' endeavours to respond to institutional, industry, community and global demands. In addition to the different sources of innovation, there are different models of innovation.

2.2.4.4 Models of innovation

The different models of innovation in the public sector are research and development-based, incremental, collaborative, radical, entrepreneurial, transfer and co-production-based (Harries, 2012:121).

With research and development-based models of innovation, new and advanced scientific knowledge is produced at higher education institutions. This becomes the source for innovation in the institution and in industry. In incremental and radical-based models of innovation, the change is gradual and basic regarding a system, product or service. The collaborative-based model of innovation focuses on an innovation that is undertaken in collaboration with different stakeholders such as higher education institutions, industry and government, whereas the co-

production-based model of innovation is jointly undertaken between or among different organisations. In the entrepreneurial-based model of innovation, the intent is to utilise new ideas, processes and methods in order to commercialise these processes and methods. The technology transfer-based model of innovation focuses on adopting and adapting ideas from other societies. This kind of innovation is institutionalized by having its own unit or university-industry linkage, with its main function being to transfer technology to communities and for its own consumption within the specific higher education institution.

Higher education has its own system of innovation with regard to employing different sources and models of innovation.

2.3 HIGHER EDUCATION INNOVATION SYSTEM

The higher education innovation system is a vital element of the national innovation system of a nation. It is described as the sub-set of an innovation system that focuses on higher education institutions in collaboration with government, industry and different communities and societies (Brennan *et al*., 2014:36). In order to observe and analyse the different levels of interactions within the different levels of governance at higher education institutions, the innovation system is perceived as a system of functions, components and relationships (Brennan *et al*., 2014:37).

2.3.1 A system of functions

The function of an innovation system at higher education institutions relates to producing, disseminating and transferring economically useful knowledge and technology to a knowledge-based society (Brennan *et al*., 2014:37). The production, dissemination and utilisation of new knowledge and technologies are best performed by linking research and innovation activities. When research activities produce new and advanced knowledge that is worthwhile for the institution, community and country at large, these innovative activities are utilized to improve services and products for significant change. Innovation as a system of functions directs the selecting, researching, transferring and adapting of new technologies and ideas from other countries to address local institutional and national problems. To discharge innovation as a system of functions, components are relevant for this discharge action.

2.3.2 A system of components

The main components of a system of innovation are individuals and institutions that contribute to the generation, diffusion and utilisation of innovation endeavour within and outside higher education institutions (Brennan *et al*., 2014:38). Individuals represent researchers in higher education institutions who work in collaboration with other researchers and organisations. Institutions are the organisations that collaborate to produce, transfer and utilise knowledge. These organisations are mainly the government, industry and higher education institutions. Components of a system of innovation presuppose relationships to engender innovation achievement.

2.3.3 A system of relationships

Relationships with regard to innovation functioning include collaboration and collaborative leadership, substitution and networking (Brennan *et al*., 2014:39). Collaboration focuses on different stakeholders working together for the common good, whereas collaborative leadership emphasises mediating conflicts among stakeholders and substitution pertaining to leadership being substituted among stakeholder interaction. As research and innovation requires collaboration and cooperation, higher education institutions establish networking opportunities among stakeholders in and outside higher education innovation system functioning.

2.4 THE LINK BETWEEN RESEARCH AND INNOVATION AT HIGHER EDUCATION INSTITUTIONS

The connection between research and innovation at higher education institutions pertains to research being the basis for innovation endeavour. In this regard, research is the main source for new knowledge and innovation at regional, national, and global level with new, or old knowledge in new ways, the basis for innovation (Crompton, 2007:200; Meek *et al*., 2009:11). Conducting significant research is one of the sources of innovation implying that new and advanced knowledge and technology produced from scientific research represents the basis for innovation (Nicolaides, 2014:5; Nooteboom & Stam, 2008:129).

Considering new and advanced knowledge as the basis for innovation, research should be carried out efficiently and effectively, resulting in communicating research results effectively (Holzbaur, 2005:54). This requires structure and a project-oriented approach as project management is an important prerequisite to perform goal-oriented tasks in research and development settings such as is possible at higher education institutions (Holzbaur, 2005:54). Apart from the direct link between research and innovation, there is also a pertinent link with education because new knowledge from research improves tuition to produce skilled human capital as a key resource for research and innovation at higher education institutions and in industry (Tarnawska & Mavroeid, 2015:6). In this regard, the Council of the European Union asserts the interrelationship between tuition, research and innovation within a knowledge-based dispensation as the functioning of a knowledge triangle (Tarnawska & Mavroeid, 2015:8). Tuition at higher education level should prepare students who are skilled in research and innovation for the organisation's own research and innovation function as well as for industry and other private and public organisations. Research and innovation activities in higher education should also address institutional problems and inadequacies.

Generally, innovation transpires into creating jobs and improving living conditions that are conducive to society (Nicolaides, 2014:13). Research utilise existing knowledge to create new knowledge and to maintain academic leadership. In this regard, higher education institutions fulfil a key role in producing competent human capital through applicable education and training and producing and transferring new knowledge to the community and contributing to economic development (Ho, 2007:1). In order to achieve all of this, alignment between research and innovation and policy and practice is crucial.

2.5 RESEARCH AND INNOVATION AS A POLICY/PRACTICE NEXUS

Shapiro, Haahr and Bayer (2007:8) describe the relationship between research, innovation, policy and practice as interdependent and interrelated functioning. Innovation occurs within the triangle of policy, practice, and research, because when there are inadequacies in practice, innovation becomes the driver of research to address these inadequacies and resolving problems. This applies then to both policy and practice, as the changes due to research and innovation serve as an input for policy reformulation. Carayannis and Campbell (2011:333) state that there should be a connection between scientific knowledge and innovation policy in

order to have sustainable socio-economic development with scientific knowledge referring to knowledge produced through research as occurring at higher education institutions.

Chen (2015:445) confirms that though policy, research and practice are distinct and have their own existence at higher education institutions, they are interconnected. The nexus between research, policy and practice is treated differently in different countries. For instance, in China, this nexus is characterised by a strong institutional basis and practice orientation at macro and meso level. The nexus is legally supported by the state and there are programme orientations for academics and administrators to support rich interaction among academics and activities in the Chinese higher education context connecting research, policy and practice endeavour (Chen, 2015:441).

Higher education policy should integrate knowledge, research and innovation as higher education institutions are the main engines of economic development through knowledge production and innovation (Ahola & Hoffman, 2012:76). With reference to policy context, higher education institutions function in triple helix with state and business (Ahola & Hoffman, 2012:76). As the connection between innovation and policy is complex, policy can hamper innovation if not formulated applicably because policy determines the performance of a higher education institution's research and innovation activities (Goatley & Johnston, 2013:98; Hoareau, Ritzen & Marconi, 2012:36). In this regard, knowledge and innovation policies should be supported by the stakeholders of higher education on governmental, community, and local and national industry level. This requires competent leadership and management to develop collaboration and networking with stakeholders to create a common mission and commitment to implement policies applicably (Chen, 2015:357).

2.6 CHALLENGES TO RESEARCH AND INNOVATION AT HIGHER EDUCATION INSTITUTIONS

Higher education institutions face different challenges to their research and innovation endeavours. Sawyerr (2004:11) identifies the challenges that African universities face to develop research and innovation capacity to relate to factors such as inadequate human capacity in the research environment, funding constraints, inadequate infrastructure, a lack of research incentives, and improper time available for research actions. Poor infrastructure at African universities includes a shortage of laboratory equipment and chemicals, and inferior libraries.

Shortages of research experts, low salaries for research staff, a constant brain drain, poor research quality and applicability of research endeavour, and unreliable sources for research funding are common challenges experienced in African countries (Teferra & Altbach, 2004:38)

In addition, challenges of African higher education institutions to engage in research and innovation activities are acute shortages of research scholars who have research capacity to produce and utilise new and advanced knowledge. Poor infrastructure, inadequate facilities, and a lack of funding is the result of a lack of investment in research and innovation because of poor resource mobilisation and utilisation and focussing on basic priority areas only for research endeavour. Weak university-industry linkages because of poor research and innovation management and leadership fail to facilitate collaboration and networking among government, industry and higher education institutions (Yizengaw, 2008:10). All these misgivings apply to higher education functioning in Ethiopia (Yizengaw, 2004:7).

According to Swanger (2016:25-34), the innovation challenges that higher education institutions in the USA face are tradition regulations, structuring arrangements, insufficient funding, faculty autonomy, accreditation regulations, government involvement, and rigid criteria for performance funding. The challenge regarding tradition regulations relates to not having goals for change and problem-solving in and outside the institution as the perception is that nothing is wrong (Swanger, 2016:25). With regard to structuring arrangements resistance to innovation is the result of loosely functioning systems because the shared governance of institutions hampers innovation due to shared governance confusion engendering stagnation (Swanger, 2016:26). Faculty autonomy which hinders or enhances institutional innovation relates to the presence or absence of committed and dedicated faculty members, which, because of the close relationship between structure and faculty, may maintain the status quo rather than facilitate innovation (Swanger, 2016:28).

As accreditation at higher education institutions emphasises processes and traditional structures, it does not encourage innovation but a mere adherence to the standard of accreditation bodies (Swanger, 2016:30). Government symbolising politics and power do not necessarily create conditions conducive for innovation, albeit influencing funding and grants for innovation at higher education institutions (Swanger, 2016:31). There is, however, contradiction between government expectations of innovation at higher education institutions and government support to facilitate these innovations in practice (Swanger, 2016:33).

Innovation challenges relating to performance funding pertain to performance of higher education institutions being measured by graduation rates, retention rates, and job placement rates only resulting in the fact that the extent of innovation pursuit is not acknowledged (Swanger, 2016:34).

2.7 THE CONCEPTS OF RESEARCH AND INNOVATION LEADERSHIP AND MANAGEMENT

When reflecting on research and innovation, understanding the concepts of research and innovation leadership and management is relevant.

2.7.1 The concept of research leadership

Considering the fact that there is no clear difference between the roles and responsibilities of research managers and research leaders, and even though research leadership in higher education is not funded substantially well, research leadership is important for the production of new ideas and knowledge through research, and for the development and production of innovation for socio-economic development (Debowski, 2010:215; Saltmarsh *et al*., 2011:293). It is therefore crucial to lead and manage research and innovation properly if higher education institutions are to contribute to knowledge in a knowledge-based dispensation.

A typical role of higher education institutions in a knowledge-based economy is to train the next generation of researchers in research and development as the main originators and disseminators of new knowledge. However, this requires research leadership knowledge and skills which pertain to select people who have the potential and the calibre to provide advanced training on basic and applied research, creativity and innovation, and to facilitate conditions to work with experienced researchers and innovators in different research and innovation projects (Saltmarsh *et al*., 2011:294). Consequently, this manpower should have the knowledge and skills to undertake research and innovation endeavours and leading and managing research and innovation projects with assertive research-related skills.

Research leadership is entrusted to academics based on their research competencies perceiving that they have the capacity of leading and inspiring other researchers (Saltmarsh *et al*., 2011:295). However, research leadership requires additional leadership skills and qualities

such as leading and managing research projects, setting direction, motivating, inspiring, and producing change, accompanied by management qualities relating to planning, budgeting, coordinating, controlling, monitoring, evaluating and establishing networks and partnerships in order to manage research endeavours at project and institutional level. Saltmarsh *et al*. (2011:303) explain that research leadership and management include planning, staffing, organising, coordinating, controlling and evaluating staff's day to day activities and their qualities and performances together with solving conflicts, establishing networks and setting the pace for research endeavour. These actions include both leadership and management qualities to be carried out for research and innovation performance at project and institutional level.

Research leadership is a fundamental role in higher education institutions presupposing that higher education institutions should have competent research leaders who are able to make their institutions productive regarding research engagement steered by personal research qualities including being a broker and having scientific capital and charisma to create and formulate research programmes (Hansson & Mønsted, 2008:667; McInnis, Ramsden & Maconachie, 2014:5). Being a broker pertains to the competency of arranging networks in teaching and research and the external higher education institution environment. In this regard, the research leader uses external contacts to disseminate research for access to further research. The research leader uses rules, negotiate in the bureaucracy, and develop organisational openings in a creative way to create an environment of self-management in a research group to mobilise young researchers to take their own initiatives. A crucial quality of successful research leaders is the ability to mobilise resources from different sources by acting as an entrepreneur and using their charisma with networking (Hansson & Mønsted, 2008:667).

Research leadership is a complex action defined at project and institutional level. At project level, the role of the research leader is to guide, inspire, motivate, facilitate and lead research team members to achieve project objectives in terms of both quality and success. Research leadership at institutional level pertains to the role of being president or vice-president for research and community engagement with as main function to set direction, and to inspire and lead research programmes to achieve institutional and national goals and objectives (Debowski, 2010:215).

Although research leadership is complementary and inseparable from research management at higher education institutions, the concept of research management needs separate clarification.

2.7.2 The concept of research management

Hansson and Mønsted (2008:655) define research management as managing material and financial resources, and researchers with the different obligations, which they have to fulfil. According to Kirkland and Ajai-Ajagbe (2013:3), research management is the action at higher education institutions carried out to improve the effectiveness of research engagement and research outputs. This includes giving advice and communicating research results to the institutional family and the society through proper dissemination and commercialisation activities. At research project level, research management entails managing the research team to identify an important research theme, to plan, implement and evaluate its quality within the time set aside for the project and the budget allotted to achieve project objectives. Research management entails the planning, organising, leading and evaluating of people, resources and systems to produce new knowledge (Bernardo, Baranovich & Manueli, 2017:4). In doing so, reference to research policy is crucial for research management (Lasambouw, 2015:7). At university level, research management focuses on policy development and implementation with supervision, whereas operational research management is carried out at college and departmental level with these levels of management each accountable for resource utilisation, facilitating a healthy competitive environment among researchers, managing policy and legal issues, and managing the quality of research outputs (Bernardo *et al*., 2017:4; Kirkland, 2008:718).

One of the goals of research management at higher education institutions is to enhance research income by increasing research productivity and to transfer knowledge to external users including the community and industry. The main aim relates to managing the impact of research regarding its practical application, its user appreciation, and its usefulness in general which is accomplished by innovation leadership and management that focuses on the utilisation of new ideas and knowledge produced from advanced research at higher education institutions (Bosch & Taylor, 2011:445). It necessitates understanding the concepts of innovation leadership and management.

At higher education level, the role of research manager includes managing research and innovation activities to accomplish research outcomes significantly (Ivey, 2015:1). Research management at higher education institutions therefore comprise managing the complex activities of research and knowledge production by means of attending to strategic planning, external relations, resource management, centre and institute management, and managing research ethics, intellectual property, technology transfer and assessment and evaluation (Bernardo *et al*., 2017:4).

2.7.3 The concept of innovation leadership

According to Horth and Buchner (2014:5), innovation leadership represents two approaches, namely an innovative approach to leadership and leadership for innovation. The former approach focuses on thinking in new ways and acting differently when leading an organisation. It also pertains to thinking and acting to overcome challenges and solve complex problems that are faced in an organisation. The second approach pertains to applying innovative thinking and developing a culture of innovation to provide new products and services, and to solve problems. It also pertains to helping employees to think differently and work in new ways to address the challenges they and their organisation face.

Using innovative thinking is the first step that leaders take to address the challenges they face through creating innovation and adapting changes in an organisation. However, developing a culture of innovation where employees apply innovative thinking to provide new services, to produce new products, and to solve problems requires leadership behaviour that supports and promotes innovation (Horth & Buchner, 2014:14). In order to make the organisation productive in an innovative way, leadership should set direction, create alignment and build commitment for innovation. This requires organisational encouragement to have a shared vision for innovation, resilience to criticism of ideas and to failure, and leadership encouragement to nurture and promote creative people (Bernardo *et al*., 2017:4). Innovation leadership also needs enough resources to make innovation a priority, a realistic workload to be productive, and freedom in order to choose the area and the method of innovation. A crucial part of innovation leadership is the challenge of setting significant goals and assigning difficult tasks, arranging teamwork and collaboration for facilitating effective communication and creating space that encourage interaction and the constructive exchange of ideas (Horth & Buchner, 2014:14).

2.7.4 The concept of innovation management

Scholars define innovation management in different contexts. In the context of firms, innovation management represents activities relating to challenges with producing products and the processes and administration of product production (Carayannis & Campbell, 2011:350; Jasimuddin, 2012:287). In higher education institutions, innovation management is the application of management techniques and tools to create a conducive environment for the development of practical innovations (Andolfi, 2016:65). It requires collaboration within and outside the institution to create technological, economic and social innovation. It also allows the institution to react to internal and external needs and challenges by establishing partnerships and networks to produce new knowledge or to adapt existing knowledge or combining knowledge from different sources to co-create knowledge in addressing institutional, industry and societal needs and challenges (Andolfi, 2016:66). In addressing these needs, information communication technology is both a means and an end to innovation management (Ho, 2007:4).

In general, leadership and management of research and innovation pertain to managing a research project by applying project leadership and management knowledge and skills.

2.8 PROJECT MANAGEMENT AND LEADERSHIP

Project management and leadership sciences are understood from different angles. For instance, project management is understood as the application of project management knowledge, skills, tools, and techniques to implement project activities to achieve set objectives (Johnson, 2013:35). In this regard, project management is a process of implementing a project on time, and within the demarcated budget to the desired level of quality of outcome to satisfy the stakeholders of the project. Project management pertains to using the management steps of initiating, planning, executing, monitoring and controlling research activities (Johnson, 2013:36). In this regard, project management is applicably used in higher education institutions to identify, plan, implement and achieve the objectives of research projects for the own benefit and for the benefit of stakeholders like the community, industry and government. In this regard, Austin, Browne, Haas, Kenyatta and Zulueta (2013:89) emphasise that applying project management in construction management and healthcare as goal-oriented competitive endeavour requiring collaboration, problem solving and competency, also applies to the higher

education context. The resemblance with construction is that higher education also requires collaboration and different competencies having different priorities to deliver quality products and services to its customers.

However, it is difficult to manage academic research using traditional project management techniques and processes when academic research entails problems relating to setting milestones and defining successes of research outcomes in terms of time, budget and objectives because of uncertainty and a lack of clarity and accountability (Powers & Kerr, 2009:1). Consequently, Powers and Kerr (2009:6) suggest a framework containing different elements for managing academic research projects relating to researchers and stakeholders agreeing on credible criteria and objectives for research actions; the project manager being devoted to achieving important milestones; and the project manager exerting applicable power to keep the research project on track.

As project leadership is a process of leading, motivating and guiding stakeholders to achieve project objectives, the ability of the project leader is crucial to create an appropriate vision for the research project, collaborating resources, and providing motivation for project team members and stakeholders to achieve project objectives outstandingly (Riaz1, Tahir & Noor, 2013:101). Applied to higher education institutions, the implication is that in order to have successful research and innovation projects at higher education institutions, strong leadership and management of research projects is vital for constant progress.

2.8.1 Research project management and leadership

A research project pertains to activities to achieve research objectives and to produce outcomes as scheduled (CDRI, 2013:11). Managing a research project implies managing researchers, a generation of new knowledge, and sharing and disseminating existing knowledge cooperatively (CDRI, 2013:11). It also implies the application of skills, knowledge, tools and techniques to manage resources in order to answer to the expectations of stakeholders (CDRI, 2013:17). In so doing, the first agenda of the research project manager is to assess and understand common management issues and dilemmas related to research project development such as the purpose of the research, tasks, staffing and coordination of research actions. In managing a multi-disciplinary research team, a research manager should know how to establish a team of researchers having different experiences and addressing their individual needs and

differences (CDRI, 2013:16). The research project manager should also have effective and efficient policies and procedures to address scope management, issues management, budget management, quality management, communication management, risk management, and change control management arrangements (CDRI, 2013:17). Moreover, research managers should be focused on locating stakeholders whose needs and goals match the mission, goals, interests and needs of the specific research project (CDRI, 2013:24).

In managing a research project, the project manager engages with the cycle of project management actions pertaining to initiating the project, planning different actions, implementing actions and finalising research outcomes. By initiating a research project, identification of an area to be researched is at stake with this area being in line with priorities of the institution and the development agenda of the country, and with consultation with key stakeholders. Planning of the research actions involves conceptualizing of the research framework, developing a research design and research methods, and planning resources relating to time, finances, and human and material resources. Implementing the project entails the developing of data collection tools, collecting and analysing data, and writing a report. Finalising the research project focuses on presenting the findings of the project, reflecting on the lessons learnt, finalising the report based on the feedback from presentations on the findings, and disseminating the findings through publication. The research project manager should apply management principles and tools that facilitate the effective and efficient implementation of research project endeavour (CDRI, 2013:24).

Johnson (2013:37) points to the twelve rules of management success relevant to research project management accomplishment. Accordingly, the project manager should gain consensus on project outcomes, build the best team, develop a viable comprehensive plan and keep this plan up to date. The manager should determine the quantity of resources needed aligned to a realistic schedule for task performance and the ongoing support of management and stakeholders. The manager should be responsive to change and to keeping everyone informed about the progress with the project while considering new approaches for improved performance and outcomes (Billot, 2010:38). These actions should be carried out based on project management leadership of inspiring and motivating team members and building trust and commitment to achieve the set objectives of the research project realistically (CDRI, 2013:17).

For higher education institutions to apply the new knowledge produced from their research project endeavours to address their own problems and the needs of the local community, they should develop innovation projects, and manage and lead this innovation properly.

2.8.2 Innovation project management and leadership

Innovation project management pertains to managing changes of inputs into outputs by incorporating feedback to check that the changes are in line with the project objectives (Filippov & Mooi, 2009:8). Innovation is then achieved as temporary endeavours applied successfully in established project teams with reference to two contexts. A first context pertains to managing innovation in public institutions to create products and services that is new to the institution without the intent of commercialisation (Filippov & Mooi, 2009:6). With regard to the second context, innovation project management pertains to managing innovation in corporate research and development companies, laboratories or public research institutes to develop a unique and novel product and service that is commercialised (Filippov & Mooi, 2009:6). At higher education institutions, both these two types of innovation projects are relevant to address the problems of the local community and to become an engine to produce relevant knowledge in a knowledge-based dispensation.

Considering its complex and non-linear nature, innovation projects represent three different types relating to imitation innovation, incremental innovation and radical innovation (Filippov & Mooi, 2009:7). The goal of an imitation innovation project relates to short term activity focused on creating a product or service that is new to the organisation and its customers but developed by another organisation. An incremental innovation project aims at improving a product or service that was developed internally while the goal of a radical innovation project is broad, and its objective is to develop a product or service that is unique and novel for both the organisation and the market.

Three project categories are included under innovation projects, namely technology projects which pertain to developing or transferring new technology, research projects that include basic research to produce new and advanced knowledge and applied research to solve real problems, and new product development projects such as computers, telephones and cars (Filippov & Mooi, 2009:9). With innovation projects, objectives are loosely defined and ambiguous, and processes are experimental and exploratory, hence risk-taking is relevant. Expenses for

innovative and research activities are characterised as long-term, with increased insecurity regarding the eventual amount of generated earnings (Filippov & Mooi, 2009:6).

Project leadership quality relates to innovation project processes that demand from project leaders to be problem solvers applying the Schon model of reflective practice with their research endeavours (Oeij, Gaspersz, van Vuuren & Dhondt, 2017:18). The Schon model includes two forms of reflection, namely reflection-in-action focused on acting instantly to improve practice and reflection-on-action after completion of the research project to contribute to the pool of knowledge on research characteristics for improved outcomes. The Schon model provides guidelines for innovation project leaders regarding reflection on their actions and experiences in order to determine what works well and what not, based on the trial and error approaches of an exploratory nature in pursuit of constant betterment.

2.9 RESEARCH AND INNOVATION IN HIGHER EDUCATION INSTITUTIONS IN A KNOWLEDGE-BASED DISPENSATION

Higher education institutions should produce new knowledge for their own benefit and for the benefit of the society (Bonaccorsi *et al*., 2010:1). Presently, universities play a key role in contributing to a knowledge-based economy by engaging in science, technology and innovation (Salem, 2014:1049). According to Oyewole (2010:20), education is the basis for a knowledge-based economy because of its focus on preparing competent and skilled human capital for the workforce of both private and public institutions. Well-educated and skilled human capital is a priority to produce and disseminate knowledge based on research and utilizing this knowledge in an innovative manner.

Due to the presence of a knowledge-based dispensation and the significance of scientific knowledge, higher education institutions fulfil a key role in producing new knowledge contributing to changed products and services for convincing competition on world market platforms (Ahola & Hoffman, 2012:111). Muresan and Gogu (2012:3682) emphasise that higher education institutions should establish a culture of research and innovation to address inadequacies in political decision areas and to adhere to labour market demands in a knowledge-based society. Higher education institutions have to play an important role in creating new knowledge, transmitting this knowledge to students and fostering innovation (Eid, 2014:1)

Advanced research in higher education as the basis for a knowledge-based dispensation and to use this knowledge to transform the nation into a knowledge-based society relates to preparing trained workers and knowledge producers (Njoku, Anyanwu & Kaegon, 2014:24). This occurs by training researchers in their postgraduate programmes in an ongoing manner to develop research capacity based on researchers having the ability to undertake scientific research and being able to produce advanced knowledge and technologies as commodities. According to the Department for Business Innovation and Skills (2014:31), higher education institutions should contribute to different innovation initiatives by producing and preserving knowledge through research and teaching, developing the skills and knowledge of research teams and individual researchers, and developing innovation-relevant technologies and new forms of problem-solving approaches in addition to scientific discoveries.

In general, higher education institutions fulfill three interrelated research roles, namely producing new knowledge, disseminating this new knowledge, and applying the new knowledge for local and national benefit (Ho, 2007:9). In order to accomplish these three roles, higher education institutions require a system change with regard to research paradigm, research purpose, research policy and research practice. Sterling (2004:64) refers to this comprehensive system change as the four P's representing paradigm, purpose, policy and practice of research endeavour. The clarification of these four P's in terms of a complete system change from the old approach to a more contemporary approach to research conduct is schematically presented in Table 2.1.

Table 2.1: System change to research conduct according to the four Ps

The four P's	Changes from the old to the new system of research	
	Old system	New system
Paradigm	Higher education rooted in a mechanistic paradigm embedded in reductionism, positivism, and objectivism	Higher education reflecting upon a research paradigm founded on a complex view of the world embedded in holism and critical subjectivity
Purpose	Higher education is seen as preparation for economic life	It is seen as broader education for sustainable changes in overall systems of economy, ecology and environment
Policy	It is seen in terms of products	It is seen in terms of developing capacity through life both individually and socially through continuous learning
Practice	It is seen as instruction and transmission	Learning is seen as a participative and dynamic learning process, generating knowledge and meaning, solving real world problems

Source: Sterling (2004:64)

As presented in Table 2.1, when the research paradigm for higher education endeavour changes from reductionism and objectivism to holism and subjectivism, its purpose, policy and practice also change. When the research paradigm, purpose, policy and practices of higher education institutions are changed, the leadership and management of research actions in higher education institutions should also be changed. Accordingly, in order to produce knowledge and apply this knowledge to resolve real problems at local, national and global level, higher education institutions should engage in research and innovation actions by managing and leading these actions effectively aligned to a knowledge-based dispensation. This requires revisiting the leadership theories that guide higher education institutions when leading and managing their research and innovation activities as the leadership theories of the industrial age are not relevant for a knowledge-based dispensation. In this regard, theories of the industrial age were mainly based on bureaucratic leadership emphasising control and influence on workers by maintaining stability and avoiding uncertainty to achieve set goals. Theories guiding a knowledge-based era focus on complexity and leading in contexts that facilitate interaction among different agents within and outside organisations to learn, to adapt and to innovate for the sake of constant improvement (Sterling, 2004:64).

2. 10 COMPLEXITY LEADERSHIP THEORY FOR A KNOWLEDGE-BASED DISPENSATION

With regard to literature on the theory of leadership for a knowledge-based dispensation, the argument is that leadership theories of the industrial age are not appropriate for the knowledge-based era as the industrial age theories are based on a bureaucratic framework, i.e. a hierarchical organizational structure which leaders use to influence their followers by controlling, creating stability and avoiding uncertainty (Uhl-Bien *et al*., 2007:301). Consequently, complexity leadership theory is considered applicable for a knowledge-based dispensation as complexity leadership theory acknowledges a bureaucratic organisational structure accompanied by enabling and adaptive leadership through interactive engagement (Uhl-Bien *et al*., 2007:302). Complexity leadership theory allows knowledge production based on organisations developing the capacity to learn creatively and being adaptable in complex adaptive systems (Uhl-Bien *et al*., 2007:304). Complexity leadership theory applies to studies on higher education institutions where the focus is on knowledge production, knowledge dissemination and knowledge application through research and innovation endeavours.

2.10. 1 Historical overview of complexity leadership theory

The concept of complexity that originated from the Latin expression 'complexus' meaning adjoining, incorporating, embracing, comprehending, and comprising was coined by Weaver in 1948 to refer to three different ways of understanding complex problems (Mason, 2008:64). A first way of understanding complex problems relates to a paradigm-of-simplicity if complex problems are addressed by reducing them into smaller parts so that each part is solved separately and consecutively in line with classical physics (Mason, 2008:64). A second way of understanding complex problems relates to rational mechanics based on the discovery of disordered phenomena in thermodynamics and quantum mechanics because complex problems cannot be addressed considering rational mechanics models only which employ linear and mechanistic approaches (Mason, 2008:64). The third way of understanding complex problems include the use of a complexity adaptive system as a comprehensive system extending physics, chemistry, biology and economics to include all complexity-related sciences such as organisational sciences (Bento, 2013:75; Hatch & Cunliffe, 2006:75; Lichtenstein & Plowman, 2009:628; Mason, 2008:33). In this regard, Uhl-Bien and Marion (2009:632) perceive the third way of understanding complexity as a generative of emergence in and among a complex adaptive system (CAS) through vibrant interaction and contact to mutually support connections between and with CAS agents (Uhl-Bien *et al*., 2007:304).

From the historical development of complexity science, it has grown from a reductionist and objectivist view to holism and subjectivism to understand and explain complex issues and practices. Although initially rooted in physical sciences and employed in a machine-like setting to solve problems in different contexts, it is currently also applied to understand complex problems in social sciences like management, administration, and education. Higher education institutions have been changing their systems from a reductionist and objectivist view to holism and subjectivity because of complex responsibility and complex functioning as knowledge producing organisations in a knowledge-based dispensation ((Uhl-Bien *et al*., 2007:302). Therefore, in order to understand higher education institutional leadership and management actions as these actions pertain to research leadership and management of knowledge production and application for consumption internally and externally, complexity leadership theory serves as a meaningful theoretical lens to direct empirical investigation.

2.10.2 Complexity leadership theory and its framework

Leadership scientists developed complexity leadership theory and its leadership functions by developing a framework for studying complex organisations.

2.10.2.1 Complexity leadership theory

Complexity leadership theory studies the complex interactive dynamics entrenched in organisational systems contexts by preparing organisations to solve their challenges using their networks in adaptive ways to address dynamic and complex problems for knowledge production in innovative manners (Uhl-Bien *et al*., 2007:304; Uhl-Bien & Marion, 2009:632).

Complexity leadership theory entertains leadership within context by focusing on facilitating learning, innovation, and the adaptive capacity of complex adaptive systems (CAS) within the setting of bureaucratic functioning in organisations (Uhl-Bien & Marion, 2009:632). In this regard, learning is not recycling existing knowledge; rather it is a journey to be explored cooperatively and through emergent self-organisation based on enabling leadership (Mason, 2008:23; Plowman, Solansky, Beck, Baker, Kulkarni & Travis, 2007:342). In this regard, complexity leadership theory assists complex organisations to interact with their complex adaptive systems and solve their complex problems through learning, innovation and adaptive networks in knowledge-producing organisations like higher education institutions. This is achieved differently within the context of each specific institution. As the context of higher education institutions is complex having complex functions and expectations from stakeholders (community, government, industry), higher education institutions rely on experience while researching their own practices to produce competent human capital, and to engage in research to produce new and advanced knowledge and technologies for application internally and by their communities and the broader society (Plowman *et al*., 2007:345). This responsibility pertains mainly to the institution's research and innovation function through interaction within the institution itself and in collaboration with other institutions, government, the local community and industry in a knowledge-based dispensation. This requires research and innovation leadership and management that are complex, albeit adaptive.

2.10.2.2 Framework of complexity leadership theory

Complexity leadership theory represents a framework allowing vibrant interaction in a complex adaptive system (CAS), controlling and coordinating the structures of organisations to achieve

their goals and objectives in line with formulated vision and mission statements (Uhl-Bien *et al*., 2007:304). There accordingly different types of leadership in the complexity leadership theory framework are based on integrating complexity with bureaucracy, enabling coordination, exploration and exploitation within the CAS hierarchy, but with informal interaction despite top-down control (Uhl-Bien & Arena, 2017:7).

The framework of complexity leadership theory encompasses three leadership functions, namely administrative (management), adaptive and enabling (Uhl-Bien *et al*., (2007:304).

- **Administrative leadership**

Administrative leadership pertains to the management roles of leaders who perform planning, coordinating, aligning and controlling in line with the hierarchical and bureaucratic functions of an organisation. Administrative leadership includes structuring tasks, building vision, allocating resources to achieve goals, and managing crises and conflict. It also pertains to managing organisational strategy to achieve organisational goals and objectives as effectively and efficiently as possible. Administrative leadership refers to the role of a manager who plans and coordinates the bureaucratic functions of an organisation, which, with complexity leadership theory, links creativity and learning with adaptability implying that administrative and adaptive leadership should be applied jointly (Uhl-Bien *et al*., 2007:305).

- **Adaptive leadership**

Adaptive leadership pertains to change behaviour that emerges due to interactions and interdependence between and among agents (Uhl-Bien *et al*., 2007:309). Adaptive leadership represents a change movement that emerges nonlinearly from interactive and collaborative change among agents. It develops from needs, ideas and preferences among agents and groups with contradictory inclinations. Leadership resulting from complex dynamics rather than individual engagement represents adaptive leadership (Uhl-Bien *et al*., 2007:306).

According to Lichtenstein, Uhl-Bien, Marion, Seers, Orton and Schreiber (2006:4), adaptive leadership is an interaction that inflames organisations to be increasingly adaptive through changing knowledge, action and behaviour. Adaptive leadership focuses on actions based on

creativity and learning that arise from complex adaptive system connections to address tension that arises from limitations, pressure from a leader and competitors (Uhl-Bien *et al*., 2007:305). Adaptive leadership is acknowledged when it has significance and impacts on learning and changes occurring in an organisation and its agents. Significant adaptive leadership relates to the importance of new, creative knowledge and adaptive ideas and the degree of usage of that knowledge and ideas by others (Uhl-Bien *et al*., 2007:306). Adaptive leadership has significance in complexity leadership theory when properly integrated into a formal structure with agents of the organisation contributing to improved change for social betterment (Uhl-Bien *et al*., 2007:307).

Adaptive leadership is characterised by network dynamics and multi-level leadership with network dynamics representing the contexts and mechanisms that facilitate adaptive leadership. The context represents factors relating to network interaction, complex patterns of conflicting constraints, patterns of tension, interdependent relationships, rules of action, direct and indirect feedback loops, and rapidly changing environmental demands (Uhl-Bien & Arena, 2017:8). Dynamic patterns of behaviour produce complex outcomes resulting in resonance, an aggregation of ideas, catalytic behaviours, dissipation of built-up tension, nonlinear information flow changes, and patterns of information and accrediting nodes. The primary outputs of this complex dynamic outcome include adaptability, creativity and meaningful learning (Uhl-Bien *et al*., 2007:307). Adaptive leadership emerging from such complex contexts symbolises two interactive and interdependent activities, namely the interaction of agents and CAS to produce ideas and knowledge, and the interaction of ideas and knowledge to produce ideas that are even more complex characterised by abstract knowledge (Uhl-Bien *et al*., 2007:307)

Adaptive leadership resembles an emergence characteristic based on producing outcomes to reformulate existing elements (Uhl-Bien *et al*., 2007:308). In this regard, multi-level leadership equates adaptive leadership as complex adaptive systems occurring on all levels of an organisation presupposing adaptive leadership at the strategic level to focus on planning, resource acquisition and a strategic relationship with the environment. At middle or organisational level, adaptive leadership focuses on planning and resource allocation whereas lower level engagement concentrates on developing the main products of an organisation by focusing on producing new knowledge through innovation and adaptation in a knowledge producing organisation (Uhl-Bien *et al*., 2007:309).

- **Enabling leadership**

Enabling leadership serves as catalyst to create entanglement between administrative and adaptive leadership to facilitate conditions conducive to satisfactory performance. Adaptive leadership occurs when innovation and adaptability are needed for the flow of knowledge and creativity from adaptive into administrative structures at all hierarchies of the organisation (Uhl-Bien *et al*., 2007:305). The role of enabling leadership in a complexity leadership scenario is then to directly foster and plan conditions that catalyse adaptive leadership and allow for emergence. Even though managers at organisational level have more opportunities to facilitate enabling behaviour as they have access to resources and have direct involvement at the edge of the production level, enabling leadership occurs anywhere in the organisation where agents engage in adaptive and enabling leadership endeavour (Uhl-Bien *et al*., 2007:309). Enabling conditions catalyse adaptive leadership with one of the functions of enabling leadership to catalyse the dynamics of complex adaptive systems in order to promote adaptive leadership based on the enabling conditions of interaction, interdependency, tension, and heterogeneity.

Interaction as an effective network condition to produce a network of linkages across which information flows, connects complex networks and is self-organisable because of the influence of enabling leadership (Uhl-Bien *et al*., 2007:309). Interdependency referring to agents who are interdependent in a system and who create pressure to act on information relies on enabling conditions to counter tension as an imperative for constructive elaboration on strategy, dissemination of information and adaptability to increased complexity (Uhl-Bien *et al*., 2007:310; Uhl-Bien & Marion, 2009:642). Upper and middle level enabling leaders engender motivation by distributing resources in a manner that supports creative engagement for improved results. At individual level, agents engage in enabling leadership by recognising the creative value of eustress and using this eustress to foster productive discussions and interaction (Uhl-Bien *et al*., 2007:311). According to Lichtenstein *et al*. (2006:5), eustress is a driver of adaptive leadership. Uhl-Bien and Marion (2009:643) understand eustress as adaptive tension and pressure to elaborate and to adjust in order to engender positive change.

Heterogeneity as a condition for enabling leadership refers to differences in both human and physical agents, including different skill sets, preferences, information, technology, techniques and worldviews (Uhl-Bien & Marion, 2009:642). Enabling leadership pertains to managing the entanglement of heterogeneity between adaptive and administrative leadership by managing

the entanglement between CAS dynamics and formal administrative systems and structures. This is achieved by using authority, access to resources, and influence to keep formal and informal organisational systems working in harmony rather than counteractively. As formal structures present obstacles for innovation to organisation interface, power is needed to facilitate, orchestrate, and share innovative ideas and outcomes throughout the organisation. Enabling leadership in collaboration with adaptive and administrative leadership determine creative outputs as most appropriate for excelling into a broader bureaucratic structure. In this regard, enabling leadership coordinates the interface between adaptive and administrative leadership by prompting policies and strategies for enabling complex dynamics (Uhl-Bien *et al*., 2007:309)

With reference to complexity leadership theory, studies on higher education institutions benefit from employing this theory as theoretical lens to study and understand the complex functioning of knowledge production to address internal problems and that of the community and the nation. This necessitates using not only administrative leadership but also adaptive and enabling leadership. This entails the leadership and management of research and innovation at higher education institutions by employing the three types of leadership, namely adaptive, enabling and administration. To accomplish such leadership-management, research and innovation leaders-managers should firstly focus on the management functions of initiating, planning, controlling, coordinating and evaluating research and innovation programmes and projects (Uhl-Bien & Arean, 2017:6). At the same time, they should employ adaptive leadership that facilitates dynamic interaction among researchers within and outside the institution, between researchers and their institution, and between researchers and government and industry through networking fostering learning, innovation and adaptation. In this regard, research leaders-managers should establish interdependence among key stakeholders and partners; and ensure eustress to drive adaptive leadership by establishing networks and partnerships encompassing heterogeneity that accommodate differences in knowledge, skills, techniques and technology (Uhl-Bien & Arean, 2017:5). Using enabling leadership, leader-managers create entanglement between adaptive and administrative leadership in order to manage and lead research and innovation outcomes addressing community, government and industry problems.

With reference to leadership functions based on complexity theory reflection, Hazy and Uhl-Bien (2013:3) identify five leadership functions namely the generative function that facilitates

adaptation and entrepreneurship, the administrative function that increases performance and efficiency, the community building function that develops shared identity, the information gathering function that fosters a culture of learning, and the information disseminating function emphasising accountability. The generative leadership function comprising adaptation and entrepreneurship assists organisations to be creative, innovative and adaptive through interaction among people and systems. The entrepreneurship component prompts engagement in tasks to find solutions to local problems and allow the development of locally useful course-grain properties that might have applicability elsewhere through experimentation (Hazy & Uhl-Bien, 2013:3; Hazy & Uhl-Bien, 2015:81).

The administrative leadership function focuses on implementing managerial functions by defining roles and responsibilities to avoid confusion and to improve performance and efficiency. The community building leadership function catalyses 'fine-grain' interactions regarding the day to day activities of people to develop shared identity of the team and the organisation as a whole (Hazy & Uhl-Bien, 2013:6; Hazy & Uhl-Bien, 2015:84). The information gathering leadership function supports leaders to collect information during fine-grain interactions and to identify the important information as the 'course-grain' characteristics of the organisation with its policies, strategies and competencies (Hazy & Uhl-Bien, 2013:7; Hazy & Uhl-Bien, 2015:84). Leadership as information -using pertains to using information gathered to change the organisation in a certain direction for improved performance (Hazy & Uhl-Bien, 2013:7; Hazy & Uhl-Bien, 2015:85).

Consequently, complexity leadership functions were reduced to three types of leadership, namely operational leadership, entrepreneurial leadership and enabling leadership with the emphasises on 'adaptive space' as the networked structure which enable bureaucratic organisations to develop their adaptive ability in complex situations (Uhl-Bien & Arena, 2017:3). Operational leadership assists leaders to convert emergent ideas into organisational systems and structures that produce innovation and on-going results. Operational leadership also contributes to introducing ideas into the organisation's formal system by creating energy, enthusiasm and support for emerging initiatives among those with the authority to formalise and act on these initiatives, and to break down the brick wall that stops innovation from happening (Uhl-Bien & Arena, 2017:7). Entrepreneurial leadership as the creation and development of new ideas, innovative solutions, and new products and services assists an organisation to adapt to pressures and to capitalise on opportunities. Entrepreneurial leadership

relates to adaptive leadership in that both entertain learning, innovation and adaptability through creating new ideas and knowledge and solving problems. Entrepreneurial leadership also has connections with generative leadership that combines adaptability and entrepreneurship with the adaptive component focusing on creativity, learning and innovation to adapt to complex situations with entrepreneurial aspects emphasising the production of new ideas, knowledge, services and products to address internal and external problems (Uhl-Bien & Arena, 2017:4).

Enabling leadership relates to operational and entrepreneurial leadership by facilitating and creating adaptive spaces that energise capacity in an organisation to respond in an adaptive way to needs and demands. Enabling leadership encourages innovation and change in an organisation's complex adaptive system and network dynamics by using collective intelligence to solve internal problems and respond to external demands (Uhl-Bien & Arena, 2017:8). Collective intelligence comprises the ability of people and their institutions to learn, understand, and think creatively in order to solve problems in a collectively innovative manner. Studying leadership and management of research and innovation practices and policies at higher education institutions benefit from understanding these practices through the theoretical lens of complexity leadership theory.

2.11 HIGHER EDUCATION INSTITUTIONS AS COMPLEX ORGANISATIONS

Higher education institutions are complex organisations having complex functions and responsibilities relating to unpredictable and non-linear operation that is difficult to control because of multiple goal realisation (Middlehurst, Goreham & Woodfield, 2009:317). Leaders of higher education institutions are successful when they establish networks with individuals and companies having expertise to mobilise resources for improved performance. Part of performance improvement is constant researching of the own practice through flexible policy formulation and implementation to facilitate positive change. In this regard, Hazy and Uhl-Bien (2013:22) emphasise that complex organisations cannot be managed as machines because of complex interaction within and outside the organisation.

The complexity of higher education functioning relates to fulfilling a triadic function of tuition, research, and community engagement. In order to perform these functions, complex interactions are relevant among different units within and across higher education institutions,

government, industries and local communities. Middlehurst *et al*. (2009:317) describe the complex nature of higher education institutions from a structural, social and cultural point of view with the structural perspective relating to the functions of the institution, and the social and cultural perspectives connected to the policies and practices of the institution while discharging its duties and responsibilities within this complex functioning scenario.

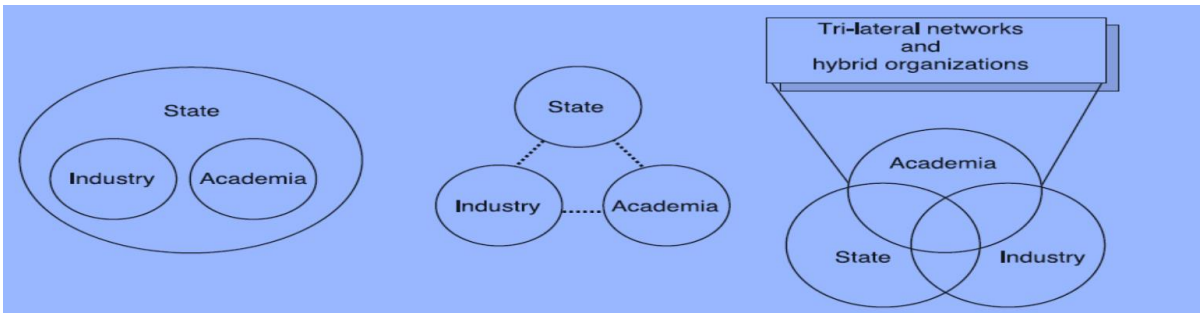
Bento (2013:51) elaborates on the rationale for using complexity leadership theory in studies on research leadership at higher education institutions stating that complexity theory includes adaptive leadership guidelines for implementation at human organisations where adaptive ways are relevant for complex and dynamic interaction among institutions, government, industry, and the local and national environment. With reference to the research function of higher education institutions, it extends research endeavour for academe promotion to include the production of new and advanced knowledge and technology for useful application in an innovative way to address institutional and external problems relying on relevant policy formulation (Uhl-Bien & Arena, 2017:6).

2.12 MODELS FOR LEADING AND MANAGING RESEARCH AND INNOVATION AT HIGHER EDUCATION INSTITUTIONS

Several models are developed for studies on research and innovation in higher education environments. Etzkowitz's (2003:302) model of 'Triple Helix' innovation includes the state, industry, and university as partners in producing and utilising new knowledge. However, the Triple Helix model for innovation does not clearly explain how research is led and managed at higher education institutions to produce new knowledge and innovation in collaboration with industries, government, and communities. The model does not include the community as a key partner of higher education institutions that suggests a change of the model to a 'quadruple helix' representation. Hamida, Abdullah, Shouldafa, Abidind and Ahmad (2015:2847) developed a conceptual framework described as an 'innovation excellence model for higher education institutions' to relate leadership, culture, change, human and other resources, but does not include basic and applied research as main sources of innovation at higher education functioning.

A schematic representation of Etzkowitz's (2003:302) triple helix model of innovation depicts the three types of configurations of state, industry and academia for a system of innovation engagement**.**

Figure 2.1: The triple helix model of innovation



Source: Etzkowitz (2003:302)

Etzkowitz (2003:295) emphasises that the link between university, industry and government is essential for innovative endeavour in a knowledge-based society. This essential link pertains to industry focusing on production, government facilitating the relationship between industry and university, and the university producing new and advanced knowledge and technology through research that is prompted by innovation and commercialization within a knowledge-based dispensation. As shown in Figure 2.1, the model for explaining the leadership and management of research and innovation at higher education institutions has three alignments, namely the state, industry and academia. The state represents government controlling the university and industry. According to Ranga and Etzkowitz (2013:239), the directing role of government, both facilitates and hinders innovation in industry and the university. This can be countered by a laissez-faire approach where the three entities of state, industry and university are at a distance from each other, having their own strong boundaries with industry initiating research topics, universities focusing on human capital development, and government regulating social and economic issues with limited intervention (Ranga & Etzkowitz, 2013:239). With this triple helix model, university, industry and government have interwoven structures to contribute to interaction and innovation representing balanced alignment for cooperative advancement (Etzkowitz, 2003:302).

Functioning of the triple helix model for innovation pertains to government, industry and university having individual and institutional innovators based on research interaction for the

purpose of technology transfer, collaboration, conflict moderation, collaborative leadership, substitution, and networking in pursuit of knowledge production, dissemination and application. These endeavours are contingent on capacity pertaining to technology, policy formulation and economic, entrepreneurial, societal and cultural competencies of the different stakeholders (Ranga & Etzkowitz, 2013:238). An addition to the triple helix model, namely the quadruple helix model emphasises community as an important part of innovation from research endeavour because new knowledge is applied within communities (Carayannis & Campbell, 2011:338). However, the quadruple helix model of innovation is criticised for negating the environment as essential driver for knowledge production in systems of innovation (Carayannis & Campbell, 2011:342).

Evans (2012:5) developed a conceptual model of leadership for research and development that focuses on the behaviour, attitude and intellect of researchers because researcher capacity should be managed and motivated at project and institutional level for productive outputs. Kantola and Kettunen (2012:12) emphasise the importance of interactive relations between teaching and research and innovation, between research and innovation and the needs of the customer, between education and the needs of customers, and between education and research and innovation. As higher education institutions are complex organisations, complexity leadership theory is relevant for studying research leadership and management of these institutions. In this regard, researchers of complexity leadership theory developed models to explain the entanglement among the administrative (management), adaptive and enabling leadership functions within the systems and subsystems of higher education institutions. This study on leadership and management of research in higher education institutions considers key components of these leadership and management models for research and innovation to be aligned with policies for functional application in practice. In reviewing the models for research and innovation, and complexity leadership theory, the need for extension and refinement of this knowledge by including knowledge on leadership and management of research and innovation at higher education institutions in developing countries like Ethiopia is perceived meaningful.

2.13 RESEARCHING COMPLEXITY LEADERSHIP

As complexity leadership theory has been refined in terms of its framework and leadership functions, the research design and methodology to study complexity leadership are still in

progress. Consequently, different scholars suggest different research designs and methodologies. For instance, Uhl-Bien *et al*. (2007:314) recommend qualitative and computer modelling approaches. Schneider and Somers (2006:360) claim that statistical methods are not useful to study complexity leadership. Hence, Stentz, Clark and Matkin (2012:1173) contend that leadership research has to be based on both a positivist and interpretivist research paradigm to understand leadership in complex context by means of a mixed-methods research approach. Since complexity leadership theory is context based (Uhl-Bien & Marion, 2009:647) and pragmatic (Mason, 2008:27). Mason (2008:25) suggests 'methodological, paradigmatic and theoretical pluralism' for studying complexity leadership in an education context relating to higher education functioning.

2.14 SUMMARY

In order to produce new and advanced knowledge at higher education institutions for addressing internal, community, industry and nationwide problems, research endeavour should be managed effectively at institutional and project level. The application of project management and leadership sciences is inevitable depicting a strong link between research and innovation, and policy and practice. An innovation system that integrates government, industry and the local community as a conducive environment for producing knowledge innovatively is needed. This demands application of leadership theory and an understanding of complexity leadership theory to serve as theoretical lens for empirical investigations. Higher education institutions have their own innovation systems based on relations with government and industry to discharge knowledge production and dissemination in an innovative way. However, challenges remain to accomplish these interactions relating to understanding research and innovation at higher education institutions by incorporating the local community. This study focuses on developing a model for leadership and management of research and innovation at higher education institutions by considering the local community.

CHAPTER 3
RESEARCH AND INNOVATION POLICIES AND PRACTICES AT HIGHER EDUCATION INSTITUTIONS: GLOBAL AND ETHIOPIAN TRENDS

3.1 INTRODUCTION

In the 21st century, both developed and developing countries have been facing complex socio-economic problems. Some developed countries face more financial crises, terrorism, climate change, and weak science and technological advancement compared to other developed countries. Developing countries face poor quality of education that results in poor human capital and in unproductivity and poverty. Developing countries also face drought caused by climate change, poor health and poor infrastructure, which includes inadequate Information and Communication Technology (ICT) infrastructure and poor science and technological development (Altbach, 2011:11). As both developed and developing countries understand that traditional sources of economy like labour, land, natural resources and commodities need to be developed through science, technology, and innovation for competitiveness on world markets, they developed national research and innovation policies to produce, use and commercialise improved knowledge to address imminent problems.

Formulations and practices relating to a Science, Technology and Innovation (STI) policy varies from country to country, and region to region, and between developed and developing countries because of different contexts. Developed countries have changed their research-related policies from a science policy to a science, technology and innovation policy to a research and innovation policy to e suffic eventually with a focus on innovation in their research policies based on experience with learning, implementation and evaluation endeavours (Rodriguez & Montalvo, 2007:477). Developing countries, however, are still focusing on moving from science to science, technology and innovation, and they are struggling to formulate relevant policies for realistic implementation in order to produce required outcomes (Rodriguez & Montalvo, 2007:477). The difference in developed and developing countries' research policy formulation and implementation endeavour pertains to developed countries having well-established research and innovation systems that developing countries do not have.

When setting priority goals in policy formulation and implementation, developed countries like China and the United States mainly use mission-oriented priority setting, an approach that should benefit developing countries with their different problems and challenges (Mazzucato, 2018:5). A mission-based policy design and implementation focuses on giving new and practical solutions to a certain problem whereas a system-based approach facilitates interaction among parts of the system (Elder & Fagerberg, 2017:5). Developed countries have developed their research policies based on the development of nuclear weapons and space science advancement representing societal demand for security and technological advancement. Even though developed countries have well-developed innovation systems and well-affirmed innovators such as private firms and research institutes, higher education institutions are the major source of research-based innovation for both developed and developing countries. Higher education institutions' research is steered by research and innovation policies to guide research endeavour to produce new and relevant knowledge to be used and commercialised for national betterment and global competitiveness (Ivey, 2015:1; Salem, 2014:1049). In this regard, higher education institutions' national and global contributions relate to preparing skilled human capital for effective functioning within knowledge-based dispensations, albeit representing different contexts.

3.2 RESEARCH AND INNOVATION VERSUS SCIENCE, TECHNOLOGY AND INNOVATION POLICIES: GLOBAL TRENDS

The concepts of science, technology and innovation are interrelated with science depicting knowledge produced by using scientific methods and technology referring to the application of this knowledge in practice (Rodriguez & Montalvo, 2007:477). To distinguish the research endeavours of higher education institutions, academics focus on the scientific way of knowledge production and the link between science and technology to produce outcomes in an innovative manner (Bonaccorsi *et al*., 2010:2). Innovation represents the utilisation of scientific knowledge and technologies to improve products and services (Ho, 2007:5; Kowang *et al*., 2015:33). Research as the production of scientific knowledge and the basis for innovation is linked to innovation as the application of research results in improved ways (Rodriguez & Montalvo, 2007:467).

Considering policy formulation and implementation, science, technology and innovation are used as a single concept with policy innovation encapsulating research, science and technology

(Rodriguez & Montello, 2007:479). In developing countries like Ethiopia, research policies are known as science, technology and innovation policies focusing on guiding the production and utilisation of scientific knowledge by researchers (Schwachula, Seoane & Hornidge, 2014:6). As the accumulation of scientific knowledge was eventually not enough, a shift occurred with science and technology policy development based on the intent to address problems by developing knowledge and skills as a mixture of basic and applied research endeavours (Schwachula *et al*., 2014:6). A further development represents linking higher education institutions' research systems to national policies for socio-economic development and global competitiveness based on complex interactions between stakeholders ((Schwachula *et al*., 2014:6). The implication is that national research policies should be linked to national contexts to contribute to the production of new knowledge and advanced technology for commercialisation and for addressing internal and external needs (Schwaag-Serger & Grobbelaar, 2016:15).

According to Edler and Fagerberg (2017:4), innovation refers to finding new solutions for social and economic problems and challenges. Innovation policies are developed for different purposes. According to purpose, three different types of innovation policy exist. A first kind of innovation policy focuses on mission-oriented innovation in the sense of finding new solutions to address specific problems or challenges. A second kind of invention-oriented policy is focused on research and development representing an invention phase only with application occurring in the market. The third kind of innovation policy pertains to system-oriented endeavour emphasising innovation systems to collaborate with stakeholders for the production and application of new knowledge to address communal and societal problems (Edler & Fagerberg, 2017:5). In this regard, the second type of policy functioning does not necessarily resemble innovation as invention does not equalise innovation because producing new ideas or knowledge (invention) does not necessarily solve certain challenges or problems if not concretely implemented to confirm innovation (Edler & Fagerberg, 2017:5). The main objective of a research innovation policy is to utilise new ideas and knowledge to solve socio-economic problems enabling a society to compete globally.

Solving communal and societal problems relies on responsible research and innovation practices characterised by three features (Owen, Macnaghten & Stilgoe, 2012:757). These features pertain to research and innovation to be focused on the problems and challenges of the specific society with positive impact in that society; research and innovation goals to be set

responsively to provide direction in the specific society; acting responsibly in linking research and innovation endeavour (European Commission, 2017:60; Owen *et al*., 2012:757). The essence of research and innovation focus is acting responsively and responsibly in the favour of societal improvement through innovative endeavour.

3.2.1 Priority setting for science, technology and innovation policy

With science, technology and innovation policy, priorities should be focused on setting realistic goals to be achieved convincingly (Hjelt, den Hertog, te Velde, Syrjänen & Ahonen, 2008:2). In line with guidelines on policy formulation for science, technology and innovation endeavour, the report of the OECD includes three categories of priority setting. A first category pertains thematic priority setting emphasising fields of science and technology, a second category depicting mission-oriented priority setting focusing on the socio-economic and technological goals of a country and the third category representing functional priority setting based on the nature of the research and innovation intent of a nation (Georghiou & Harper, 2011:245). In addition to these three categories of priority setting, three phases of priority setting for science, technology and innovation policy pertains to a first phase based on science intent and science approach to develop technologies such as nuclear use and aerospace activity in physics. A second phase depicts top-down strategic areas for research and innovation engagement with a third phase representing a functionalist method of setting priorities for strategic planning in a decentralised way in different institutions like universities (Institut für Technologie und Regionalpolitikn, 2004:3). The functionalist phase for research policy priority setting is based on an innovation system for interaction among universities, government and industry motivated by addressing the needs of the applicable society.

With regard to research and innovation policy priority setting in different first world countries, priority setting in Canada does not represent a specific emphasis but focuses on innovation as a whole, Ireland focuses on science and technology by using both thematic and functionalist methods with particular emphasis on a functionalist approach with New Zealand's thematic and functionalist methods representing engagement at different levels of government and higher education institution endeavour. Influenced by its commercialisation and imitation of foreign technologies, South Korea's priority setting depicts a functionalist approach focusing on basic research, the development of core technologies and the promotion of innovation through a top-down policy. The Netherlands engage in all three forms of priority setting with

a bottom-up approach with universities mandated to set their own priorities. The United Kingdom's research policy priority setting is science oriented and disciplinary thematic with pertinent progression to a technological innovative approach (Institut für Technologie und Regionalpolitikn, 2004:4). The different ways of research policy priority setting in different countries is the result of countries having different contexts directing different goals based on possessing different scientific knowledge, technological advancement and innovation and with different socio-economic problems and needs for the future.

3.2.2 Science, technology and innovation policies and practices in developed and developing countries

Both developed and developing countries know that to solve socio-economic problems and challenges and to increase productivity for the sake of global competitiveness, they should invest in science, technology and innovation. As a result, countries have been formulating and implementing science, technology and innovation policies in a tailor-made way for their societies' specific contexts. All countries are experiencing successes and challenges with research and innovation endeavour. Reviewing the innovation policy of Sweden as a distinguished developed country, strengths and weaknesses exist. Some of the Swedish strengths contributing to successful economic development pertain to having a strong human resource base, investing substantially in research and development, possessing knowledge-based capital and information communication technology, and having a strong science base with significant innovation performance, and solid international networks (OECD, 2015:13). Weaknesses encountered with the Swedish innovation policy system are declining educational performances, a decrease in the number of academic centres of excellence, and a weak link between universities and small and medium-sized enterprises (OECD, 2015:15).

In order to improve the link between research and innovation, Sweden has selected strategic innovation areas that universities, industry and research institutes collaboratively focus on in pursuit of improved research and innovation outcomes (OECD, 2015:15). In its national research and innovation policy, Sweden recognises the importance of addressing societal needs and challenges by developing a programme that supports research and innovation activities in areas relevant to societal challenges (OECD, 2015:17). Swedish higher education institutions have been given the responsibility of linking research and innovation through teaching, research and development, and innovation to contribute to local economic development

(OECD, 2015:78). Swedish universities emphasise research-based teaching with a focus on basic research, which resulted in not being able to address the specific skills needs of industry as their graduates obtain general rather than specific skills (OECD, 2015:22). The implication is that, regardless of Sweden being a distinguished developed country, its institutions are not concerned about a fit between curriculum, tuition and industry and societal needs, resulting in graduates not being prepared for carrying out specific employment skills (OECD, 2015:22).

A review of policy trends in the US and Sweden represents a fit with mode 2 knowledge production in that universities, government and industry work together to facilitate innovation processes and knowledge transfer from university to industry (Lundequist & Waxell, 2010:276). However, the major business of mode 2 knowledge production is to undertake interdisciplinary research to produce knowledge in universities to solve real problems (Carayannis & Campbell, 2011:329; Sousa, 2011:64). Innovation as is relevant with mode 3 knowledge production interconnects universities, government and industry for productive research and innovation collaboration. Lundequist and Waxell (2010:276) emphasise, however, that inadequacies between policy and practice in terms of the role of university research for innovation and economic growth is difficult to determine if such judgements are based on reviewing literature and analysing policy and other documents only without collecting and analysing empirically collected data from universities and industry.

The European Union (EU) has many policy tools and instruments for addressing research and innovation with regard to the vision of Horizon 2020 that relates to the challenge of creating jobs for socio-economic growth (European Commission, 2015:5). The reason being that although projects are implemented successfully, and the EU research and innovation policies are successfully applied, budgets are not properly utilised (European Commission, 2015:7). In order to overcome improper budget utilisation, the EU now focuses on considering research-related policies comprehensively by engaging in different projects to ensure adhering to beneficiary demands by addressing societal challenges relating to socio-economic development (European Commission, 2015:7).

With regard to developing countries, the science, technology and innovation policy of Mexico encountered four different stages with the first stage the period between 1930 and 1970 with an absence of explicitly formulated institutional research and innovation policies (Corona, Dutrénit, Puchet & Santiago, 2014:38). The second period of 1970 to 1980 represented a linear

approach to science and technology endeavour based on centralised decision-making and resource allocation and poor coordination among key stakeholders. The third period after 1980 pertains transition because of crisis prompting reform and improved management based on defining the what why and how of research and innovation policy formulation. The final period since 2000 is characterised by understanding innovation as an important activity to enhance coordination among key stakeholders for engagement in a national innovation system relying on improved governance of the system through decentralisation and regionalisation of capacities and research activities (Corona *et al*., 2014:38). Science, technology and innovation policies in Mexico are applicable to a limited number of higher education institutions only that have bargaining power with regard to basic research capacity as a strategy to compete with world leaders in science, technology and innovation (Corona *et al*., 2014:39).

In India, research, with the assistance of sufficient budgeting is converted into knowledge and innovation prompting knowledge to improve societal well-being. As India is facing challenges relating to energy and food security, nutrition, affordable health care, water, sanitation, and employment, its science, technology and innovation system focuses on providing solutions for these societal challenges (Government of India, 2013:1). In this regard, Hjelt *et al*. (2008:24) point out that all countries are now including societal challenges in their research and innovation policy goal formulations, which creates increased budget pressure. China has, with its science, technology and industry policy goals developed into a well-coordinated innovation-based economy (Liu, Simon, Sun & Cao, 2011:917). Among China's strengths with research and innovation endeavour features the role of companies as main knowledge innovators engendering the development of science and technology to modernise transport, energy and information services, and to foster a convincing manufacturing sector (World Economic Forum, 2016:5). Regarding its research and innovation weaknesses, China lags behind developed countries in core technology like high-performance circuits and infrastructure software (World Economic Forum, 2016:10). However, China's successes with competing on world markets relate to reforming its management of higher education and research institutions and focussing more on basic research in addition to market-oriented technology innovation, commercialising of technology, protecting intellectual property rights, and on maturing the legal and policy environment (World Economic Forum, 2016:10)

Iran as a third world society, faces the challenges of building a knowledge-based economy in the face of research and knowledge management difficulties and with the relationship between

universities, industry and the society being weak (Mahdi, 2015:210). In contrast to Iran, Switzerland as a first world society has an efficient research and innovation system with a globally competitive business sector, good quality publicly funded education and research institutions, universities that fulfil their teaching, research and service functions successfully, and significant knowledge and technology transfer. The Swiss society is also characterised by sophistically trained human capital and diversified local networks (SERI, 2016:7) which is an indication of their STI policy functioning satisfactorily to contribute to socio-economic development. The main factor common to countries' successes or failure with research and innovation endeavour is directly related to the sophistication of their scientific research activities and the quality of human capital production by their higher education and research institutions (Evoh, Mugimu & Chavula, 2013:312; Iiauk & Gault, 2015:7). Innovation intent is a key factor for economic activity with both developed and developing countries realising this as a main driver for economic growth and global competitiveness (Cornell University, 2015: ix). In this regard, developing countries realised that the adoption of technologies from developed countries does not result in advanced economic growth if not linked to their own research and innovation endeavour to contribute to production within their own contexts aligned to their own technology and societal needs (OECD, 2012:4).

3.2.3 Science, technology and innovation policies and practices in African countries

Africa as a continent consisting of underdeveloped societies has recognised that its science, technology and innovation (STI) policies have a paramount role to fulfil in addressing African countries' socio-economic problems and to accelerate sustainable development in pursuit of levelling economic and technological advancement with the developed world. As a result, the African Union has prioritised STI policy development by establishing the African Science and Technology Consolidated Plan of Action that has been implemented through New Partnership for Africa's Development [NEPAD] (Meek *et al*., 2009:172).

In line with the African continent's STI plan of action, the African Union Commission (2014:10) developed a strategy for STI progress by 2024 putting STI development at the centre of African socio-economic development. To achieve the vision for the African Union, priority areas relate to eradication of hunger and achieving food security; prevention and control of diseases; communication advancement; protection of space allocation; living together harmoniously and pursue wealth creation. To address these priority areas, strategies relate to

building and upgrading research infrastructure; enhancing professional and technical competency; promoting entrepreneurship and innovation; and providing an enabling environment for STI development on the African continent. Each member state is responsible for implementing the strategy, and to include the strategy in their national development plans. The strategy for STI development includes a mission with objectives pertaining to accelerating the transformation of Africa to a knowledge-based economy based on certain objectives (African Union Commission, 2014:24):

- strengthen STI to implement priority areas effectively;
- develop the capacity of research-related institutions and technical competency;
- promote global competitiveness by promoting innovation;
- protect the intellectual property of individuals and institutions for the knowledge produced and technology developed;
- facilitate STI policy reforms, coordination, and resource mobilisation.

With regard to the STI development strategy of 2024 for the African Union, sub-Saharan African countries like Angola, Ethiopia, Ghana, Mozambique, Nigeria, South Africa, Uganda and Zimbabwe have developed national innovation strategies to solve country specific socio-economic problems in pursuit of comprehensive development (Schwaag-Serger & Grobbelaar, 2016:15). Despite efforts with developing and implementing STI policy in Africa, challenges relating to linking theory with practice include STI policy formulations not based on evidence-based research resulting in difficulties with articulating and prioritizing STI areas (Wamae, 2008:42). The consequence is that research policy formulations are not effectively implemented; policy documents are out-dated; and policy formulations are not focused (Wamae, 2008:42). There is also not effective linkage between public and private companies, universities and industry, which is exacerbated by higher education institutions' incapacity to deliver high skilled human capital needed for knowledge-based functioning (Iizuka & Gault, 2015:5). African countries also encounter problems with commercialising and utilising knowledge produced at universities to address societal needs because of an exclusive focus on academic intent relating to promotion possibilities (Iizuka & Gault, 2015:7). Although a link exists between STI policies and research plan developments in the higher education institutions of Ghana, Kenya and Uganda, this linkage does not transpire into consistent collaboration within and among research policies, programmes and institutions. The higher education

institutions of these three countries do not incorporate knowledge-based development in their research policy and practices endeavour and there is no adequate and diversified funding available to establish research and innovation infrastructure (Jowi *et al*., 2013:7).

There is progress in African countries to integrate and mainstream STI policy implementation in their national development plans and agendas (African Capacity Building Foundation, 2017:6). Challenges, however, persist regarding poor infrastructure, a small pool of researchers and low investment in science and engineering programmes. Further challenges pertain to poor intellectual property frameworks and minimal scientific output relative to the rest of the world (African Capacity Building Foundation, 2017:6). A main reason for not having enough researchers and competent human resources for STI implementation relates to not having prestigious higher education institutions to produce sophisticated research skills for employment possibilities. Strong institutional leadership is needed to counter typical African research challenges relating to fragmentation, poor networking, and lack of national research agendas, poor linkage between research and industry, and inadequate funding opportunities (African Capacity Building Foundation, 2017:8).

3.2.4 Science, technology and innovation policy and practice in Ethiopia

The first national policy on science and technology in Ethiopia was developed in 1993, and the first science, technology and innovation (STI) policy in 2006. The argument was that the science and technology policy was not connected to the national development plan, as it did not have implementation strategies (The Ethiopian Science and Technology Agency, 2006:2). One of the main reasons to have revised the science and technology policy was to establish a national innovation system in order to combine universities, scientific and technological institutions and the private sector in the production, transfer and application of knowledge (The Ethiopian Science & Technology Agency, 2006:2). The science and technology policy focused on advancing science and technology whereas inclusion of innovation encapsulates the application of knowledge produced from research and technology development to address societal problems. In this regard, the 1993 science and technology policy of Ethiopia did not incorporate the concept of innovation, however, this oversight was not acknowledged as one of the reasons for revision of the science and technology policy (The Ethiopian Science and Technology Agency, 2006:3).

The revision of the 1993 Ethiopian science and technology policy was motivated by the extent of the policy, and the goals and objectives of different other policies and strategies at national level such as the policy and strategies on agricultural development, industrialization, poverty reduction, and agricultural development in rural areas. An integrated water resources management policy and water sector development programme also directed the revision of the national science and technology policy (The Ethiopian Science & Technology Agency, 2006:3). Further policies and strategies that prompted change were the capacity building strategy, the education sector strategy and development programme, the health sector development programme, and the population policy and industrial development strategy. The science and technology programmes of the African Union Commission and the New Partnership for Africa's Development aimed at strengthening the link between science and technology and economic development of Ethiopia, guided the revision endeavour of the science and technology policy (The Ethiopian Science & Technology Agency, 2006:3).

Although the 2006 science, technology and innovation policy of Ethiopia does not have a vision and mission, it has objectives and priority areas. Two of the objectives related to build national capacity to generate and apply scientific knowledge and appropriate new, indigenous and emerging technologies, and to improve competitiveness through efficient application of innovation (The Ethiopian Science & Technology Agency, 2006:4). The priority areas are agriculture, commerce and industry, and education and human resource development. Energy, environment, health, mining, tourism, water, transport and communication are also identified as priority areas. Priority areas also include basic and applied research, social sciences, nuclear science and technology. Safety in the generation and application of science and technology, intellectual property rights, and national quality and standards are also acknowledged as priority focus. Priority areas also included meteorology, science and technology information, and media and extension services (The Ethiopian Science & Technology Agency, 2006:10).
In 2012, the 2006 draft STI policy of Ethiopia became a formal policy document including a vision and mission formulation focussing on foreign technology transfer but excluding priority areas of the 2006 policy (FDRE, 2012:3). One of the objectives of the 2012 STI policy document includes technology transfer with both the objectives of the 2006 and 2012 policy documents emphasising the development of suitable, new and indigenous technologies. Although the focus of research in the 2012 policy document is technology transfer, it does not reference the concept of a knowledge-based dispensation in line with the strategic mission statement of the STI policy of the African continent. As technology transfer is one of the

models of innovation (par 2.2.4.4) and socio-economic development is contingent on the production of the own new knowledge and technologies to represent innovation, this is crucial for context specific societal improvement (par 3.2.2). In this regard, the policy strategies to implement the STI policy of Ethiopia are technology transfer, human resource development, and manufacturing and service providing enterprises. Other strategies relate to research, financing and incentive schemes and national quality infrastructure development. Linkages among universities, research institutes, TVET institutions and industries are also determined as strategies to implement the Ethiopian STI policy.

Intellectual property, science and technology information, environmental development and protection, and international cooperation as identified as strategies of the STI policy of Ethiopia, are hampered by the lack of skilled human capital because of higher education institutions' challenges to deliver such skills (FDRE, 2012:5). The reason for these challenges pertains to higher education institutions' research and teaching activities not being aligned with the Ethiopian national development agenda (FDRE, 2012:5). The poor capacity of higher education institutions to conduct applicable research and produce appropriately skilled human capital for internal and external consumption relate to a lack of convincing research and innovation leadership and management functioning (par 3.3).

At national level, plans and programmes are developed to integrate research, science, technology and innovation. In this regard, the Growth and Transformation Plans of Ethiopia incorporate science and technology priority areas including the establishment of a national innovation system, technology transfer and development, and research and technology capacity building. The plans also include human resource development, national quality infrastructure, science, technology and innovation information development, and intellectual property protection and development (FDRE, 2016:76). With regard to higher education, national plans specify research and technology transfer for application for the development of tailor-made outputs (Ministry of Education [MoE], 2015:108).

In order to link the research activities and technology transfer of Ethiopian higher education institutions to the development needs and challenges of the country, the Ministry of Education has developed a draft document called the *Research and Technology Transfer Conceptual and Governance Framework of Ethiopian Higher Learning Institutions.* Its vision includes making Ethiopian higher education institutions world-class regarding research and technology transfer

by 2025, with its mission statement pertaining to solving the development problems of the country through relevant research and technology transfer from higher education institutions (MoE, 2016:13). The research-related framework for Ethiopian higher education institutions emphasises that research and technology transfer should focus on local problems requiring local solutions (MoE, 2016:23). With reference to this Framework, the research and technology transfer weaknesses of Ethiopian higher education institutions are acknowledged as relating to low-level scientific skills to engage in research, poor research infrastructure, and poor integration of teaching and research actions. The poor impact of research outcomes on community functioning, the poor potential of universities to solve problems of industry, and weak linkages between university and industry endeavour are also acknowledged as acute weaknesses of Ethiopian higher education institutions (MoE, 2016:24).

According to the Framework document, a crucial role for Ethiopian higher education institutions is producing new knowledge and technology for transfer to local communities and industry and applying new knowledge and technology innovatively for societal benefit. The Framework document emphasises innovation as being contingent on basic research conducted in higher education institutions (MoE, 2016:36). The inability of Ethiopian higher education institutions to undertake research and innovation because of inadequacies with leadership and management of teaching, research and innovation relates to a lack of emphasis on these leadership-management qualities (MoE, 2016:36). The Ethiopian higher education institutions should conduct innovative research to address their academics' poor research skills, poor teaching and research links, poor university and industry linkages, and the limited impact of their research endeavour on societal improvement (Yizengaw, 2004:7).

Small and medium size enterprises in countries like Algeria, Egypt, Morocco, Tunisia, China, India, Indonesia, Thailand, Ghana, Ethiopia, Honduras and Bulgaria are not innovative (Janischewski & Branzk, 2008:3). This lack of innovation relates to a weak link between universities and industry in these countries with universities not knowing what industry needs and industry doubting university capacity to provide knowledge, skills and technology. Regarding Ethiopia, there is limited innovation in companies as companies do not invest in research and development, and they do not have the ability to absorb foreign technologies, which relates to a lack of demand-driven research and skilled research manpower in the country (Janischewski & Branzk, 2008:40). This situation is unfortunate because innovation, although having challenges, holds significant opportunities for countries relating to income growth,

improved health, more food, extension of indigenous knowledge in a knowledge-based dispensation, and technology transfer from other countries (International Organisation for Knowledge Economy and Enterprise Development, 2006:4). Challenges with innovation relate to addressing the low demand for new products and services, coping with a limited number of researchers and scientists produced by the education system, dealing with poor health that reduces productivity, and facing poor information technology infrastructure (International Organisation for Knowledge Economy and Enterprise Development, 2006:6).

With regard to inputs like human capital, finances and infrastructure, the innovation system of Ethiopia is not well-developed (International Organisation for Knowledge Economy and Enterprise Development, 2006:12). A weak linkage between key stakeholders of innovation such as government, universities and industry with outputs in terms of exports from Ethiopia not of high-technological content because of limited patents and scientific articles (International Organisation for Knowledge Economy and Enterprise Development, 2006:12) exacerbates this. However, successes of STI policy endeavour in Ethiopia pertains to being linked to the national Growth and Transformation Plan and allocating 70% priority for science, technology and engineering fields and new science and technology universities (African Capacity Building Foundation, 2017:68).

In summary, reviewing science, technology and innovation (STI) policy endeavour in developed and developing countries, and in African and Ethiopian contexts, there are constant reforms taking place regarding priority setting. Developed countries are successful with policy formulation and implementation and with investing enough money in their research endeavours. They have human capital with sophisticated skills and well-developed infrastructure for their research and technology engagement. Their world-class universities engage in basic and applied research producing competent human capital for industry purposes in a knowledge-based dispensation. In African and Ethiopian contexts, although acknowledging that STI is crucial for socio-economic development, unskilled human capital, financial constraints, poor infrastructure for research, technology and innovation endeavour, and a poor linkage between government, industry and universities hamper societal development. Ethiopian higher education institutions need to align their research and innovation policy endeavour with national intent for implementation to address societal needs in pursuit of global competitiveness.

3.3 RESEARCH AND INNOVATION POLICIES AND PRACTICES IN HIGHER EDUCATION INSTITUTIONS

Research and innovation policies direct the production of new knowledge and technologies from research activity engagement, including technology transfer application. For higher education institutions, this requires research ability, and application of new knowledge and technology to address institutional and societal problems with higher education institutions functioning as engines for a knowledge-based dispensation (Muresan & Gogu, 2012:3682). Different higher education institutions use different names for their research and innovation policy formulations. With regard to the higher education research, science and technology transfer policy progress in East Africa, six challenges hamper proper implementation that relate to a shift to knowledge-based societal functioning, globalisation, under-resourcing, and increased competition amongst providers (Nyerere, 2013:20). These challenges are intensified by diverse needs of societies and learners and the demand of acting as an engine for social and economic development. In the South African context, South African universities fulfil a crucial role in knowledge production contributing to higher standards of living, based on well-developed economic policies, and a government that supports research, development and innovation (Nicolaides, 2014:13). However, an analysis of the efficiency of South African research and innovation policies and practices at higher education institutions to translate national policies into practice needs to be re-examined. In this regard, the impact of higher education institutions on the Ireland economy is significant as is the case with higher education institutions in the UK (Zhang, Larkin & Lucey, 2017:1618).

The weak linkages between university, industry and government functioning in Tanzania are the result of inventions of academics not related to real life problems. Academics focus on the development of innovation, negating transfer possibilities with the limited linkage, which exist focusing on traditional relationships like internships, consultancy services, and inviting guest lecturers from industry for presentations on certain topics (Mpehongwa, 2013:2096). In Egypt, collaboration between industry and higher education institutions is limited, as industry perceives academic research not to be relevant for work purposes (El Hadidi & Kirby, 2017:195). With regard to the Tanzanian influence of higher education policy on promoting research in universities, universities are categorised as research universities as they perform teaching, research and community engagement functions. Fussy (2017:10) asserts that research

universities in Tanzania are the engine for societal development as they produce knowledge and skilled human capital, especially at doctoral level.

As the cost of investment in fiscal, physical and human resources of research universities is high, countries like Australia, the UK, Canada, Japan, China, Hong Kong, South Korea Thailand and Malaysia choose some of their higher education institutions to be both research and teaching universities for the sake of being cost-effective. Tanzania fails to provide enough funds, infrastructure, machinery, and employed skilled researchers resulting in most of its higher education institutions sufficing with teaching responsibilities only (Fussy, 2017:10). In the USA and China, research universities are tasked with intensive research engagement to provide postgraduate training at doctoral level (Altbach, 2011:12). Countries like Finland, South Korea and the US (North Carolina) have developed a framework for knowledge-based functioning and they understand the role of higher education institutions to be linked to economic planning by arranging effective partnerships and networking to ensure quality education, and to engage in appropriate research and innovation (Cloete, Bailey, Pillay, Bunting & Maassen, 2011:12). Adequate funding for higher education produces skilled human capital for the labour market, and enhancement of research and innovation endeavour based on significant incentive (Cloete *et al*., 2011:12).

Regarding African countries, they do not agree on a development framework that higher education institutions can use for development. Although governments realise that higher education institutions have an important role to fulfil in a knowledge-based economy, research activities of the institutions do not make an effective contribution to societal development by producing new knowledge because of inadequate funding and limited incentives for academic staff to undertake research to produce new knowledge (Cloete *et al*., 2011:166). A lack of coordination prevails between government, universities and other stakeholders to facilitate the contributions of institutions for societal development, which relates to a lack of strong leadership and management of research endeavour (Cloete *et al*., 2011:167). Cloete, Maassen and Bailey (2015:2) concur that higher education institutions in Africa have not developed their own capacity for producing and applying new knowledge. This relates to their research and innovation incapacity to solve societal problems because they should first be able to solve their own research and innovation shortcomings with their research endeavour (Abari *et al*., 2014:5; Saad, Guermat & Brodie, 2015:1205).

With regard to the East Asian context, Mok (2012:330) reviews the national innovation systems of Hong Kong, Singapore, Taiwan and South Korea in relation to promoting research and development, and technological research. Mok (2012:330) points out that the universities in Asia do not play key roles in innovation compared to universities in Europe and the USA. Reconstructing innovation and knowledge discourse, epistemic governance and epistemic innovation policy are significant to understand knowledge comprehension and reflection, and knowledge production and application as key factors for effective governing and governance (Campbell & Carayannis, 2016:1). As higher education institutions are important for the development of an advanced knowledge-based society they should facilitate epistemic governance that integrates different modes of knowledge production to encourage practices that are basic to research in the context of knowledge application and innovation (Campbell & Carayannis, 2016:9). In this regard, higher education institutions should be organised in line with mode 1, 2, and 3 knowledge production with mode 3 the basis for knowledge production and innovation.

In order to achieve the science, technology and innovation strategy of Africa by 2024, Juma (2016:2) claims that African countries need higher education institutions that integrate education, research and innovation. In this regard, Juma (2016:2) proposes the establishment of innovation universities that undertake research, teach, provide community engagement, and commercialise in their missions and operations by strengthening research, community engagement and commercialisation. This can be achieved in the already established universities or by establishing new universities in collaboration with public corporations, private enterprise, and development agencies (Juma, 2016:2). Although higher education institutions in Africa focus on teaching with no incentives for research and commercialisation of research outputs, some institutions have innovation leadership such as the University of Stellenbosch in South Africa that built and launched a satellite, and the Jomo Kenyatta University of Agriculture that commercialised tissue culture bananas (Juma, 2008:9). Building a satellite and using this satellite to address local socio-economic problems is the result of innovation and research leadership.

Evoh *et al*. (2013:287) argue that African countries should understand the role of their higher education institutions to produce relevant skills to promote technological innovation for competition on world markets. The economies of African countries are being marginalised internationally as they do not have appropriate skills and technologies which results in poor

utilisation of the potential of their higher education institutions. African countries should have research policies that facilitate the production, distribution and utilisation of knowledge and technologies by their higher education institutions for all sectors in order to develop their economies to be aligned to a knowledge-based dispensation. As industrial societies embracing a knowledge-based dispensation swop land, labour and machinery as production factors for knowledge as production factor, African countries should follow suit (Evoh *et al*., 2013:289).

From cases studied of higher education institutions in Kenya and Uganda, Evoh *et al*. (2013:285), found that the systems of higher education institutions in Africa are not well equipped to produce knowledge for economic advancement of African countries. This is because higher education institutions still have traditional curriculum delivery and skill training. The institutions also do not have the capacity to drive innovative ideas and produce skills to enhance the African economy to compete in a knowledge-based dispensation. Higher education institutions in Africa cannot produce knowledge unless they integrate information and communication technology in their teaching and research activities. The African higher education institutions have inadequacies in research and innovation engagement that hamper economic development. Higher education institutions also have shortcomings relating to skill, research and innovation capacity, research funds and university and industry linkage to serve as the driver of knowledge-based functioning. The infrastructure inadequacies relating to electricity, internet and communication technology inhibit progress (Evoh *et al*., 2013). African higher education institutions do not have qualified and competent academics in research and innovation to produce, adapt, innovate and solve problems (Evoh *et al*., 2013:310).

According to Cloete *et al.* (2015: xii), and with reference to Africa rising to where more than ten of the fastest-growing economies in the world are from Africa, higher education institutions in Africa should produce and apply relevant knowledge to strengthen socio-economic development. However, there are not enough higher education institutions to produce knowledge, as is the case with OECD member countries, as the capacity of the higher education institutions in Africa are not inspiring. To address this shortcoming, the Higher Education Research and Advocacy Network in Africa (HERANA) project was developed by the Centre for Higher Education Transformation situated in South Africa in 2007. The aim of CHET is to identify the relationship between higher education and economic development by conducting different studies in eight flagship universities in sub-Saharan Africa. These universities are the

University of Botswana, the University of Cape Town (South Africa), the University of Dar-es-Salaam (Tanzania), Eduardo Mondlane University (Mozambique), the University of Ghana, the University of Mauritius, Makerere University (Uganda), and the University of Nairobi (Kenya). Having reviewed the mission statements of these eight universities, Cloete *et al*. (2015:29) found that the only university that fulfilled the goal of high-quality research to produce relevant knowledge that would help national and regional development was the University of Cape Town with Makerere University performing second best. The implication is that the rest of the higher education institutions in Africa do not include research goals for contributing to economic development in their mission statements at policy level or implement these mission statements practically.

Even though the World Bank policy for African higher education institutions had not included the production of new knowledge as one of its functions, the World Bank recognised that higher education institutions in Africa have to be supported to develop their knowledge production function to produce new knowledge for their own teaching and national development (Cloete *et al*., 2015:260). However, one of the findings of the HERANA project showed that the University of Mauritius failed to manage these two functions of teaching and research properly though the university stated as research policy goal to be a leader in the establishment of a knowledge-based economy for its country (Cloete *et al*., 2015:263). Leading and managing policy implementation to achieve desirable outcomes is challenging requiring leadership that creates dynamic interactions and networking among key stakeholders, with this leadership and management relying on adapting to the specific context through learning from experience and through research and innovation.

In summary, for higher education institutions to contribute to a knowledge-based dispensation, they should be competent in research and innovation leadership and management. Research and innovation leadership and management needs to be integrated as the one action prompts the other action. In this regard, Cai (2017:5) concurs that higher education institutions have a key role to fulfil in a national innovation system, and they are a key source of innovation in industry. Higher education institutions should also be engines of innovation for local communities with knowledge and innovation existing together for knowledge-based innovation (Carayannis & Campbell, 2009:213).

3.3.1 Investigations on research and innovation leadership and management in higher education institutions

Research and innovation in higher education institutions should be led and managed vibrantly to contribute to human capital development aligned to market needs. Leadership pertains to six key areas of functioning, namely being environment manager, network manager, policy manager, crisis manager, knowledge gap manager, and future leader preparation manager (Martin & Marion, 2005:140). In this regard, Venter (2006:455) studied research management at two South African universities who have merged with one in an instilling phase and the other in a honing phase. The institution in an instilling phase did not have deans and academics focused on research, as there was no research activity at the institution other than a developed policy and an established system for future practice in a centralised way. The university at a honing phase had enough researchers, leaders and drivers of research with a significant research output record confirming that productive research implies competent researchers with competent research leaders who motivate and inspire research activities (Venter, 2006:455).

Factors significant to research conduct are capable researchers, infrastructure, funding, and correctly formulated policies (Nguyen, 2013:121 The tasks of research management relate to creating research and research management positions; deciding on primary organisational units for research delivery, creating a research office and creating research oversight committees (Nguyen & Meek, 2016:50). Less visible tasks of organising and structuring research include developing rules for research integrity, developing rules and procedures for managing the lifecycle of a research project, and developing a mechanism for evaluating the quality of research outcomes. Preparing researchers and research managers for the necessary skills and knowledge needed for research conduct and deciding on vertical and horizontal decentralization are also research-related tasks less visible (Nguyen & Meek, 2016:52. Successful research leaders, who mobilise different resources to construct and expand scientific capital, direct and influence research outputs at higher education institutions (Hansson & Mønsted, 2008:667). In this regard, skilled research leaders and managers are resources for higher education institutions to conduct relevant research constructively.

Higher education institutions should lead researchers to undertake research that is creative, innovative and technology-oriented to respond to local and global demand (Meek *et al*., 2009:76). In the contexts of low and middle-income countries, research should be relevant with

higher education institutions focused on the needs of the local community with alignment to global standards (Meek *et al*., 2009:132). Higher education institutions should manage basic, applied and strategic research with the success of such research endeavour determined by research management competency contingent on effective research leadership skills (Meek *et al*., 2009:165). In this regard, research leadership relates to the managerial activities of managing efficiency and performance with research culture including reward and punishment with research leadership inspiring researchers to produce new ideas and knowledge and apply this knowledge in an innovate way for society's socio-economic development (Saltmarsh *et al*., 2011:293).

Research leadership is conceptualised as research incentive in terms of 'carrots and whips', in supporting research and counting research outputs (Saltmarsh *et al*., 2011:303). Regarding the qualities of research leadership, the following features are identified (Hansson & Mønsted, 2008:667):

- the scientific capital and charisma of the leader to create respect and formulate research programmes;
- the ability to be a broker between networks in teaching and research;
- the ability to use external contacts and to disseminate research for access to further research;
- the ability to use rules and negotiate in the bureaucracy to develop organisational openings in a creative way; and
- the ability to create an environment of self-management in a collective organised research group to mobilise young researchers to take their own initiative.

With regard to the meaning and competencies of research leadership in African countries, Owusu, Kalipeni, Awortwi and Kiiru (2017:235) found that members of the research team evaluated the research leadership as not effective as the leader seems not to be knowledgeable, does not lead the research process encouragingly and shows dishonesty It was also revealed that the research leaders have poor writing skills, work on other projects and do not meet deadlines. The leaders are also not transparent on the spending of research funds since the leadership focuses on financial benefits rather than project outcomes (Owusu *et al*., 2017:236). Research team members preferred relationship and task-oriented leadership styles linked to

participative leadership styles as they have strong elements of humanness for the African context. Research leaders should act as being part of a team, have team-building skills, have financial management skills, and effective communication skills (Owusu *et al*., 2017:241). In this regard, research leaders should have research leadership and research management competencies expected from a single person, especially at research project level. Research project management in higher education institutions encounter challenges of using project management techniques that are not developed as part of higher education functioning (Moore & Shangraw, 2011:1; Powers & Kerr, 2009:1).

Developing project management techniques for higher education institutions include research project implementation considering time and budget factors and conducting a project risk assessment at the beginning of the project and having a project management office to manage the project successfully (Moore & Shangraw, 2011:74). Taghavi, Taghavi and Taghavi (2013:284) developed a system for selecting research project leaders among academics using a decision tree model for leader selection and a neural network model for leader performance selection. The results showed that research and development project success is not dependent only on academic leadership expertise but also on managerial and intellectual competencies, communication skills, and self-realization and fulfilment.

Although African countries acknowledge that higher education institutions should produce skilled and competent human capital, knowledge that leads to technology advancement and innovation to be competent in a knowledge-based dispensation, shortcomings exist with regard to inadequate institutional capacity, brain drain, a shortage of critical technical skills, excessive costs of higher education functioning, deficiencies in funding and research management, low funding, poor research management, and uncoordinated policy outcomes (African Capacity Building Foundation, 2017:44). However, many African countries have improved their education and human capital development, and their technological capability in pursuit of alignment to the need of human capital development, development of business and commerce liaison, improvement of policy formulation and practice, and improvement of general societal well-being (Research Councils of UK, 2007:14).

3.3.1.1 Leading and managing research and innovation at higher education institutions to address internal problems

For higher education institutions to discharge their research-related responsibilities effectively, they should lead and manage their research activities engendering research-based innovation to address internal and external demands. Sergeev (2017:56) emphasises that to develop innovative societies, higher education institutions should be transferred from knowledge and skill transmission and development to innovation production as higher education institutions represent the basis for developing innovative societies. In order to transform the teaching of knowledge and skills at higher education institutions to be the source of innovation, higher education institutions should research and understand their curriculum development and implementation, their actual teaching and learning, and their assessment and evaluation procedures (Sergeev, 2017:57). Higher education institutions should move from traditional to innovative practice providing education by adopting and adapting from others. Then, they should develop their own way of carrying out their day-to-day practice, especially by producing human capital that is innovative for their own teaching and research activities, and for public demand. This is possible with a proper linkage between education, research and innovation at higher education institutions.

Regarding the integration of education, research and innovation at some higher education institutions in Norway, Borlaug, Aanstad, Solberg and Thune (2016:9) emphasise that although enough emphasis is put on research outputs aligned to research goals captured in well-formulated policies and strategies, shortcomings regarding implementation pertains to limited incentive for innovation activities. There is no obligation for academics to conduct research during recruitment and promotion although education should be research- and innovation-based (Borlaug *et al.*, 2016:49). Jacob and Hellström (2014:1327) and Hobeanu (2011:12) emphasise the importance of research and its impact on science development for societal improvement, which is even more important than teaching and which warrants teaching and research to be interrelated with the management of higher education institutions emphasising this important relationship. However, research and teaching should be connected to innovation, because the application of research findings in tuition improves teaching and learning to produce competent graduates for a knowledge-based economy (Hobeanu, 2011:12). Leading and managing this important relationship between research, innovation and teaching is crucial and should be included in higher education institutions' policies and practice.

To increase the profile of teaching innovation in higher education, the Equal Acclaim for Teaching Excellence (EquATE) project explored the effect of teaching innovation on the

development of academics' criticality and engagement with theory. The project found that by including innovation intent, academics' reflectivity was improved; they negated ordinary practices and became responsive to new theoretical and pedagogical perspectives (Robson, Wall & Lofthouse, 2013:92). Participants in the EquATE project reported that the project helped them to improve their planning, to look for opportunities of exploration and to use research results convincingly (Robson *et al*., 2013:97). The EquATE project initiative represents an example of research on academics own teaching, the way they identify problems with their teaching, how they explored different solutions to address the identified problems, their attempts to identify appropriate solutions, and how they developed their own new ways of teaching, which represents innovation actions in teaching in higher education institutions.

With regard to the management of higher education institutions in the UK, Deem (2006:213) found that leaders and managers of higher education institutions in the UK lacked a culture of developing research-based practices, and research-based innovation with regard to their own leadership and management practices, and with regard to the teaching and learning practices of the academics (Deem, 2006:223). Wilson-Medhurst (2010:4), however, explored how the Activity Led Learning (ALL) concept of learning constituted innovation in response to the need for organisational adaptation. The ALL initiative was focused on innovation at Coventry University in the UK, representing an adaptive response to the challenges of evaluation. Academics identified the challenges they faced, they created new operational knowledge, and they applied and tested their new knowledge for on-going refinement and learning (Wilson-Medhurst, 2010:9).

With regard to organisational culture and technology-enhanced innovation in higher education institutions in China, a strong relationship exists between organisational culture and the perceptions about and implementation of innovation (Zhu, 2015:74). The predictors for implementation of innovation are goal orientation, innovation orientation, formal relationships among academics, structured leadership, with both cultural and academic-related variables influencing the adoption of technology-enhanced innovations (Zhu, 2015:73). In this regard, leaders develop a culture of academics researching their own practices and ways of innovation to improve their teaching for the benefit of their learners and the community. Properly led, higher education institutions produce human capital to produce new knowledge and technology and apply this knowledge and technology to address internal and external problems (Abari *et al*., 2014:8).

3.3.1.2 Leading and managing research and innovation at higher education institutions to address the problems of the local community

The report of the European Network on Economics of Education on the contributions of higher education institutions to innovation, growth and development indicates that higher education institutions play a significant role in local economic development by managing their teaching and research functions jointly (Veugelers & Del Rey, 2014:59). The roles that higher education institutions fulfil relate to being creators, receptors, and interpreters of innovation and innovative ideas, developing different forms of human capital and contributing to social infrastructure and social capital (Veugelers & Del Rey, 2014:59). If these roles are not fulfilling, a situation equivalent to that of Brazil occurs where Brazilian industrial firms did not have qualified workers. As there was no dialogue between higher education institutions and the firms, higher education institutions were unable to produce graduates with knowledge and skills for innovation in line with the specific demands of the firms (Rapini, Chiarini & Bittencourt, 2017:168). This required the higher education institutions of Brazil to collaborate with firms to produce human capital aligned to industry needs. In doing so, the firms and the higher education institutions needed to manage the development of a curriculum and its implementation to contribute to producing graduates skilled in technological application and innovation based on collaborative leadership and management with government being an important role-player (Rapini *et al*., 2017:168).

Similarly, Fatah, Thiruchelvam and Ng (2013:59) examined the interactions of Malaysian innovation systems on the less-developed regions of Sabah with regard to technological development and innovation attempts and found that higher education institutions as the key to an innovation system lacked a formulated mission statement to assist specific sectors of the economy. The higher education institutions were also more focussed on academic excellence rather than addressing problems encountered by local industry (Fatah *et al*., 2013). This was the result of shortcomings with leadership and management pertaining to policy formulation and implementation at national, institutional and industry level (Fatah *et al*., 2013:62). As higher education institutions are the engine for development by producing and transferring knowledge to the society in a knowledge-based dispensation, Romanian higher education institutions had to change their leadership at both policy and practice level because the production, transfer and application of new knowledge and technologies necessitates competent research and innovation leadership and management at institutional and project

levels (Nicole & Vielar, 2013:374). In this regard, Africa should also produce competent and qualified professionals and produce and adapt knowledge in science and technology relevant to address the challenges of poverty reduction and effective human capital development (Mohamedbhai, 2012:21). However, the innovation opportunities of higher education institutions in sub-Saharan Africa depict a lack of academic focus and leadership resulting in research and teaching not addressing issues relevant to the local environment (Schwaag-Serger & Grobbelaar, 2016:32). Because of a lack of strong private firms to drive research and innovation, higher education institutions in Africa are tasked with the responsibility of advancing science, technology and innovation, which requires competent research and innovation leadership and management (Cloete *et al*., 2015:261).

An example of interdisciplinary research successfully applied, relates to the research conducted by the University of Technology of Jamaica with this research dedicated to influencing and being relevant to the socio-economic problems of the Jamaican society. The research managers of the Jamaican University of Technology managed the university research fund in such a way that contributed to improved health for homosexual men living with HIV (Ivey & Henry, 2016:6). This happened because of a researcher on HIV at the Jamaican university and an academic at the Jamaican university collaborating with researchers at the University of Maryland's Institute of Human Virology in the USA. By applying for a research grant at the University of Technology on HIV drug resistance surveillance among homosexual Jamaicans, the research managers approved of the relevancy of the research project. The research contributed to policy development at the Ministry of Health of both societies and to the professional development of the Jamaican researchers who participated as they developed capacity while they were working with experienced and skilled researchers at the University of Maryland (Ivey & Henry, 2016:5). A team of researchers from the University of Technology, Jamaica College of Health Science, undertook an additional societal problem in Jamaica relating to under-nutrition and obesity. The research management of the Jamaican university evaluated the research project as relevant to policy intent, the life of people suffering from obesity and human capital development as undergraduate students participated as assistant data collectors.

Findings contributed to an improvement of university and industry linkage, the nutrition policy of Jamaica, the quality of life for people exposed to malnutrition, and to capacity development for the undergraduate students who participated in the study (Ivey & Henry, 2016:8). Higher

education institutions should lead and manage the research and innovation activities of their academics and postgraduate students' research to be focused on addressing local community needs. In this regard, Ilon and Kantini (2013:150) found that Zambia's higher education institutions fail to fulfil the development needs of local communities in that research is not aligned to communal needs and research by postgraduate students are merely focused on obtaining their masters or doctoral degrees without simultaneously pursuing societal development. Students did not relate their research problems with local communal needs because of a lack of proper leadership and management of research and innovation endeavour at the Zambian institutions for higher education (Ilon & Kantini, 2013:150).

3.3.1.3 Leading and managing research and innovation at higher education institutions to produce new knowledge and technology

With regard to the functional implementation of research conducted by universities versus industry, the private sector performs better than universities and research institutions albeit universities and research institutions having enabling measures such as a governance structure, an intellectual property policy and management office, a technology transfer office, and an infrastructure to support innovation (Bolo, Odongo & Awino, 2015: iv). In a study by Cloete and Bunting on the responses of five South African universities, namely the University of Cape Town, KwaZulu-Natal, Fort Hare, Nelson Mandela Metropolitan University, and the Tshwane University of Technology regarding knowledge production, the University of Cape Town focused most strongly on developing academics' capacity and new researchers. The University of Cape Town emphasises research projects developed by individuals and groups of academics in collaboration with institutional and national projects (Cloete & Bunting, 2013:15). Regarding the University of KwaZulu-Natal and Nelson Mandela University, these institutions have centrally driven research policies not accommodating individual and group research project engagement because of limited academic capacity. While the University of KwaZulu-Natal has adequate research management capacity despite its insufficient research activities, the Nelson Mandela University encounters limited research-support capacity and research funding (Cloete & Bunting, 2013:22).

The research policies of Tshwane University of Technology focus mainly on applying research and innovation, and on solving specific societal problems focused on economic development. However, the Tshwane University of Technology does not deliver research outputs

convincingly due to a lack of management capacity and academic capacity accompanied by constraining research funding (Cloete & Bunting, 2013:41). The University of Fort Hare focuses on developing institutional research policy strategies only because of a shortage of resources (Cloete & Bunting, 2013:30). The capacity of universities to produce knowledge is determined by the research capacity of their academic staff, research management capacity and research funding (Cloete & Bunting, 2013:31). With regard to adequate research management capacity, important factors pertain to research leadership, capacity for innovation, and leadership and management of higher education institutions to be producers of new knowledge and technology. In this regard the innovative research leadership capacity of the Jamaican University of Technology serves as an example of initiative-taking to improve street lighting with a modular LED lighting system implemented successfully in practice (Ivey & Henry, 2016:11).

Considering the reason why some research projects produce commercial outputs while others not, Ambos *et al*. (2008:1438) emphasise the scientific excellence of a principal investigator with significant citations as an important factor associated with the generation of commercial outputs. Academics, who are motivated by commercial output with the understanding that this approach would not harm their academic career, are successful in producing outputs for functional application in industry and society (Ambos *et al*., 2008:1442). Researchers in such a scenario do not question the contribution of research leadership skills and competencies of the principal investigator to produce new ideas and knowledge to be commercialised because these skills and competencies represent innovative management and leadership at both project and university level to be carried out successfully (Ivey, 2015:1). In a study by Whitworth (2012:154) on large-scale educational technology innovation projects relating to building technology-rich teaching spaces to facilitate flexible teaching and learning, this project failed as it was initiated by individuals instead of central sponsorship and strong research leadership and management. The project would have been successful if it was managed and sponsored convincingly by central government (Whitworth, 2012:154). In this regard, Abari *et al*. (2014:5) and Saad *et al*. (2015:1195) concur that one of the contributions of higher education institutions to innovation is producing new and valuable knowledge and technology based on government support. Higher education institutions should have the capacity for research engagement combined with strong leadership to create an enabling environment with enough human resources to promote innovation (Abari *et al*., 2014:5). Innovation should be planned and managed with focus to ensure positive outcomes (Elliott, 2013:74).

In summary regarding research projects, the management thereof and the applicability of its research findings to address societal problems, the University of Technology of Jamaica serves as a good example to be applied to African countries' higher education institution endeavour. Having equally numerous socio-economic problems demanding that research leadership and management approve research projects that are contributing to internal and external problem solving, the essence pertains to salient qualities relating to strong research leadership and management and enough funding for a realistic fit between research aims and realistic outcomes. The research managers of the University of Technology of Jamaica managed research projects' research funds with these projects contributing towards internal human capital development, community development, and improved policy formulation for enhanced societal functioning. Ethiopia as the country of focus for this study on research leadership and management at higher education institutions has many socio-economic problems at local and national level. These problems need to be addressed by higher education institutions having the same research-related qualities as those of the University of Technology of Jamaica. Higher education institutions in Ethiopia need to lead and manage their research and innovation policies and practices to be an engine for the development of a knowledge-based Ethiopian society.

3.4 LEADING AND MANAGING RESEARCH AND INNOVATION POLICY AND PRACTICE AT HIGHER EDUCATION INSTITUTIONS IN ETHIOPIA

Ethiopia has a vision of becoming a middle-income country by the year 2025 (FDRE, 2016:76). To achieve this vision, Ethiopia has been transforming its economy from agriculture to an agriculture-led industrialised sector where land, labour, natural resources, and commodities are the main sources for the socio-economic development of the country (FDRE, 2010:19). However, considering knowledge-based economic development, knowledge and innovation are the sources for fast, continuous, and advanced development for being globally competitive. In this regard, higher education institutions contribute to transforming a country from an agrarian to an industrial and eventually a knowledge-based society (Maitra, 2007:5). In order to transform Ethiopia from its present agrarian status, higher education institutions should fulfil the responsibility of contributing with knowledge and technology in an innovative manner. Ethiopian higher education institutions should transform their teaching, research and innovation functions and produce graduates with competent knowledge and skills for engagement in societal development as facilitated through the own, public and private sector

endeavour. Hobeanu (2011:12) asserts that higher education institutions should provide advanced skills training for knowledge-based engagement, which should be related to engaging in producing new and relevant knowledge and technology to contribute to innovation for internal and external development. This obliges higher education institutions to have competent research and innovation leadership and management to translate research and innovation policy into practice (López, Santoyo & Paolacci, 2017:11).

In the 1960s, the faculty council of the Haile Selassie I University in Ethiopia motivated academics to undertake research for rural development based on University goals to produce relevant knowledge by linking teaching to practice through curriculum changes in order to solve contextual problems experienced in the Ethiopian society (Wondimu, 2003:322). This endeavour related to linking research to the problems of higher education institutions themselves, the problems of the society, and rural development challenges. However, since the 2000s higher education institutions in Ethiopia have been facing teaching and learning problems related to leading and managing research in order to address their own internal problems and that of the society (Desta, 2004:63).

The concepts of research, science, technology and innovation are included in national public policies, strategies and plans of Ethiopia. The role of its higher education institutions is to address development problems and challenges of an internal kind relating to curriculum development with related teaching and learning and assessment and evaluation changes to produce competent graduates aligned to the needs of industry, and the public and private sector (par 3.2.4). In this regard, in a general meeting in September 2017, the president of Segu University in Ethiopia explained the need for graduates from university becoming employees in industry to be trained for competency in industry for a period of at least six months to capacitate these students to become an effective part of a competent workforce. Although higher education institutions' academics engage in professional development to improve their teaching competencies through reflecting on and researching their own teaching ability and students' learning capacity, academics are not applying the knowledge and skills gained from professional development training to improve teaching and learning endeavour (Berku, Andarege & Getachew, 2017:1)

Regarding the lack of a research culture in Ethiopian higher education institutions, Emiru (2012: i) studied the research culture of the Teaching English as a Foreign Language PhD

programme at Addis Ababa University. One of the research findings indicates that PhD students' research activities have no resemblance with application for societal development but are only focused on adhering to requirements for doctoral degree engagement to obtain a qualification. This depicts a lack of proper research leadership and management to address the institution's own teaching problems, and the problems of the community based on a strong link between research endeavour and functional outcomes as engendered by strong research leadership and management in a sound research culture environment.

Considering organisation culture for research engagement, Gebremeskel (2015: ii) emphasises that university leadership should develop an organisational culture pertaining to research leaders understanding the what, why and how of innovation at universities. Ethiopian university leaders lack commitment to research endeavour, have poor communication skills in English, and do not monitor research policy implementation and reporting (Gebremeskel, 2015: ii). Crucial to research commitment is the link between research and innovation as research is the basis for innovation in higher education institutions relying on strong research and innovation leadership and management for innovation endeavour to flourish. Mulu (2017:1) found the factors hindering academics' research initiatives at Addis Ababa University to contribute to economic development as the absence of a quality national framework for research endeavour, a lack of collaboration between university and industry and a lack of profound research infrastructure. Part of research infrastructure shortcomings related to a lack of facilities at universities and industries to undertake collaborative research and innovation initiatives, a lack of institutional commitment and support for research endeavour, and capacity inadequacies of academics to undertake research (Mulu, 2017:8). Research and innovation leadership at higher education institutions hampers individual actions by academics to participate in research and innovation projects that are focused on societal improvement in Ethiopia (Mulu, 2017:8).

With regard to translating research vision and knowledge transfer into practice, Ethiopian universities need to develop the capacity for research and technology transfer by transforming the approach of research outputs shelved for journal publication and promotion purposes only to functional application for the sake of community development (Nega, 2017:2). Although Ethiopian universities have research policies, research structures, and research priority areas for implementing research activities aligned to their research policies, they produce limited patents for industry use because of a lack of competent research and innovation leadership and

management skills (Nega, 2017:2). According to the studies of Emiru (2012), Gebremeskel (2015), Mulu (2017) and Nega (2017), no study has focused yet on the extent of leading and managing research policy implementation based on research and innovation endeavour through competent research leadership and management in the Ethiopian higher education institution environment.

3.5 SUMMARY

Considering knowledge-based functioning, research, science, technology and innovation have a key role to fulfil in order to address socio-economic development in both developed and developing countries. As countries have context specific problems and challenges to ensure societal development, they have been developing and implementing science, technology and innovation policy to be aligned with priority area identification. There are differences in leading and managing policy formulation either through top-down or bottom-up approaches with some countries focussing on big science development while others focus on developing technology to improve productivity and global competitiveness capacity. Developing countries emphasise addressing socio-economic problems relating to poverty, ill-health, human capital inadequacies and poor ICT infrastructure. In order to adopt and adapt the technology of developed countries though knowledge and technology transfer, developing countries need competent human capital and research and innovation capacity.

Higher education institutions should produce well-trained and skilled human resources for consumption by public and private sector functioning. Where developed countries have private firms and companies that drive research and innovation, higher education institutions in developing countries are tasked with research and research-based innovation responsibilities. Successful research is contingent on competent research and innovation leadership and management to develop higher education institutions' research and innovation policies to be aligned with national research policies and priority areas. Higher education institutions in developing countries, especially in Africa, are not led and managed effectively for significant research and innovation activities functional to societal development. This limitation results in a lack of competent human capital skilled for research and innovation endeavour producing relevant knowledge and technology for application to internal and external problem-solving. Problems related to limited research capacity, limited funding, and competent research and

innovation leadership and management engendering networking and collaboration for funding possibilities can counter limited infrastructure for research and innovation activity.

In the Ethiopian higher education context, although science, technology and innovation policy formulations are aligned to national research policy and development framework guidelines, these institutions are not producing competent graduates in research and innovation, and related competencies for industry, public and private sector consumption. Ethiopian higher education institutions are faced with poor quality teaching, poor quality research undertaking and poor technology transfer. The how and what of higher education institutions' leading and managing of research and innovation endeavour to address internal challenges and problems relating to community and industry shortcomings need to be studied, hence this study on research leadership and management in Ethiopian higher education institutions.

CHAPTER 4
RESEARCH METHODOLOGY AND RESEARCH DESIGN

4.1 INTRODUCTION

As stated in paragraph 1.5, the main aim of this study was to understand the research and innovation leadership and management of higher education institutions in Ethiopia both at policy and practice level. To achieve this aim, both a literature review and an empirical investigation were conducted. The study of literature focused on relevant concepts, theories, contexts and methodological elements. It was found that complexity leadership theory guides higher education institutions in leading and managing their research and innovation activities according to their specific contexts through their administrative (management), adaptive and enabling leadership functions (par 2.11). Higher education institutions, as knowledge producing and utilising organisations, should employ complexity leadership theory to lead and manage their research and innovation activities in order to address their own internal problems relating to teaching and producing competent human capital, the problems of the local community, industry and the nation at large. It was found that higher education institutions are complex organisations that should employ complexity leadership theory as they have complex functions also regarding their research and innovation activities having dynamic interactions and networking within the institution and outside with different stakeholders and partners (par 2.11). Researching and understanding its complexity leadership endeavour and the complexity of functions of higher education institutions requires a research design and research methodology that combines both qualitative and quantitative actions representing a mixed-methods research approach (par 1.6).

The findings from the literature review show that higher education institutions are main knowledge producing organisations, and main sources of research-based innovation in both developed and developing countries (par 3.3). While higher education institutions in developed countries are performing well in this regard, higher education institutions of developing countries like Ethiopia have been criticised for not addressing their own problems, the problems of the local communities and the nation's problems through their research and innovation activities. Research leadership and management was studied in developed and developing countries using case studies and surveys (Chapter 3). The leadership and management of research and innovation activities of higher education institutions in the

Ethiopian context have not been investigated yet. Hence, there is need to investigate the Ethiopian case by means of empirical research. Therefore, with this empirical study a mixed-methods research design and research methodology was used based on employing both quantitative and qualitative research methods for data collection in order to understand research and innovation leadership and management at higher education institutions in Ethiopia.

4.2 RESEARCH PARADIGMS

The concept of paradigm is rooted in Thomas Kuhn's book *The Structure of Scientific Revolutions* in 1962, which is defined as the beliefs researchers have and the efforts they exert to produce knowledge (Morgan, 2007:50). Creswell (2007:19; 2009:6) equates paradigm with worldview defining worldview as a general philosophical assumption that researchers apply in their studies. An alternative knowledge claim is understood to mean the assumption of researchers about the content and the methodology of their inquiry (Creswell, 2003:6). Lukenchuk and Kolich (2013:65) define paradigm in three ways, namely as a system of inquiry, as a model, and as a way of knowing. Morgan (2007:49) defines paradigm as an established belief that helps researchers to identify research questions and the right methods to conduct research practically. Hence, a research paradigm helps researchers to choose the right research approach and methods in line with the research problem as a guide for research endeavour (Shannon-Baker, 2016:321).

Generally, there are four varieties of research paradigms as discussed by Morgan (2007:50). The first research paradigm, as a worldview, focuses on general beliefs about life pertaining to morals and values. The second research paradigm, as epistemological stance, emphasises the nature of knowledge and how knowledge is known without indicating the what and how of studying this knowledge. Research paradigm as shared beliefs represents the third variety that focuses on the common beliefs of researchers about important questions and the relevant ways of answering research questions. With this view, mixed-methods research approaches are employed emphasising combining quantitative and qualitative data collection endeavours to answer research questions more comprehensively. The fourth research paradigm focuses on having a model research approach that serves as a guide for others in a specific field or discipline of research, especially applicable to beginner researchers still operating according to specific guidelines. These four varieties of research paradigms are interrelated and focused on the purpose of the specific research endeavour (Morgan, 2007:50).

In addition to positivist, constructivist and interpretivist research paradigms, pragmatism as research paradigm emphasises the mixing of quantitative (positivist) and qualitative (constructivist) research endeavour (Makrakis & Kostoulas-Makrakis, 2016:145). Creswell (2003:6; 2007:19) categorises research paradigms as worldviews into four main groups, namely post-positivism, constructivism, advocacy/ participatory and pragmatism. Cohen *et al*. (2007:26) discuss critical theory and complexity theory as emerging research paradigms. Each research paradigm has its own assumptions about the nature of reality, its own epistemology, its own axiology, its own rhetoric and its own research methodology (Creswell, 2007:15)

4.2.1 Positivist/ postpositivist research paradigm

The positivist research paradigm is associated with quantitative research methodology and methods. According to positivism, reality is objective, the relationship between the researcher and the researched is distant and the researcher discovers the truth and reality through observation and measurement. It is value free in that it does not consider the value of the researched and the researcher. In addition, the language of the research is formal, and the researcher uses deductive logic (Cohen *et al*., 2007:9; Creswell, 2014:35; Walliman, 2011:72). While these assumptions are mainly for the natural sciences and the natural world, the assumptions of positivism have also been used for the social sciences and the social world (Mertens, 2005:8). However, some researchers do not agree on applying positivism assumptions to social science, and criticise positivist ontological and epistemological assumptions that treat human beings like non-living objects because research on human beings implies different assumptions (Cohen *et al*., 2007:17; Walliman, 2011:73)

4.2.2 Interpretivist/constructivist research paradigm

For interpretivists, reality is subjective and there are multiple realities for participants and for different contexts (Creswell, 2007:17). The researcher constructs knowledge in collaboration with the researched, and the researcher acknowledges the values of the researched. The researcher uses informal language that entertains the direct voices of the research participant. The methodology employs inductive logic, developing theory rather than testing theory as with a positivist research paradigm (Cohen *et al.*, 2007:19; Creswell, 2014:36; 2007:17; Walliman, 2011:74). However, Cohen *et al.* (2007:26) criticise both positivist and interpretivist research

paradigms that do not embrace the political and ideological contexts of educational research, which is countered by a critical theory research paradigm.

4.2.3 Advocacy/ critical theory/emancipatory/participatory/research paradigm

The main aim of critical theory is not to present reality and understand meaning in different contexts, but to arrange equality and democracy by focussing on change in the society (Cohen *et al*., 2007:26). Critical theory as research paradigm transforms society and changes injustice to justice by introducing freedom in questioning the legitimacy of equality, democracy and power in educational contexts.

Like critical theory, advocacy, participatory and emancipatory research paradigms criticise the postpositivist research paradigm as it imposes laws and theories on individuals who are marginalised and do not have justice in society, and the interpretivist research paradigm who does not advocate action for marginalised people (Cohen *et al*., 2007:26). The intention of these research paradigms is that research should address political issues and advocate participatory actions to free people from racial, ethnic, gender, social, economic and political-related injustice, inequality and discrimination (Creswell, 2003:9; 2009:9). This research paradigm is criticised for its intentionally political focus favouring one group of people above the other (Cohen *et al*., 2007:30).

The discussed research paradigms focus on philosophical and ideological issues rather than focusing on the practicality of the methodology and methods to understand complex problems in a complex world. To understand the complexity of the world, a pragmatism research paradigm's main intent is to focus on the research problem as such.

4.2.4 Pragmatic research paradigm

Ontological and epistemological assumptions, the nature of reality and the nature of knowledge are not the main point of focus of a pragmatic research paradigm, which is mainly concerned about the research problem and how to find meaningful answers to the identified problem (Creswell, 2003:11; Feilzer, 2009:8). Pragmatism represents a worldview that prioritises actions, situations and consequences of the research (Creswell, 2014:38). With a pragmatic research paradigm, the researcher chooses methods, techniques and procedures to achieve the

purpose of the research based on the social, historical and political contexts and reality and truth of the actual situation for that specific point in time (Creswell, 2009:11; 2014:38). Researchers who use pragmatism as a research paradigm for their studies use different methods of data collection to collect both quantitative and qualitative data focusing on the practicality of the research and addressing the research problem from different angles (Creswell, 2007:23).

As a pragmatism research paradigm allows researchers different worldviews and different assumptions combined with different methods to collect and analyse both quantitative and qualitative data, scholars base their research on a pragmatism research paradigm when employing a mixed-methods research approach (Creswell, 2012:537; 2014:38). However, the pragmatism research paradigm does not accommodate complexity as does complexity theory research paradigms.

4.2.5 Complexity theory research paradigm

According to the complexity theory research paradigm, issues and phenomena should be studied as whole rather than as separate parts by using specific variables to ensure all the dynamic interactions and components of a system are covered. This research paradigm holds that the relationship between components of a system is necessary and analytic and not contingent and synthetic (Cohen *et al*., 2007:34). The complexity theory research paradigm contributes to understanding societal and institutional changes using different research methodologies (Cohen *et al*., 2007:33). For instance, as discussed in paragraphs 2.11 and 3.3, higher education institutions have dynamic and complex interactions and relationships with stakeholders including the community, industry and government. Higher education institutions have also complex functions including their research and innovation functions that are complex in the sense of pertaining to addressing internal and external problems by producing and utilising relevant and advanced technology in a knowledge-based dispensation. To understand the complexity of higher education functioning as this functioning relates to the management and leadership of research activities in Ethiopian institutions of higher education, such a study should be based on a complexity theory research paradigm. This research paradigm engenders a mixed-methods research approach of using both quantitative and qualitative research approaches to collect data underlined by a pragmatic worldview.

4.3 A PRAGMATIC RESEARCH PARADIGM TO LINK WITH A MIXED METHODS RESEARCH APPROACH

A pragmatic research paradigm based on a mixed-methods research approach is a popular approach applied with social science research as it is characterised by abduction, intersubjectivity and transferability rather than the positivist approach which is characterised by deduction, objectivity and generality and the interpretivist approach characterised by induction, subjectivity and context (Shannon-Baker, 2016:331). Intersubjectivity of a pragmatism research paradigm provides the answer for positivism and interpretivism conflicting ontological and epistemological assumptions by suggesting reflexive methodological options (Morgan, 2014:72). A pragmatism research paradigm also rejects the issue of context-specific and generalizable research results of interpretivism and positivism by emphasising and questioning whether the results of a research study are transferable to other contexts that can be applied practically rather than in abstract generalisations (Morgan, 2007:72; Shannon-Baker, 2016:331). In order to understand this contextual and social world, the focus of pragmatic research is on the significance of the goal of the research and the use of the right methods to achieve the goal (Morgan, 2014:1050).

Instead of treating social science research in terms of ontological, epistemological and methodological assumptions, pragmatism focuses on the beliefs and actions of researchers, as research is a human experience. Similarly, a mixed-methods research approach emphasises applicability of the research by using both the strengths of qualitative and quantitative methods and not the theoretical assumptions of the approaches (Morgan, 2014:1051). Linked to the pragmatism of John Dewey about the importance of considering the philosophical base of human experience instead of focusing on ontological and epistemological assumptions of the nature of knowledge, a pragmatic research approach to social science research represents a research approach that relates to action and not to philosophical assumptions (Morgan, 2014:1048).

Although there is a strong link between pragmatism and a mixed-methods research approach, scholars suggest that mixed-methods research necessitates different paradigms rather than using only pragmatism (Cameron, 2011:101; Mertens, 2012:2). However, Hall (2012:3) argues that a mixed-methods research approach should be justified by a single research paradigm, namely critical realism since it considers the complexity of social phenomena and it does not

have the limitations of pragmatic and transformative research paradigms. According to McEvoy and Richards (2006:69) and Maxwell and Mittapalli (2010:150), research by critical realists explain and understand a research problem by choosing the right methods based on critical realism facilitating the mixing of quantitative and qualitative inquiry motivated by a worldview of no objective reality and knowledge as knowledge is partial, incomplete and fallible. Critical realism is focused on integrating quantitative and qualitative assumptions and methods for a better understanding of the research context and its processes (Maxwell & Mittapalli, 2010:146).

Mixed-methods research approaches should consider four types of research paradigms based on their methodological importance with these paradigms being pragmatism, transformative emancipation, dialectics and critical realism (Shannon-Baker, 2016:322). Pragmatism is characterised by transferability of research findings into another context, and the researcher can be both subjective and objective in data collection and analysis. The transformative emancipation research paradigm is significant when the research problem of mixed-methods research focuses on a context where there is injustice, inequality and discrimination based on individuals' or groups' race, gender, social, economic and political conditions within the specific society (Creswell, 2012:546; Mertens, 2012:2). When a researcher uses the transformative emancipation research paradigm, the history of the society should be understood, and data should be collected and analysed in line with its historical and social contexts by showing the power domination when considering the voices of the oppressed. Some scholars prefer dialectics that suggests that mixed-methods researchers use more than one research paradigm within a single study known as a multiple research paradigm (Hall, 2012:3).

4.4 PRAGMATISM, CRITICAL REALISM AND COMPLEXITY THEORY AS RESEARCH PARADIGMS FOR THIS STUDY

Creswell, Plano Clark, Gutmann and Hanson (2003:186) recommend that researchers use both quantitative and qualitative methods based on a mixed-methods research approach in order to understand a research problem comprehensively. As a mixed-methods research approach represents different research designs, researchers apply different research paradigms, as a single research paradigm may not fit with the different research designs of mixed-methods research approach. This study on research management and leadership in institutions of higher

education is embedded in three different research paradigms, namely pragmatism, critical realism and complexity theory.

As the assumption of pragmatism is using research methods applicably for the best understanding of a research problem (Morgan, 2014:1049), the philosophical assumption emphasising understanding of human experiences and actions with this study is focused on understanding the experiences and actions of participants aligned with the aim of understanding leadership and management of research endeavour at higher education institutions. The study is also rooted in critical realism using integrating quantitative and qualitative research approaches in order to understand the leadership and management of research endeavour at higher education institutions comprehensively inferring two types of data. Critical realism also provided a perspective for the study based on the assumption of no objective reality regarding the nature of knowledge.

The study is also rooted in a complexity theory research paradigm assuming that the complex world cannot be studied using specific variables of analysis only. Instead, a certain context or a research problem should be studied using both quantitative and qualitative research methods to understand it in better breadth and depth. As the main intent of this study was to understand the complex functioning of leadership and management of research actions at higher education institutions as aligned to research policy formulation and implementation, the study also considered the assumptions of complexity theory as research paradigm.

4.5 RESEARCH DESIGN

As the main plan for a study containing the strategy, conceptual framework, participants of the study, and methods of data collection and data analysis, the research design includes the procedure for collecting, analysing, interpreting and reporting the data for the research (Creswell & Plano Clark, 2007:53; Punch, 2005:63). The research design as the basic plan of a research study also includes the research paradigm and research approach underlying data collection, data analysis and data interpretation.

The research design matches the purpose of the study (Cohen *et al*., 2007:79). As the aim of this study was to understand the research and innovation leadership and management of higher education institutions at policy and practice level, which represents a complex problem, a

mixed-methods research approach was employed in order to collect sufficient data for the answering of the research question.

4.6 A MIXED-METHODS RESEARCH APPROACH

Mixed-methods research methodology originated from the studies of different scholars in the fields of education, management, sociology and health sciences in the late 1980s early 1990s (Creswell, 2014:257). In social, behavioural and human sciences, a mixed-methods research approach is more recently applied by researchers in pursuit of using both quantitative and qualitative research methods for a more comprehensive address of the research problem (Johnson, Onwuegbuzie & Turner, 2007:113). Mixed-methods research approaches pursue researching complex problems by mixing the strengths of quantitative and qualitative methods to enable researchers to inference for improved understanding of the studied problem (Guetterman, 2017:1).

4.6.1 Definition of a mixed-methods research approach

Scholars define a mixed-methods research approach in different ways. Johnson and Onwuegbuzie (2004:17) and Johnson, Onwuegbuzie and Turner (2005:19) define mixed-methods research as a research approach where researchers integrate quantitative and qualitative research techniques, methods, approaches and language in a single study. Johnson *et al.* (2007:123) define a mixed-methods research approach as one in which researchers combine both quantitative and qualitative research approaches to understand and corroborate a research problem in breadth and depth. With mixed-methods research approaches researchers collect and analyse quantitative and qualitative data simultaneously or consecutively with equal or unequal weight, to integrate the data in different phases of the study (Creswell *et al.*, 2003:165). Researchers are enabled to collect and integrate quantitative and qualitative data in line with a specific design having its own philosophical assumptions and theoretical framework for comprehensive understanding of a research problem incorporating different timings, weights and phases for the integration of collected data (Creswell, 2014:32).

Among the four basic designs of a mixed-methods research approach, namely convergent parallel, explanatory sequential, exploratory sequential and embedded (Creswell & Plano Clark, 2007:69), this study employed a convergent parallel design referring to triangulation

(Creswell & Plano Clark, 2007:77). A convergent parallel design as a mixed-methods research approach implies that a researcher employs data collection actions simultaneously with the two types of data having equal weight with the integration of the data in its interpretation phase of determining research findings (Creswell, 2014:260; Creswell & Plano Clark, 2007:70). Tashakkori (2009:289) argues, however, that determining the weight of the two types of data collection approaches is difficult during the planning and conducting phases and is only possible at the stage of integration of the findings of the study.

When choosing a data collection focus from the different mixed-methods research approaches, researchers should be familiar with the criteria of the design and the timing of data collection with regard to being concurrent or sequential. Researchers should also be sure of the weight of the quantitative and qualitative data (equal or unequal) and the phase of integration of quantitative and qualitative data, namely whether at data collection, data analysis or at data interpretation phase (Creswell *et al*., 2003:170; Creswell & Plano Clark, 2007:64). Integration of mixed-methods research approaches can occur at the research question formulation phase where both quantitative and qualitative research questions are formulated and at data collection phase where both open- and closed-ended questions are included in a structured data collection instrument (Creswell *et al*., 2003:173). Integration can also be at data analysis and data interpretation phase where the quantitative and qualitative results are integrated to examine the convergence of the research findings. In this study, the integration was at both the phase of formulation of the research question and at the phase of data analysis and interpretation of the collected data.

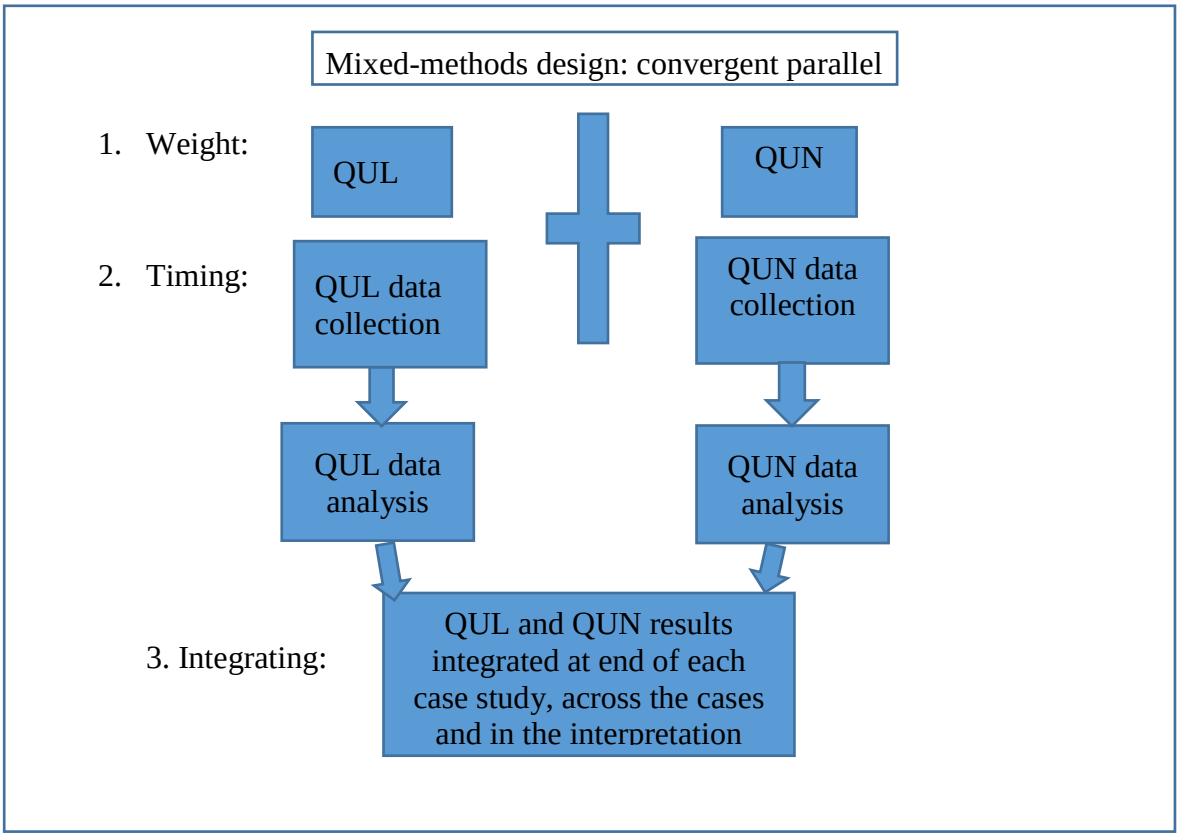
4.6.2 Purpose and rationale of a mixed-methods research approach

The purpose of using a mixed-methods research approach is to understand a research problem comprehensively by combining the strengths of quantitative and qualitative data collecting methods and to minimise their weaknesses (Creswell & Plano Clark, 2007:77; Creswell *et al*., 2003:183; Johnson *et al*., 2007:100). The rationale for using a mixed-methods research approach in this study was to explore and explain complex research questions that cannot be answered using only quantitative or qualitative research methods (Bronstein & Kovacs, 2013:355). Combining both research approaches resulted in understanding the research problem comprehensively.

4.6.2.1 Procedures of the mixed-methods research approach

According to Creswell (2012:537), a researcher should develop a visual model of a mixed-methods research design employed in a study and the main procedures used while implementing the design. A visual model of the mixed-methods research design used in this study on research leadership and management is presented next.

Figure 4.1: Procedures of a mixed-methods research approach applied to this study



Source: Adapted from Creswell (2012:541)

As presented in Figure 4.1, the weight of the qualitative (QUL) data and the quantitative (QUN) data was equal. In addition, both the qualitative and quantitative data were collected concurrently. After the qualitative and quantitative data were analysed separately, they were integrated at the end of each case, across the cases and in the interpretation part of the study.

4.6.2.2 Strengths and limitations of a mixed-methods research design

The strengths of a convergent parallel research design as one of the four options of a mixed-methods research approach (par 4.6) are that its findings are well-validated and substantiated (Creswell & Plano Clark, 2007:77). The main limitations of this design are that it requires much effort and expertise, it is difficult to compare the results of the two forms of data, and it is difficult to address contradictory research findings (Creswell *et al.*, 2003:184; Creswell & Plano Clark, 2007:80; Johnson *et al*., 2007:101).

In general, a mixed-methods research approach has its own advantages and disadvantages. The advantages of a mixed-methods research approach pertain to researchers being able to compare, confirm and cross validate results from qualitative and quantitative data about a single topic or issue of investigation. As it uses more data from both methods, a mixed-methods research approach provides more insight than using either quantitative or qualitative methods. A mixed-methods research design helps the researcher to understand the research questions in a comprehensive way as opposed to using one of the methods only (Johnson *et al*., 2007:100). The main advantage of using a mixed-methods research approach pertains to researchers being able to read again and check the quotes from qualitative data collection endeavour in line with the results of the quantitative data (Malina, Nørreklit & Selto, 2011:63).

According to Maxwell and Mittapalli (2010:148), the key argument for using mixed-methods research approaches is that the research paradigms and research methods of a combination of quantitative and qualitative endeavour are harmonising as these paradigms and methods have different strengths and weaknesses so that researchers can arrive at conclusions that are not possible using one of the approaches only. The disadvantages of a mixed-methods research approach pertain to demanding from the researcher to be an expert in both quantitative and qualitative research methods and having the time and money to undertake both methods of data collection (Johnson *et al*., 2007:101). However, with this study on managing and leading research actions at higher education institutions, the researcher has addressed the main limitations of the design by exerting maximum effort and having training and experience in both quantitative and qualitative research designs' data collection methods.

4.7 SELECTION OF SITES AND PARTICIPANTS

The population for this study were the researchers, the research coordinators at university, college and project level, the research directorate, the technology transfer directorate and the

vice president for research and community transfer at higher education institutions in Ethiopia. Higher education academic and research managers at the Ministry of Education, and policy, research and innovation managers at the Ministry of Science and Technology, the local community leaders at zone level and industry managers around universities in Ethiopia were also part of the population for this study. This is because these groups of people are the key stakeholders in the leadership and management of research and innovation activities at policy and practice level at higher education institutions in Ethiopia. They are also active role-players in the production and application of research-based knowledge and research-based innovation.

As discussed in paragraph 1.6.2, the research sites of the study were selected based on cases, not variables. Four higher education institutions were chosen from three different generations of Ethiopian higher education institutions in line with year of establishment. One university was chosen from the first-generation universities, one university from the second-generation universities, and two universities were chosen from the third-generation universities (one from general universities and one from science and technology universities) of all the universities in Ethiopia. The main reason for selecting a university from each generation of universities was the fact that there is no study yet conducted about any university from any rank of university representation in Ethiopia on its research and innovation leadership and management actions as aligned to policy formulation and implementation. Therefore, the researcher was motivated to understand policy and practice alignment of research and innovation management and leadership at the Ethiopian universities with representation from each generation of universities in order for research findings relating to comprehensively understanding leading and managing research and innovation activities at higher education institutions in Ethiopia.

4.7.1 Research sampling

The aim of this study was to understand the research problem relevant to the higher education institutions studied, not to generalise the findings to all higher education institutions. The sampling techniques employed were in line with the aim of understanding rather than confirming (Onwuegbuzie & Collins, 2007:285). As indicated in the selection of research sites, the higher education institutions that were chosen were cases of generations of higher education provisioning in Ethiopia. Consequently, as discussed in paragraph 1.6.2, the research sites were selected using random and purposive sampling techniques as mixed-methods research uses

such sampling techniques for such kind of research endeavour focused on confirming and understanding the phenomenon of study (Onwuegbuzie & Collins, 2007:287).

For a mixed-methods research approach, a researcher has to select sampling techniques for the compiling of both a research sample for the collecting of quantitative data and a research sample for the collecting of qualitative data. According to Teddlie and Yu (2007:92), for a convergent mixed-methods research design, a researcher should use two types of sampling techniques, namely probability sampling for the quantitative data and purposive sampling for the qualitative data from identically parallel samples. The researcher should also choose the sampling design based on the timing of data collection in terms of being collected simultaneously or consecutively and with consideration of the relationship between the quantitative and qualitative research samples. The relationship of the samples refers to whether the two types of data were collected from a single, parallel, nested or multilevel sample (Collins, Onwuegbuzie & Jiao, 2007:276; Onwuegbuzie & Collins, 2007:290).

Bronstein and Kovacs (2013:356) suggest that with a mixed-method research approach, a researcher uses more than one sample for a study. Accordingly, in this study, multilevel sampling was used for the collection of quantitative and qualitative data based on a concurrently convergent parallel mixed-methods design as participants of the study represented different levels of operation in higher education institution functioning (Collins *et al.*, 2007:278). First, the total sample size of participant group was determined in line with the population size and confidence level as recommended by Cohen *et al*. (2007:103). The data of the populations and their representative samples at a 5% confidence level are presented in table 4.1. Second, to collect the quantitative data from the researcher participants, they were selected using systematic random sampling based on a list from the research director of each university. As the number of research coordinators, research directors and technology transfer directors at the four research sites are small; all of them were included as they were. To collect the qualitative data, from the researchers and research coordinators who completed the structured questionnaire, they were selected using purposive and convenience sampling techniques. All the vice presidents for research and community engagement, research directors and technology transfer directors were interviewed. The community leaders at zone level and the industry managers around the universities were selected to be interviewed using the purposive sampling technique.

4.7.2 Selection of research participants

The research population and research sample for the study are presented in Table 4.1. The names of the universities acting as research sites are pseudonyms.

Table 4.1: Research population and research sample

S/N	List of participants	Names of the Universities								Total	
		Fignu		**Segnu**		**Thgnu**		**Thgnstu**			
		Pop.	Sam.	Pop.	Sam.	Pop.	Sam.	Pop.	Sam.	Pop.	Sam.
1	Researchers	500	217	150	79	50	44	75	63	775	403
3	Research coordinators at college level	8	8	10	10	6	6	5	5	29	29
4	Research directors	1	1	1	1	1	1	1	1	4	4
5	Technology transfer directors	1	1	1	1	1	1	1	1	4	4
6	Vice presidents for research and technology/community engagement	1	1	1	1	1	1	1	1	4	4
Total		511	228	163	92	59	53	83	71	816	444

Keys: Pop – Population, Sam – Sample

The following groups of participants were included in the research sample: local government leaders at zone level, industry managers near each university, academics, research directors from the Ministry of Education (MoE) and from policy and research planning from the Ministry of Science and Technology (MoST). A total of 403 researchers, and 29 research coordinators at college level completed the questionnaire to collect the quantitative data, and 12 project leaders, 12 co-investigators and 12 research coordinators at college level were interviewed to collect the qualitative data from the group of researchers who completed the questionnaire. Apart from the 12 project leaders, 12 co-researchers and 12 research coordinators, four vice presidents for research and technology transfer or community engagement, four research directors and four technology transfer directors at university level were also interviewed to collect qualitative data. In addition, two officials at the Ministry of Education and the Ministry of Science and Technology, three community leaders and two industry managers were also interviewed from each research site. Out of a total of 432 participants approached at the four selected universities to complete the structured questionnaire, 358 (82.9%) completed and returned the structured questionnaire. Out of 70 participants anticipated to be interviewed at different levels of governance at the four research sites, 64 (91.4%) took part in the semi-structured individual interviewing. From the total of 466 participants anticipated to participate in the study with 36 participating in both the structured questionnaire and in individual interviewing, 389 (83.5%) participants completed the structured questionnaire and 33

participants who completed the structured questionnaire also engaged in individual interviewing.

4.8 DATA COLLECTION METHODS

With a mixed-methods research approach both quantitative and qualitative data collection instruments are used. The quantitative instruments are questionnaires, observation checklists and numerical records, whereas the qualitative data collection instruments are interviewing, observation, document analysis and qualitative records (Creswell, 2012:549; 2014:260). Among these instruments for data collection, a structured questionnaire and document analysis were used to collect the quantitative data for this study. The document analysis for the quantitative data used a checklist to examine the research and innovation achievements of each selected university for the five-year period 2012/13-2016/17. Individual interviewing and document analysis were used to collect the qualitative data. The document analysis for the qualitative data used guiding open-ended questions to analyse the research and innovation policy of each selected university. As leadership and management of research and innovation at higher education institutions in Ethiopia has not been researched yet, there are no instruments developed by other researchers, or are available in literature to be adopted or adapted for this study. Hence, as recommended by Creswell (2012:157), the researcher developed the data collecting instruments for this study following the steps for developing new data collecting instruments, namely planning, construction, quantitative evaluation and validation of the instruments.

Following and adapting the scale development tree of Barry, Chaney, Stellefson and Chaney (2011:98), Likert type scale items were developed, pilot tested, evaluated and validated. First, it was checked from different databases and sources to confirm that there are no instruments developed already that could enable the researcher to collect data to answer his research questions. Second, the decision was taken to develop an instrument to collect data as the researcher had a clear understanding of the issues to be studied based on a theoretical framework and literature review study. Third, outlines were developed, the format of items was designed, and a pool of items was developed. In so doing, the researcher developed a structured questionnaire, and compiled interview schedules for the different groups of participants to be interviewed and compiled a checklist for consultation of applicable research site documents. In order to validate the contents of the data collecting instruments, experts were approached to

assess whether the items are relevant and answerable based on easy comprehension with reference to a validation form adapted from Taherdoost (2016:29). The revised instruments were pilot tested in a context like that of the study. The participants of the pilot study were requested to comment on the unclear items both orally and in written form. Based on their comments and suggestions, the items that were unclear were revised for clarity. Finally, a pilot study was conducted, the items were evaluated and validated in terms of relevancy using Skewness and Kurtosis's item-scale correlation to identify similar content, and Cronbach Alpha for internal consistency as this statistical phase of evaluating the appropriateness of the items is crucial in new scale development as recommended by Barry *et al*. (2011:99). The Statistical Package for Social Science (SPSS) was used.

In order to collect data for this study on research management and leadership, a structured questionnaire consisting of closed-and open-ended questions, individual interviews and document analysis was used.

4.8.1 Structured questionnaire

Data collection for the quantitative part of the empirical investigation comprised a questionnaire developed by consulting theoretical framework and literature review findings (Chapter 2 & 3). The items of the questionnaire are based on a Likert type six-point rating scale ranging from strongly disagree to strongly agree for sub-scales I, II and III, and no contribution to very high contribution for sub-scale IV (Appendix E). This even number response (six points) is significant to minimise participants' choice of a 'neutral response category' without reflecting on their answers critically (Barry *et al*., 2011:100; DeVellis, 2003:79; Johnson & Christensen, 2008:181). In addition, two open-ended questions under each sub-category of the questionnaire and one general question at the end of the questionnaire are included to provide participants the opportunity to include what they think is relevant and important to be included. The content of this data collection instrument was discussed in paragraph 1.6.3.1 relating to collecting quantitative data about research and innovation leadership and management at higher education institutions at policy and practice level.

The structured questionnaire consisted of five parts. The first part focused on items designed to explain the leadership and management of research and innovation policies and practices at higher education institutional level. The second part represented items designed to explain the

leadership and management of research and innovation policies and practices at college level. The third part focused on items designed to examine the leadership and management of research and innovation policies at project level. The fourth part emphasised items designed to examine the contributions of research and innovation goals (practices) of higher education institutions in solving internal and external problems. The final part represented demographic data of research participants. Two of the open ended-questions appeared at the end of each paragraph of the first four parts, and one open-ended question at the end of the questionnaire. The validated structured questionnaire comprised 141 questions with nine of these questions being open-ended.

A structured questionnaire comprises advantages and disadvantages. Advantages pertain to collecting high quality data, having a good response rate and offering participant anonymity to provide genuine and honest answers to questions. Disadvantages relate to poor response rates, information not provided by information-rich respondents, confusing questions and no opportunity for respondents to express their own views if open-ended questions are not included (Marshall, 2005:132). In order to minimise the disadvantages of a structured questionnaire relating to poor response rate, confusing items and being completed by respondents not having good insight in the studied matter, the researcher of this study administered the questionnaire himself in order to clarify possible confusion even though items were validated for clarity and distributing the questionnaires himself to ensure a good response rate. Open-ended questions included in the structured questionnaire provided participants the opportunity of expressing their own views on matter relevant to the study, but not included in the pool of items.

4.8.2 Semi-structured individual interviews

The main data collection instrument for qualitative data collection was semi-structured individual interviews. As was the case with the structured questionnaire, based on the conducted literature review, interview items were developed to refer to during interviewing to ensure that all the important aspects relating to the focus of study are addressed with interviewing (Appendix G).

As discussed in paragraph 1.6.3.2, a semi-structured individual interview is important to collect quality data to understand complex problems. It is also important to understand unknown

aspects of people and organisations. It also opportune interviewers to modify their interview questions to obtain the required responses from interviewees. It provides interviewees the opportunity to respond in their own words and language (Qu & Dumay, 2011:246). An important advantage of individual interviewing is that it helps to understand complex issues, enabling the interviewer to collect accurate and deep data through probing participants for further sharing of their authoritative knowledge on the phenomenon of study. However, interviewing is costly and time-consuming demanding thorough planning before, during and after the interview is conducted and demanding adequate skill with question probing and interpreting of collected data (Cohen *et al*., 2007:381; Qu & Dumay, 2011:248). As the research problem of this study was complex, using individual interviewing was beneficial for understanding matter in depth albeit time consuming.

4.8.3 Document analysis

In order to understand whether the research and innovation policies of the higher education institutions that served as research sites are in line with national policies such as science, technology and innovation policy or research policy, and the national development plan of the country, questions were developed to determine the extent of applying with policy prescriptions. Using guiding questions (Appendix H), the research and technology transfer innovation policies of the higher education institutions selected were analysed.

In relation to the importance of document analysis as data collection instrument pertaining to providing data on the context within which research participants operate, and providing supplementary research data (par 1.6.3.3), additional advantages include document analysis being less time consuming. Documents to be analysed are readily available, document analysis is a less costly research endeavour, documents are unpretentious in terms of the research process, and these documents are stable and accurate. Documents can cover data over an extended time, in different events and in different settings (Bowen, 2009:31). However, documents may not have enough detail and may not necessarily be retrieved easily. Documents may also be subject to biased selectivity (Bowen, 2009:32).

To examine the research and innovation accomplishments of higher education institutions to address internal and external problems by means of document analysis, a checklist was developed in line with the basic research questions and the literature review. It was developed

to collect data about the achievements of each university's research and innovation projects. The content of the checklist pertaining to analysing the research sites' documents representing their annual research and innovation performances by means of their reports for the five-year period 2012/13 -2016/17 is discussed in paragraph 1.6.3.3 (Appendix H).

4.9 METHODS OF DATA ANALYSIS

With a mixed-methods research approach, both quantitative and qualitative methods of data analysis were used to analyse the collected data. As the rationale was to triangulate the quantitative data with the qualitative data in order to understand the research problem comprehensively, the two types of data were analysed separately, and the results then compared based on a case and cross case analysis (Combs & Onwuegbuzie, 2010:2).

Creswell (2014:263) proposes procedures of data analysis for each of the different types of mixed-methods research approaches. For the convergent parallel mixed-methods research approach that is applicable to this study (par 4.6.1), researchers can analyse the quantitative and the qualitative data separately, and they can integrate and compare the results. Alternatively, they can transform the quantitative data into the qualitative data or the reverse and compare the results, or they can compare the two types of data using a table or a graph. As shown in the visual model of the procedures of a mixed-methods research approach applied to this study, the first type of analysis was employed in this study, namely analysing the quantitative and the qualitative data for each research site separately and then integrating each case's data to eventually compare across the cases (Figure 4.1).

The analysis of the quantitative data and that of the qualitative data is discussed next.

4.9.1 Quantitative data analysis

Quantitative data was analysed using quantitative methods of data analysis. The method of data analysis in quantitative research endeavour is determined by scale of data (nominal, ordinal, interval or ratio). As the Likert type scale is ordinal data, nonparametric statistics was used. Specifically, percentages, frequencies, bar charts and chi-square are used as quantitative data analysis methods as recommended by Cohen *et al*. (2007:502). For this study, in order to analyse the quantitative data by means of percentages, IBM SPSS version 20 was used with

this IBM SPSS referring to International Business Machines Statistical Package for the Social Sciences.

4.9.2 Qualitative data analysis

According to Creswell (2007:148), the three general methods of qualitative data analysis are preparing and organising the data (transcription), coding and developing themes, and presenting the data in terms of discussion and critical interpretation. Regarding the analysis of cases, Creswell (2007:172) states that after the above analyses were made for each case, a researcher should make a cross case analysis by comparing the differences and similarities of the themes between and among the cases.

After the quantitative and qualitative data were analysed separately, the analysed data were jointly interpreted as research findings. The integration of the two types of data as the essence of a mixed-methods research approach is carried out for three reasons, namely as illustration, as convergent validation, and as analytic density (Fielding, 2012:127). Illustration represents displaying the reality of the research topic using presentation. Convergent validation pertains to checking if the findings from the different methods are the same. Analytical density includes having a wider and deeper understanding of the research topic from different dimensions (Fielding, 2012:127). The first two reasons for a joint interpretation of the quantitatively and qualitatively analysed data applies to this study, namely to get a complete and clear understanding of the research problem and to confirm that the interpreted data from both research methods concurred to represent valid research findings.

4.10 RELIABILITY AND VALIDITY OF FINDINGS

Conducted research should adhere to reliability and validity considerations in order to be evaluated as trustworthy outcomes.

4.10.1 Reliability

Reliability refers to collecting consistent data using reliable instruments (Creswell, 2012:159; 2009:190). The focus of reliability is on accuracy and precision of measurement using data gathering instruments (Cohen *et al*., 2007:146). The three types of reliability for quantitative

methods are stability, equivalence and internal consistency (Cohen *et al*., 2007:146). Stability pertains to collecting consistent data from the same respondents at different times; equivalence represents the collection of consistent data using two equivalent data collection instruments; internal consistency represents collecting consistent data using the items of the instrument by administering it once while stability and equivalence require the same outcomes if an instrument is administered twice.

There are different ways of checking the internal consistency of all items in a data collecting instrument, namely by means of the split half approach, the Kuder-Richardson formulas and the Cronbach alpha verification (Cohen *et al.,* 2007:95). Among these, Cronbach alpha is recommended to check the reliability of Likert type scale items because with Cronbach alpha researchers can check the internal consistency among items of an instrument by calculating the correlation of each item with the sum of all items for many item scales (Cohen *et al.*, 2007:148). The focus of reliability of qualitative research is on credibility, transferability, confirmability, trustworthiness and dependability (Cohen *et al*., 2007).

Reliability in qualitative research comprises matching the data collected by the researcher with what is available in the natural setting, which, in essence is also applicable to quantitative research in that the reliability of the quantitative items was calculated using Cronbach's alpha coefficient internal consistency test using SPSS, founded on the sub-scales for Part I (A=0.89, B=0.96, C=0.89), for Part II (A=0.94, B=0.84, C=0.85), for Part III (A=0.94, B=0.86, C=0.83) and for Part IV 0.98. The guidelines for the alpha coefficient are >0.90-very highly reliable, 0.80-0.90-highly reliable, 0.70-0.79-reliable, 0.60-0.69 marginally reliable, and <0.60-unreliable (Cohen *et al*., 2007:506). With reference to Gliem and Gliem (2003:88) and Cohen *et al*. (2007:506) recommending the calculating of items of Likert type scale or sub-scaling as a whole, the reliability for the items of this study were calculated for all the items of each sub-scale.

The dependability of the qualitative data was addressed by developing an interview protocol and creating a database for each selected higher education institution.

4.10.2 Validity

Validity refers to a data collection instrument that measures what it is intended to measure; it is about interpretation and implications of the data. The three main types of validity of instruments are content, criterion and construct validity (Punch, 2005:97). Content validity questions if all the contents or concepts that are planned to be measured are included in the data collection instruments. Criterion validity includes two types of validity: concurrent and predictive validity. Concurrent validity refers to the criterion variable of the present while predictive refers to the criterion variable of the future. Construct validity examines whether the instrument adapts theoretical issues (Punch, 2005:97). Lodico *et al*. (2006:111) and Taherdoost (2016:29) explain face validity as a subjective assessment of items in an instrument by researchers and experts in relation to their appropriateness to measure what is planned to be measured, format consistency, instructions and language clarity. All these validity issues are mainly related to quantitative research.

Validity in qualitative research pertains to trustworthiness, credibility, transferability, confirmability and dependability (Creswell, 2007:203). Applying the concepts of validity in qualitative research pertains to the researcher spending enough time in the field, using different methods to triangulate collected data for credibility and including thick descriptions of data to address transferability of findings between the researched and the researcher (Creswell, 2007:203). To address the issues of dependability (the findings might be changed), and confirmability (the results are verified by the participants of the study), the researcher has to monitor the research process. However, Creswell (2007:203) argues that validity in qualitative research is the correctness of the findings of a study when examined by the researcher and the researched; it is also a process, not a confirmation. Three strategies for addressing validity in qualitative research relates to triangulation, member checking and a detailed description of the data (Creswell, 2007:205). Validity threats in qualitative research are minimised by exerting maximum effort in the research process, being honest in using real evidence, triangulating data from different sources, and by protecting the research participants (Asgedom, 2007:4).

With regard to a mixed-methods research approach, the concept of legitimation includes sample integration legitimation, inside-outside legitimation, weakness minimization legitimation, sequential legitimation, conversion legitimation, paradigmatic mixing legitimation, commensurability legitimation, multiple validities legitimation, and political legitimation (Dellinger & Leech, 2007:315; Onwuegbuzie & Johnson, 2007:57). According to Onwuegbuzie and Johnson (2007:56), sample integration legitimation focuses on the

relationship between quantitative and qualitative samples for better inferences. Inside-outside legitimation includes exactly presenting the views of the insider and the observer. Weakness minimization legitimation addresses the weaknesses of quantitative methods by the strengths of qualitative methods and the reverse. Sequential legitimation refers to addressing the problem of doing quantitative or qualitative research first to make higher inferences. Transforming quantitative data into qualitative data or the reverse provides a researcher with the opportunity to quality inference. Paradigmatic mixing legitimation represents mixing the philosophical assumptions of quantitative and qualitative approaches successfully. The highest inference made by mixing the two research methods, namely quantitative and qualitative representing confirming the applicability of integration of research paradigms. Focusing on the legitimation of quantitative and qualitative research implies focusing on the legitimation of a mixed-methods research approach as the highest quality inference. The users of the results of mixed-methods research as highest inference, namely the outcomes of quantitative and qualitative research combined points to political legitimation (Onwuegbuzie & Collins, 2007:304). Torrance (2012:3) opines that triangulation is the basis for mixed-methods research designs as these designs compare, contrast and integrate quantitative and qualitative data.

With this study on leadership and management of research endeavour at higher education institutions, the validity of qualitative data was addressed by using triangulation and detailed descriptions of data. The validity of the quantitative research was assessed by experts, especially regarding the content and face validity of the items. As a mixed-methods research approach focuses on validity, the validity of this study was addressed through sample integration, weakness minimisation and integrating the data collected quantitatively and qualitatively.

In summary and in order to have ensured the reliability and validity of the data collected for answering the research questions of this study, evaluation of quantitative and qualitative data was obtained through judgement of experts, statistical analysis, and application of a pilot study. Maximum effort was exerted to minimise validity threats by applying triangulation to verify data from different sources and by protecting research participants throughout the research process including reporting on the research results.

4.11 ETHICAL CONSIDERATIONS

Ethical issues in research should be addressed in line with the codes of ethics of specific disciplines and professional organisations. As this study focused on applied social sciences, it considered the ethical issues of social science since the participants were people with the research focused on people. Ethical issues should be considered constantly and consistently in quantitative and qualitative research endeavour (Punch, 2005:276).

In addition to ethical considerations discussed in paragraph 1.6.6, the essence of ethical arrangements relates to protecting research participants from any harm. The ethical considerations relating to this study on leadership and management of research and innovation in higher education institutions at policy and practice level were addressed as follows:

- Ethical clearance to undertake the study was applied for and approved by the University of South Africa (Appendix I).
- Permission to undertake the research was requested and obtained from vice presidents for research and community engagement at each research site (Appendix B).
- Participants signed letters of consent. Participants were ensured that they could withdraw from the study at any time without giving any reason for not wanting to participate. Participants were ensured of their authoritative knowledge to contribute to a better understanding of the topic being researched. Participants were assured that their sharing of information will remain anonymous and confidential (Appendix D).

4.12 SUMMARY

The third research paradigm, pragmatism, was applied to counter the weaknesses of the two research approaches, namely qualitative and quantitative and to capitalise on their strengths. Unlike the other research paradigms namely interpretivist and positivist, pragmatism recognises the importance of values in research without having specific ontological and epistemological assumptions. Pragmatism focuses on using the right methods to address a research problem practically. For pragmatism as research paradigm, what matters is thorough research endeavour that combines different research methods to understand complex research

problems comprehensively as is possible with a mixed-methods research approach rooted in pragmatism.

John Dewey's argument, as cited in Morgan (2014:1048), was considered for applying pragmatism as research paradigm for this study because of its philosophical basis namely that the nature of reality and knowledge and the way these two phenomena are known are not based on the abstract assumptions of positivism and constructivism, but on human beings' experiences and actions which need to be understood in more depth. In addition, a complexity theory research paradigm benefitted the understanding of complexity pertaining to higher education institutional functioning.

With the mixed-methods research design for this study on research and innovation leadership and management at higher education institutions, the convergent parallel design was applicable for collecting quantitative and qualitative data simultaneously, with equal weight and by combining these data in the analysis and interpretation stages. The rationale for using the convergent parallel design pertained to understanding the research problem by combining, comparing, contrasting and integrating both quantitative and qualitative data for breadth and depth of comprehension.

CHAPTER 5
RESEARCH FINDINGS FROM AN ANALYSIS OF DATA OF FIRST- AND SECOND-GENERATION UNIVERSITIES

5.1 INTRODUCTION

Higher education institutions should be the engine for a knowledge-based society including developing countries like Ethiopia because of a lack of private company involvement in knowledge production and technology advancement in third world environments. Higher education institutions are expected to produce advanced knowledge and apply this knowledge to address their internal teaching problems, the problems of the local communities, industry and the problems of the country at large. In doing so, they should move from using leadership theories developed for the industrial era to leadership theory that has been developed for the knowledge-based dispensation, namely complexity leadership theory (par 2.10.2.1).

Higher education institutions as knowledge producing organisations have to lead and manage their research and innovation activities within the framework of complexity leadership theory that consists of administrative (management), adaptive, and enabling leadership. Complexity leadership theory enables higher education institutions to lead and manage their research and innovation activities within their specific contexts. The theory also helps the institutions to lead and manage the complex interactions they have when they engage in their research and innovation function with different stakeholders to fulfill different purposes and inadequacies. Consequently, higher education institutions are complex organisations that need complex research and innovation leadership and management to address complex problems (par 2.11).

Higher education intuitions in Ethiopia are organised based on their establishment period as first, second and third generation universities (par 1.6.2). In order to understand and explain the leadership and management of research and innovation policy and practice at higher education institutions, both quantitative and qualitative data were collected simultaneously. Since each research site representing a different generation of university engagement has a specific context, the data of each university was analysed as a case. Within each case, the qualitative and the quantitative data were analysed separately, followed by an integration of the two sets of data. Following this approach, the research findings from the first-and second-

generation universities are presented in chapter five, followed by the two third-generation universities in chapter six.

5.2 RESEARCH AND INNOVATION LEADERSHIP AND MANAGEMENT AT FIGNU UNIVERSITY

5.2.1 Profile of the research site as a first-generation university in Ethiopia

Fignu University is one of the eight first-generation universities in Ethiopia. Established in 2000, the university has seven functional campuses, nine colleges and two institutes, and offers 81 undergraduate, 108 masters and 16 PhD programmes. Performing the three functions of tuition, research and community engagement, the University strives to become the best university at national level by 2025, competent in Africa and internationally renowned (Fignu University, 2018:6).

In order to understand the research and innovation leadership and management of Fignu University at policy and practice level, both qualitative and quantitative data were collected using document analysis, semi-structured individual interviewing and a structured questionnaire. The results of the qualitative and quantitative data are discussed separately followed by an integrated interpretation representing the final research findings. The results of the qualitative data based on research policy document analysis and semi-structured individual interviewing, with data from the open-ended questions of the structured questionnaire incorporated into the data from interviewing, are presented next.

5.2.2 Results of the qualitative data analysis

The research findings of the document analysis are discussed next, followed by the research findings from interviewing in which research findings are incorporated from an analysis of participants' responses to the open-ended questions in the structured questionnaire.

5.2.2.1 Results of document analysis

As discussed in the orientation to this study, national policies, especially the national Science Technology and Innovation (STI) policy and policies related to research and innovation

endeavour at higher education institutions are the basis for the development of the research policies of each higher education institution (par 1.2.2). The fourth aim of this study was to evaluate to what extent the research and innovation policies of the selected higher education institutions are developed in line with the national higher education research and technology transfer framework, and the STI policy (par 1.5). To achieve this aim, the research policies of the four universities serving as research sites were analysed based on the guiding questions relating to the translation of the vision, mission, objectives and priority areas of the national higher education research and technology transfer framework, and the STI policy into the research policy of the specific university. A related aim pertained to evaluating the extent to which the research sites' policy documents included research and innovation leadership and management in accordance with the national higher education and STI policy documents (Appendix H). A discussion of the research findings on Fignu University's research and innovation leadership and management performance at policy and practice level follows next.

Fignu University research policy

The results of the document analysis are presented comparing the vision, mission, objectives and priority areas of the national STI policy and the national higher education research and technology transfer framework with the vision, mission, objectives and research thematic areas of Fignu University. In this regard, the research and innovation leadership and management discussions of the national policy documents and of the University research thematic areas document are compared.

From an analysis of these documents, it was found that the vision of the national STI policy is for Ethiopia to entrench the capabilities, which enable rapid learning, adaptation and utilisation of effective foreign technologies by the year 2022/23(FDRE, 2012:3). The vision of the national framework for higher education institutions research and technology transfer is for Ethiopian higher education institutions to become world class universities in research and technology transfer by the year 2025 (MoE, 2016:13). It was found that Fignu University had a research thematic areas document only and not a research policy document. It was further determined that the research vision of Fignu University was to be one of the best universities in research in East African countries and to be renowned in Africa by 2025 (Fignu University, 2017:4). It was clear that there is a mismatch between the vision of the national higher education framework for research and technology transfer, the national STI policy, and the

research vision of Fignu University. This mismatch pertains to the fact that the focus of Fignu University's vision is on research and status position within the African context, and the framework focuses on excellence of universities in research and technology transfer while the national STI policy emphasises the functional transfer of foreign technologies for applicable adoption within the own context.

Comparing the mission of the three documents, it was found that the mission of the national STI policy is to create a technology transfer framework that enables the building of national capabilities in importing effective foreign technologies in manufacturing and service providing enterprises of Ethiopia (FDRE, 2012:3). The mission of the national research and technology transfer framework for higher education document is to develop the capacity of the higher education institutions in solving the country's development problems through appropriate research and technology transfer (MoE, 2016:13). Compared to these mission statements, the mission statement of the research thematic areas of Fignu University pertained to improving the life and health of the society by producing solutions to context-specific problems and preparing skilled researchers for solving future societal problems (Fignu University, 2017:4). It was clear that there are differences related to context among the mission statements of the national policy documents and the documents of Fignu University. While the mission statement of the STI policy emphasises the transfer of foreign technology to manufacturing and service providing industries, the mission statement of the national framework for higher education research and technology transfer focuses on a tailor-made application in the sense of solving development problems of the country by means of conducting and transferring the right kind of research and the right kind of technology for the right kind of development. With regard to the mission statement of the Fignu University, the focus is on finding solutions to context specific problems in the society and developing the capacity of researchers to address these context specific challenges. However, whether the search for solutions for the context specific problems is based on research findings of research conducted by the University itself or based on transfer of foreign technology, is not clear as the vision statement of Fignu University focuses on research only without including applicability to societal needs.

With reference to the analysis of objectives included in the three documents, it was found that there are differences regarding the objectives of the national STI policy, the national framework for higher education research and technology transfer, and the Fignu University research thematic areas. The objectives of the national STI policy focuses on promoting research and

technology transfer including indigenous knowledge and technology. The objectives of the national framework focus on matters relating to preparing for research conduct, to developing structures and facilitating adequate resources for technology transfer, to developing staff capacity and coordinating the management of research and technology transfer and the teaching and research endeavours of technology transfer. The national framework also aims at establishing and strengthening linkages of universities to undertake collaborative research and technology transfer. In contrast, the objectives of the research thematic areas document of Fignu University focus on identifying and prioritizing research areas, increasing staff and stakeholders' participation and integration, and managing resources within the context of the specific university environment.

Concerning priority setting, it was found that the national framework for higher education research and technology transfer did not have priority areas. Rather the national framework priorities related to mandating higher education institutions to set their own research priority areas in line with local, regional and national priorities, to be custodians for indigenous knowledge and technologies, and to choose thematic areas, rather than projects, within every five-year-period (MoE, 2016:34). The national STI policy prioritises technology transfer, research endeavour, university-industry linkage arrangements and intellectual property affirmation, whereas the Fignu Uuniversity research thematic document focuses on prioritising basic science research. Matters relating to human resource development, liaison with manufacturing industries, and the protecting of natural resources and environmental protection were common to both the national STI policy and the Fignu University research thematic areas policy. The national STI policy incoroporates service providing enterprises and national quality infrastructure development, whereas the Fignu University includes priorities relating to agricultural development and food security, human health development through nutrition, population, governance, construction and urban development through improved infromation and communication technologies.

With regard to an analysis of the three policy documents regarding research and innovation leadership and management matter, it was found that the Fignu University thematic areas document focused on research management while the national STI policy focused on financial and incentive mechanisms. The national framework for higher education research and technology transfer document describes the research management and leadership activities that the universities should employ with expected outcomes for each. In this regard, the national

framework states that universities should pursue result-based research management pertaining to emphasising and visualising the contribution of research outputs towards development outcomes, accompanied by learning, monitoring and evaluation systems in order to ensure research management professionalism that develops human resource capacity to provide scientific leadership (MoE, 2016:41).

To translate and incorporate the national higher education framework for research and technology transfer, and the national STI policy into institutional research policy, higher education institutions need competent research and innovation leadership and management practices. To understand Fignu University practice, qualitative data was collected through semi-structured individual interviewing of researchers, research leaders at different levels of university governance, community leaders at zone level and industry managers around the university (par 5.2.1). The research findings from the data collected with interviewing are discussed next.

5.2.2.2 Results from the semi-structured individual interviews

As discussed in the theoretical framework of the study, the three elements of complexity leadership theory (administrative leadership, adaptive leadership and enabling leadership) are components of the leadership and management practices at the top, middle and lower levels of higher education institutions (par 2.10.2.2). The third aim of this study was to understand how leaders lead and manage research and innovation policies and practices at university, college and project level to attain research and innovation goals. The research and innovation leadership and management of Fignu, Segnu, Thgnu and Thgnstu universities were, therefore, studied at three levels of governance of the university incorporating research and innovation leaders for interviewing at university, college, and project level. The qualitative data collected from semi-structured individual interviewing were analysed thematically in line with the theoretical framework of the study, representing the major themes of administrative, adaptive, and enabling leadership under each level of university governance.

With regard to these different levels of governance, a total of 17 participants were interviewed at Fignu University representing research and innovation leaders, researchers, community leaders and industry managers. To ensure confidentiality of disclosure and authenticity of interpretation, excerpts from the participants' verbatim responses are distinguished by the

labels RLU1 to RLU3 for research leaders at university level, RLC1 to RLC3 for research leaders at college level, PL1 to PL3 for project leaders, CI1 to CI3 for co-investigators, CL1 to CL3 for community leaders and IM1 to IM2 for industry managers. These labels are used for reporting on each university. The research findings interpreted from the analysed data collected via individual interviewing are presented next under the themes, namely administrative, adaptive and enabling leadership.

Administrative leadership at university, college and project level

The research and innovation leaders of a university as the administrative leaders of their institution should discharge their managerial roles in the formulation and implementation of the research and innovation policy of their University in line with national policies and priorities (par 2.10.2.2). Consequently, the leaders at university level are responsible for facilitating the development of their institution's research policy to be in line with national policies, especially to concur with the national higher education research and technology transfer framework and the national STI policy. In this regard, as background perspective for the focus on Fignu University, leaders RLU1 and RLU2 explained that they developed the University research thematic areas in line with higher education proclamation and policy documents, science and technology guidelines, and with national policies. A third leader stated that the national STI policy was not officially known by everyone, except for a few relevant professionals who had information on the policy. Therefore, most universities continue their research practices based on previous custom, and very few universities adjust themselves in line with the national STI policy (RLU3*)*. Leader RLU3 explained the lack of agreement regarding policy implementation at university and country level as follows:

> *"I have not seen any university that follows the policy. The problem starts from the budget. There is no budget heading for technology transfer and university-industry linkage. The government developed the policy, but the financial system does not know. In terms of political concern, it is led by Prime Ministry but when we cascade it down, it is not working like that"* (RLU3).

The research and innovation activities of the colleges at Fignu University should be managed in line with the research thematic areas of Fignu University. When the college level research leaders were asked about their alignment endeavours with the University's thematic areas, it

was clear that they do pursue alignment, but that they tend to focus on "*problem solving research"* (RLC1). Leader RLC1 explained as follows:

> *"In terms of fully implementing the research policy, there are gaps mainly related to individual interest. When we guide them towards a particular direction; there are situations that the researchers may not be interested as long as their interest and needs are not taken into consideration" (RLC1).*

The research leaders of Fignu University should manage the priority research areas of the University in line with the national STI policy priority areas. In this regard two of the research leaders explained that the priority areas at Fignu University are prepared as thematic areas, and out of ~~44~~ thematic areas, only 11 thematic areas are prioritised based on need assessment of the stakeholders. However, the two research leaders were not able to confirm that the areas are in line with the priority areas of the national STI policy. In this regard, leader RUL2 explained that the research at their university *"is not researchers' or donors' interest driven, it is societal demand driven"* (RLU2), which is different from research actions based on thematic research. Research leader RLU3 described the priority areas of Fignu University as having a university-industry linkage based on a technology transfer perspective. RLU3 acknowledged that the government identified the research themes pertaining to the road construction industry, the sugar industry, cement production, electricity, and the metal industry. This confirms the misunderstanding between the priority areas of the University and the priority areas of the government insofar as that a university may not necessarily include all the priority areas of the country into the priority areas of the university in terms of capacity, budget and time.

The research leaders at college level should prioritise the research and innovation areas of the colleges in line with the priority areas of Fignu University. Two of the research leaders stated that the University priority areas are the priority areas of the colleges as each college has input in deciding on the University thematic areas. RLC2 explained that they prioritise the priority areas of the University as per the technology needs of specific villages close to the University "*where we conduct research, provide community engagement, and transfer technologies … based on that particular village, we prioritise our research and technology areas* (RLC2).
Based on the research priority areas of the University, research leaders should develop research strategic plans in collaboration with key stakeholders of research and innovation activities at the University for the sake of a shared vision. In this regard, research leaders at Fignu

University admitted that research was one of the components of the University's strategic plan and that they did not have a separate research strategic plan.

Based on the thematic research areas at Fignu University, leaders at university level should manage project identification, project planning, project implementation and application at their university. Research leaders explained that they announce calls for proposals, selected at department, college and at university level by inviting relevant senior professionals from different disciplines, allocating a budget for the selected proposals, and delegating each college research coordinator with the responsibility to sign the routine withdrawal of money and pay settlements. RLU2 distinguished between the responsibility of the research leader and the researcher, namely that research leaders supervise and coordinate *"but the main responsibility of project development is with the researchers themselves"* (RLU2).

As administrative leaders, college level research leaders at Fignu University are responsible for managing research and innovation projects by identifying these projects, developing them and implementing the projects. Like the research leaders at university level, the research leaders at college level also post calls for proposals specifying the theme and topic of research, assessing submitted proposals, and communicating possibilities of collaboration to researchers at other colleges of the University. RLC1 emphasised the difficulty of team building, because although principal investigators manage research projects once teams are established, *"coming together* [team building] *was the challenge"*. With regard to building the right team, PL2 determined research team building as being based on determining *"areas of specialization with the theme of the research, and those that had knowledge and skills closely related to the type of work like laboratory, analysis and write up being included in the team".* It was clear that teambuilding also pertained to "*personal relationships, as most of them are my colleagues"* (PL1) and to *"interest and having potential background for the specific research"* (CI1).

In contrast to the key roles of research leaders at project level relating to the identification, development and implementation of research and innovation projects, leaders at university level at Fignu University focus on research funding and research coordinating responsibilities as described by RLC3:

> *"We are not in a position to plan research, but we are funding and coordinating what the researchers are planning. Implementation is the responsibility of the*

researchers, but we follow up through presentations annually, through reports biannually. We also follow up the efficient utilisation of the budget" (RLC3).

In exercising administrative leadership, project leaders are the main actors in managing the identification, development and implementation of research and innovation projects. In this regard, the project leaders from the College of Medicine and Health at Fignu University, and from the Institute of Technology at Fignu University concurred that development of a research project starts by identifying a problem in general, relating to basic research. However, a senior professor from the College of Agriculture acting as a project leader emphasised that project development pertains to the nature of the specific project. The project leader explained that he considers literature and what is pointed out in literature to be lacking, but with regard to action research, *"you cannot develop by your own, you have to talk to the direct beneficiaries and you have to check with them what is really the gap* [in research] *with them"* (PL2).

While implementing research and innovation projects, research leaders at university level manage the progress of projects by means of supervision, considering progress reports and requiring presentations on progress. In this regard, a college research leader at Fignu University explained that they have quarterly a research monitoring system meeting and every six-month they have to submit progress reports, conduct presentations and are subject to evaluation within small groups with the presence of leaders at university and college levels, the college dean, and relevant professionals. The leaders at college and project levels focus on monitoring research activities and utilisation of budgets at the planning and reporting phases of the activities. A leader at college level described, *"We have evaluation of both technical and financial issues of the progress of the research projects with the presence of students, researchers and senior researchers"* (RLC2).

In order to manage the implementation of projects effectively, leaders at the different levels of governance should have project implementation success criteria including aspects such as project lifetime, project budget and the satisfaction of the project beneficiaries and stakeholders. Although some leaders at university, college and project level reacted that they do not objectively set project implementation success criteria, other leaders at college and project level pointed out that utilisation of the project budget optimally, completion of projects in the required period, achieving the expected outcomes for the project and publishing their results were some of the implementation success criteria which they considered. Funding

research and innovation projects at a university implies that research leaders manage the researchers and the financial and material resources of the existing and future projects to ensure successful implementation. Regarding this approach, leaders at Fignu University answered that once the budget was granted; college level research and technology transfer coordinators manage the routine activities. One of the leaders at university level at Fignu University pointed out that the shortages of finances is their main problem and not incompetent resource management because "*we have well established structures, we have no problems in managing them but we have the scarcity of what to be managed rather"* (RLU2). With regard to resource management, PL2 emphasised that managing resources was the responsibility of the project leaders and, although financial resources for their projects are limited, they do not experience difficulty in managing these projects, however, *"some of the resources are abused" (PL2)*

Implementing research and innovation projects effectively and efficiently relies on the effective management of human resources, namely the project leaders and the researchers. In this regard, one of the leaders at college level at Fignu University commented that "*it is very difficult to manage the personal engagement of researchers and the only way that we can manage them is requesting them a report"* (RLC3). The research leaders at Fignu University admitted that there were not separate performance evaluation criteria for project leaders and researchers and that they both were evaluated at departmental level as academics who are conducting research and providing community engagement as their responsibilities.

Maintaining quality with research and innovation projects is the main responsibility of the project leaders. In this regard, project leaders at Fignu University manage the quality of research projects by checking the progress and quality of research actions relating to laboratory work, data collection, data analysis and reporting on research findings. Although co-investigators stated that they maintain quality with their projects by following scientific methods and procedures, and standard laboratory etiquette, CI1 complained that they are working with limited finances, limited time and a lack of crucial facilities hampering project quality. In his own words: *"We have limited lab capacity, we cannot do everything that we want to acquire due to capacity and these are very threating factors for our project quality"* (CI1).

Managing the quality of projects and the outcomes of these projects is not only the responsibility of the project leaders and co-investigators but the responsibility of all leaders at

all levels of governance. In this regard, one of the leaders at college level at Fignu University explained their responsibility relating to peer reviewing:

> "*We have a peer review mechanism tha is actually done by three internal and external professional evaluators to improve the research ideas, and to check the quality of the outputs of the research projects. Therefore, once this big crew acknowledges, we will transfer the outputs to the community*" (RLC2).

As research managers are also innovation managers, they were asked how they ensure innovation in their research projects. Two of the research leaders at Fignu University explained that much research has been conducted for the last 30 years but the results of these research endeavours are fragmented. The research leaders focused on facilitating and packaging the research attempts to ensure outcomes to be innovative solving problems internally and externally; however, research was mainly focused on agriculture and on the developing of many manuals for development agents. RLU2 pointed to the mega research project initiative which they hope will result in positive outcomes for Fignu University itself:

> "*The university started this thematic mega research project in the last three years with government budget. We have a lot which can strengthen our teaching -learning process and curriculum issues, and even the research execution system but we are waiting for those results*" (RLU2).

Regarding mega research projects, one of the leaders from the College of Health and Medicine at the Fignu University acknowledged that researchers are advised to change their research outcomes into innovation projects to solve crucial health problems. However, RLC1 was of the opinion that there are still no significant developments, but there is potential because *"we are just beginning, and we have good start and we will strengthen this in the future"* (RLC1). A leader from the Institute of Technology at Fignu University emphasised the functionality of collaborative innovation projects between university researchers and stakeholders in order to transfer knowledge and technology. This approach was confirmed by RLC2 who pointed out that "*once the community engagement and technology transfer projects are approved, we do not allow the researchers to work alone"* (RLC2).

Research and innovation managers as administrative leaders at university, college and project levels are also adaptive leaders who should lead research and innovation activities at Fignu University according to specific needs and shortcomings within context. In so doing, research leaders at different levels of governance should apply adaptive leadership.

Adaptive leadership at university, college and project level

As presented in the theoretical framework for this study, adaptive leadership is a process which adaptive leaders of complex organisations like universities use to find specific solutions in terms of knowledge, technology and behaviour through learning, creativity, innovation and adaptability. Fignu University as a complex organisation demands from its research leaders to apply adaptive leadership to lead research and innovation activities as per the university's specific context and as per the problems of the local community and the country. In this regard, leaders at university and college level said that they engage in thematic research aligned to local and national needs and problems (par 2.10.2.2).

Contrary to the responses of leaders at university and college level, one of the project leaders at Fignu University reacted that his research project was selected based on personal observation, not based on consulting the local community. The leader described, "*I observed that there was problem of animals feed having the required nutrition as they were crops residuals"* (PL2). One of the co-investigators also confirmed that they were doing discipline-based research only because of a limited budget. However, as the budget for mega thematic research was more extensive, they planned to take actions based on the research outcomes of the projects. In agreement with the responses of the project leader and the co-investigator, the community leaders at zone level at Fignu University and the industry managers around the University also stated that the research and innovation projects of Fignu University were not aligned to real and specific problems of the local community and industry. The community leaders said that the community has different real problems related to agriculture and agricultural productivity, human health and quality education that need practical solutions by the research and innovation activities of Fignu University. Agreeing on the problem of quality education and focusing on the lack of skilled graduates for industry, one of the industry managers emphasised the skill shortcomings of graduates to operate machines as a criterion to be incorporated into the University's grading system. The manager explained:

> "*When we employ different professionals like engineers, there is problem of graduates' practical skills. We recruited a graduate whose commutative grade point average was 3.9, and good in the interview but his practical job performance was below 100% from the expected*" (IM2).

With regard to addressing teaching and learning problems at Fignu University, one of the leaders explained that "*there had been researches on the teaching and learning"* (RLU1). However, leaders at college and project level and co-investigators responded that they did not have any training in tuition as they believed that this role was the sole responsibility of the College of Education. Leaders should lead research and innovation projects as per the type of knowledge and technology they pursue to produce and develop to address real problems. In doing so, the research leaders should distinguish between basic, applied or action research and between disciplinary, interdisciplinary and collaborative research. The research leaders at different levels of the university agreed that applied research was preferred though there was no objection to do basic research. However, one of the leaders at university level described the reasons for not engaging in basic research and preferring interdisciplinary applied research at Fignu University because of financial constraint and value for the community. The leader stated:

> "*Basic research in the first place is expensive; in most cases it needs highly sophisticated and expensive equipment that we cannot have. We have critical problems that need to be solved soon, and such problems can be solved by doing applied interdisciplinary research because most of the problems are crosscutting that involve different disciplines*" (RLU1).

Agreeing with leaders at university level on the expensiveness of basic research, one of the leaders at college level at Fignu University explained the reason for preferring applied research to basic research as applied research is being pragmatic in solving community problems. The leader explained:

> "*In the region particularly within the village that we are working, nearly 99% of the community problems are not yet solved. And applied research is quite easily to address the problems of the community compared with basic research though basic reach has big significant for the scientific community*" (RLC2).

Because of the expensiveness of basic research, leader RLU2 emphasised that applied research was preferred but that most of the research still conducted at the University was basic. RLU2 described the type of applied research as relating to action research which they prefer and what outcomes they expect with this action research:

> "*When we say applied research, it is action research that is problem solving. When we develop thematic areas research execution system, we are trying to make more applicable. And at the end of those projects, we expect some problems to be solved, and some values to be added*" (RLU2).

However, interdisciplinary applied research is different from action research unless the action research is participatory and collaborative giving different people from different disciplines a chance to participate. Regarding collaborative research, one of the leaders at university level at Fignu University reported that they had both local and international collaborative research projects. The leader reported that "*we have more than 50 mega projects with international collaborators and some projects with regional bureaus and research centres"* (RLU2).

As adaptive leaders, the research leaders at university, college and project level should lead research projects at Fignu University to contribute to practically applied knowledge, technology, and behavior at community, industry and country level. In this regard, one of the leaders at university level described that they have been working with farmers and other community members to improve the productivity of some crops and they tried to increase the agricultural productivity of different crops by reaching 74,000 households with this endeavour. The leader described that *"the challenge is how we can address more people*" (RLU1). Leader RLU2 questioned the contributions of research projects in real terms albeit acknowledging involvement for societal improvement. RLU2 explained:

> "*What I have confessed first is that we are not to the level we are talking. We are counting the number of researches and the number of researchers but when summarising what really the outcomes are, it is not comparable to the level of expectation, but it does not mean that we are zero. We have achievement in the area of agriculture both in crops and livestock aspects. We have research outputs to be transferred to the community in the form of manual or some sort of innovation, or policy messages for policy makers*" (RLU2).

In this regard, one of the leaders at college level mentioned that "*one of the projects was Kangaroo mother care that significantly improved infant neonatal mortality rate" (*RLC1). Research leader RLC3 concurred that they have developed technology in relation to soil fertility, crop productivity, and pulse innovations especially with regard to producing, utilising and securing nutrition. One of the senior academics from the College of Agriculture at Fignu University acknowledged their contribution to the local community relating to animal feed by saying the following: "*I have contributed improved animal feed to the local community and the region*" (PL2). One of the community leaders confirmed that "*the university provided some improved seeds to the farmers*" (CL1), whereas other community leaders, project leaders and co-investigators sufficed by admitting that as the mega research projects were not completed yet, they have not made any valuable contributions yet. The leaders at college and project level confessed that they had never been engaged in research projects to solve the challenges of good quality teaching and learning at Fignu University.

In order to improve research and innovation leadership practice to contribute to practical knowledge and technology, leaders should exercise leadership as a process so that they can learn, create and adapt from their leadership practices. In this regard, one of the research leaders at college level responded that "*we have not really come up with such thoughts*" (RLC1). Understanding both the shortcomings of researchers in cooperating and learning about one another and the research system of the University in facilitating dynamic interactions with other universities and organisations, leader RLC3 explained:

> "*Researchers are living in their own islands bounded by their territory, and within their own interest areas so that they never interact and learn from each other. I saw that the university research system is also much closed and weak*" (RLC3).

With reference to the University research leadership practice moving from discipline-based to interdisciplinary thematic mega research, research leaders were asked if the move emerged from dynamic interactions among research and innovation project beneficiaries, key stakeholders, the researchers and the research leaders of Fignu University. One of the leaders described the reasons and the process they went through to change the research leadership practice as relating to fragmented research activities of the University to address complex problems. The leader stated:

> "*We discussed and internalised with the university management. I and the research coordinators realised that we could not respond to some of the problems of the community. Our problems by their nature are multifaceted so we could not tackle societal problems with our fragmented system. And some of the donors want to do with us but they also see fragmented research activities. So, we discussed with our stakeholders by collecting their satisfaction with our research through survey, and gain some experiences of other first-generation universities, and changed our practice*" (RLU2).

The research leaders at college level reacted that there were two reasons for the leadership and management change to interdisciplinary research. One was national direction in that the government was forcing universities to undertake relevant research as many research endeavours had been conducted in the country that were disciplinary and shelved. The University also recognised that a thematic interdisciplinary approach was more appropriate for solving the problems of the public meaningfully because all relevant researchers from different disciplines could be engaged. However, project leaders and co-investigators did not agree with the opinions of research leaders at university and college level. As the main reason for the problems experienced with research endeavour, one of the project leaders identified a top-bottom approach for deciding on research topics and research collaboration. He emphasised that "*they prepared document, distributed and presented for us about thematic research...so it is simply from top-bottom as university plan, and it was not emerged from our interactions"* (PL1).

Research leaders at different levels of governance at Fignu University are expected to learn and to be creative and adaptive in adjusting their leadership practice by incorporating their actions into administrative (management) research and innovation leadership of the University. By engaging in this incorporating endeavour, leaders should apply enabling leadership.

Enabling leadership at university, college and project level

With reference to the theoretical framework of the study, enabling leadership is relevant at any level of governance at an institution of higher education to facilitate enabling conditions like interaction, interdependency, and heterogeneity between individuals and groups of people.

Therefore, research and innovation leaders at university, college and project level should use enabling leadership to facilitate enabling conditions for meaningful research and innovation activities to take place at Fignu University (par 2.10.2.2).

In exercising enabling leadership at Fignu University, there should be strong interdependence between tuition, research, and innovation so that postgraduate tuition can prepare prospective competent researchers for research and innovation activities of higher education institutions, and competent human capital for industry and the society at large. In this regard, leaders at Fignu University stated that they had been producing human capital at masters and PhD level for university, industry and government absorption. With regard to research goals, research leaders emphasised that although academic researchers were expected to use their research outputs to improve the curriculum and their tuition capacity, this did not realise in practice. Enabling leaders should arrange for alignment between researchers and key stakeholders of research and innovation projects in terms of people, funds, skills, and technology. To address differences, research leaders have to create enabling conditions for researchers and project leaders to engage in research and innovation projects effectively. The leaders at university and college level at Fignu University explained that they provided training for young researchers on how to write research proposals and scientific papers, and on statistical analysis to improve their research conduct capacity. Research leaders also stated that they encouraged researchers to develop collaborative projects with foreign partners, and they provided 300 Birr as an incentive if a researcher published project results in an accredited journal.

As enabling leaders, research leaders at college level were responsible for facilitating enabling conditions for researchers and project leaders to engage constructively in research and innovation projects. In this regard and relating to incentives for researchers, one of the leaders pointed out that there were no conducive conditions arranged for researchers. Leader RLC1 stated that "truly *speaking, there is no any special privilege, special advantages or any beneficial conditions"* (RLC1) whereas, another leader explained the environment created in thematic research for researchers. The leader described the environment as being conducive to thematic research in that "w*e are creating an ideal environment for both senior and junior staff to engage in thematic mega research"* (RLC2). However, one of the leaders described the difficulty to facilitate overseas exposure to research undertakings in that "*we do not have the capacity to send our researchers to gain foreign experience"* (RLC3).

As enabling leaders, project leaders should facilitate enabling conditions for co-investigators. In this regard, one of the project leaders at Fignu University responded that there were no special conditions except facilitating transport for field work. However, one of the senior academics working as project leader described the conditions that were facilitated to improve the knowledge and skills inadequacies of co-investigators. In this regard, the project leader referred to meetings in which shortcomings in research conduct are addressed by means of meaningful comments, training and research resources. In the senior academic's own words: "*There are periodic meetings on how things going on. I give comments about the shortfalls and gaps of the researchers. I give materials and guidance, and I facilitate training programmes" (PL2*). Emphasising the conditions facilitated for students to improve their research competencies, one of the co-investigators stated that "*an environment that is conducive is also created for students to engage in the research projects so that they are sharing knowledge and experiences"* (CI3). Project leaders indicated that to facilitate enabling conditions for co-investigators, and to manage research and innovation projects effectively, project leaders should have personal qualities and competencies relating to being skilled in coordinating teams, having proper communication skills, being competent in budget management, and having appropriate knowledge, skills, and experience to undertake meaningful research for societal development. Project leaders should also be skilled in harmonious interaction, being friendly and constantly acting as a model for other researchers and being transparent about financial management.

In order to facilitate interactions and interdependence with the local community, the University, government, and industry, research leaders should coordinate interaction between these stakeholders for the sake of collaborative research pursuing innovative projects and collaborative leadership. In this regard, research leaders admitted that there was no collaboration between these different stakeholders. One of the community leaders described the working relationship they had with the University as pertaining to functioning individually instead of collaboratively. The leader stated that "we *do have our goal; as university, it has its own goal. We were trying to achieve those goals separately rather than working collaboratively"* (CL2). Community leaders at zone level and industry managers around the University confirmed that they were not engaged in any collaborative research and innovation projects with the University. One of the industry managers had suggestions for government to strengthen the link between the University and industry for effective innovation and tuition,

namely that government should encourage industries to allocate some funds for the practical training of students to improve the quality of tuition. The manager described:

> "*The government has to enforce the industries, not the universities to involve in the technological development of the country because there is technology transfer in the industry that should be linked with the university. So, the government should push not only the universities, but also the industries to allocate some percentage of budgets to the students' practical learning and to improve the quality of education*" (IM1).

Reflecting on the lack of collaboration between Fignu University and industry, industry managers criticised the general lack of collaboration other than providing some training and facilitating internships for students. The manager explained that "*there is no effort to coordinate the factories by establishing system and an organ that links us to work together for our mutual benefits, for the benefits of the community and the nation at large*" (IM2).

In order to create effective interaction among key beneficiaries and stakeholders of research and innovation projects of Fignu University, leaders should establish a functional innovation system. In this regard, one of the leaders at Fignu University replied that they had established a system for university and industry linkage and technology transfer. The leader explained the challenges in relation to establishing a functional innovation system as follows:

> "*I think we have functional innovation, but I cannot say perfect. We are not giving enough attention and we are not working to widen the structure, as there is budget constraint. Otherwise, the understanding is there but it is not boldly shine in like that of research activities of the university*" (RLU2).

Leader RLU3 disagreed on the presence of an established and functional innovation system. According to RLU3, "*I cannot say that there is established and functional innovation system. We are in struggle. Rather than promote innovation, the effort is for conventional research"* (RLU3). Research leaders at college level confirmed that there was a separate office for collaboration and innovation, but the system was at an infancy stage. With regard to collaboration with the community, one of the leaders admitted that "*it is very weak truly speaking. We have some efforts mainly for the academic purpose, to train the students in the community"* (RLC1).

Research findings reveal that there are efforts, shortcomings and challenges in leading and managing research and innovation activities at Fignu University. Participants taking part in the semi-structured individual interviews and those who completed the structured questionnaire were requested to indicate the main strengths and weaknesses of leadership and management practices at project, college and university level at Fignu University.

Strengths and weaknesses of research and innovation leadership and management practices at Fignu University

Participants indicated the main strengths of leadership and management practices at Fignu University. The strengths related to the presence of a research governance structure at university and college level. Research leaders at all levels were trying to apply thematic research focusing on limited themes in limited areas. While leaders at university level were good at allocating resources to selected areas, to decentralising and delegating power, and to announcing calls for proposals on time, the leaders at college level were good at planning, communicating deliverables, and organising research activities. At university level, there were also clear guidelines and formats for writing proposals and reports, and at university, college and project level, there were attempts to solve community problems using research outcomes.

However, participants also indicated main weaknesses observed in research and innovation leadership and management practices at Fignu University. At university level, research leaders lacked vision, and they were corrupt, and attached in terms of department, friendship and ethnicity. There were inadequacies with regard to coordination, facilitation, periodic communication, fund management, continuous follow-up, clear monitoring and evaluation of research and innovation projects. Leaders failed to establish networks. There was a lack of funds, transport, reserved land, research laboratories and equipment, and logistics for research and innovation projects. At college level, leaders simply communicated information to researchers from higher officials. Leaders did not encourage and inspire researchers. There was a problem of flexibility as calls for thematic research areas were announced when staffs were overburdened with teaching duties. At project level, project leaders did not have the capacity to manage projects and the potential risks associated with research endeavour at project level. There was a lack of feedback, and no one knew what the other one was doing with regard to research and innovation at the different projects. At university, college and project level, research projects were not need-based and not related to real local and national problems. The

research results of research projects were not shared or implemented as most of the research conducted were for the sake of academic ranking and financial gain. There was also a lack of experience in doing research, and a shortage of training to improve the lack of research experience.

Participants were asked to provide suggestions to improve research and innovation leadership and management practice at Fignu University.

Suggestions by participants to improve research and innovation leadership and management practice at Fignu University

At the end of each individual interview and with the open-ended questions of the structured questionnaire, participants were invited to make suggestions for effective research and innovation leadership and management practice at Fignu University. At project level, it was suggested that research problems should be aligned to problems encountered in the community and there should be an organ that identifies the problems to be studied in collaboration with the University, with the research outcomes communicated to the community at district and zone level. At college level, it was suggested that researchers should be oriented and guided towards conducting research that will benefit at least a portion of the community, and in doing so, there should be clear guidelines to lead the research process. At university level, it was suggested that experienced researchers should lead research and innovation activities at the University. Government should allocate enough funding and resources to do problem-solving research, and universities should identify and prioritise major problems in different areas and solve these problems systematically. Research management offices should monitor each researcher in terms of finance allocation and research outputs as it is public money that is spent on research with money being a scarce commodity in a developing country like Ethiopia.

In summary, considering the results of the qualitative data analysis about research and innovation leadership and management practice at project, college and university level at Fignu University, it was clear that there were efforts with regard to managing and leading research and innovation activities especially at the College of Agriculture at Fignu University. There were, however, also shortcomings regarding research leadership and management at all levels of governance. To increase and confirm the researcher's understanding of research and innovation leadership and management at policy and practice level at Fignu University, the

quantitative data that was collected are following discussed. These data were collected using a structured questionnaire distributed to researchers and research leaders at college and project level, supplemented by data from considering documents about the University's research and innovation performance over the five-year period of 2012 to 2017.

5.2.3 Findings of the quantitative data analysis

Of the total of 225 participants at Fignu University approached to complete the structured questionnaire, 170 (75.6%) participants returned their completed questionnaires. Table 5.1 presents the demographic information of the participants who returned the questionnaire.

Table 5.1: Demographic information of the research participants at Fignu University

Demographic information	**Categories**	**N**	**%**	**Demographic information**	**Categories**	**N**	**%**
Gender	Male	150	88.2	Work experience in the specific position	1-3 years	35	20.6
	Female	10	5.9		4-6	51	30.0
	Not indicated	10	5.9		7-10	14	8.2
Qualification	PhD	51	30.0		Above 10	26	15.3
	MA/MEd/MSc	109	64.1		Not indicated	44	25.9
	Not indicated	10	5.9		Total	170	100.0
	Total	170	100.0				
Academic ranks	Professor	5	2.9	Total years of work experience as an academic	1-5 years	20	11.8
	Associate professor	10	5.9		6-10	57	33.5
	Assistant professor	48	28.2		11-15	20	11.8
	Lecturer	97	57.1		16-20	13	7.6
	Not indicated	10	5.9		Above 20	17	10.0
	Total	170	100.0				
Training related to responsibilities	Yes	23	13.5		Not indicated	43	25.3
	No	136	80.0		Total	170	100.0
	Not indicated	10	6.5				
	Total	170	100.0				

Key: N= Number of participants

As shown in Table 5.1, most participants from Fignu University were males, namely 88.2% males, while females represented only 5.9% with 5.9% of participants failing to indicate their gender. The reason for this low percentage of females is attributed to the fact that the number of female academics is very small, and even this small number of females do not actively participate due to socio-cultural factors relating to male domination at both workplace and home so that females spend their free time with child rearing and household activities. One

third of the participants, namely 30%, had doctoral degrees and two thirds, namely 64.1%, master's degrees, while the remaining 5.9% did not indicate their qualifications. With regard to academic rank, the majority of participants, namely 57.1%, were lecturers, whereas 28.2% were assistant professors, 5.9% associate professors and 2.9% professors with the remaining 5.9% not indicating their academic rank.

Regardless of the qualifications and academic ranks of academic researchers and research leaders, they should get training applicable to their managerial roles and responsibilities. In this regard, 80% of participants did not get any training while only 13.5% received training, with the remaining 6.5% not indicating if they got training related to their responsibility or not. In addition to getting training, researchers and research leaders can share their research-conduct experiences. Half of the participants, namely 50.6% had research-related working experiences of between one to six years, 8.2% of them between seven to ten years, and 15.3% above ten years. One-fourth of participants, namely 25.9% refused to provide information about their work experience possibly due to feeling inferior because of a perception of inadequacy relating to limited amount of working experience. With regard to having been an academic in addition to being a researcher and a research leader, one-third of participants, namely 33.5% have been working at Fignu University for six to ten years, 11.8% for one to five years, 11.8% for 11 to 15 years, 7.6% for 16 to 20 years, 10% for above 20 years with 25.3% of participants not indicating their years of work experience, possibly due to feeling inferior because of a perception of inadequacy related to limited working experience.

Based on an analysis of the demographic data of the participants, the findings of the quantitative data regarding administrative (management), adaptive and enabling leadership at university, college and project level at Fignu University are presented next.

Administrative leadership at university level

Research leaders at Fignu University are responsible for facilitating the development and implementation of the research policy of the University. In this regard, as shown in Table 5.2 the participants were requested to indicate the extent of their agreement or disagreement with regard to the practice of administrative leadership at Fignu University (Appendix F).

Table 5.2: Agreement and disagreement of participants on matters pertaining to administrative leadership at university level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14	AdL15	AdL16
Participants having	Disagreement	1	N	6	11	15	6	4	75	18	11	47	66	76	18	13	29	35	27
			%	3.5	6.5	8.8	3.5	2.4	44.1	10.6	6.5	27.6	38.8	44.7	10.6	7.6	17.1	20.6	15.9
		2	N	6	11	16	14	21	29	70	55	38	38	43	63	100	94	64	37
			%	3.5	6.5	9.4	8.2	12.4	17.1	41.2	32.4	22.4	22.4	25.3	37.1	58.8	55.3	37.6	21.8
		3	N	27	23	16	17	85	58	46	47	49	39	32	47	35	40	51	65
			%	15.9	13.5	9.4	10.0	50.0	34.1	27.1	27.6	28.8	22.9	18.8	27.6	20.6	23.5	30.0	38.2
		Sub-total	N	**39**	**45**	**47**	**37**	**110**	**162**	**134**	**113**	**134**	**143**	**151**	**128**	**148**	**163**	**150**	**129**
			%	**22.9**	**26.5**	**27.6**	**21.7**	**64.8**	**95.3**	**78.8**	**66.5**	**78.8**	**84.1**	**88.8**	**75.3**	**87.6**	**95.9**	**88.2**	**75.9**
	Agreement	4	N	55	69	81	82	44	8	27	39	24	13	17	31	87	7	15	39
			%	32.4	40.6	47.6	48.2	25.9	4.7	15.9	22.9	14.1	7.6	10.0	18.2	7.6	4.1	8.8	22.9
		5	N	60	52	36	44	9	0	9	13	12	14	1	11	9	0	5	2
			%	35.3	30.6	21.2	25.9	5.3	0	5.3	7.6	7.1	8.2	0.6	6.5	5.3	0	2.9	1.2
		6	N	16	4	6	7	7	0	0	5	0	0	1	0	0	0	0	0
			%	9.4	2.4	3.5	4.1	4.1	0	0	2.9	0	0	0.6	0	0	0	0	0
		Sub-total	N	**131**	**125**	**123**	**133**	**60**	**8**	**36**	**57**	**36**	**27**	**19**	**42**	**22**	**7**	**20**	**41**
			%	**77.1**	**73.6**	**72.3**	**78.2**	**35.3**	**4.7**	**21.2**	**33.4**	**21.2**	**15.8**	**11.2**	**24.7**	**12.9**	**4.1**	**11.7**	**24.1**
	Total		N	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree and 6=strongly agree

AdL=Administrative Leadership

AdL1=The research policy of the university is developed in line with national STI and related higher education policies.

AdL2=The research policy of the university incorporates important elements from national, continental and international science, technology and innovation policies.

AdL3=The university research leaders are managing the policy in line with national priority areas.

AdL4=The research leaders are managing the research policy by developing a research strategic plan.

AdL5=The research leaders of the university see the research policy as a finished document.

AdL6=The research leaders influence their followers by controlling their day-to-day activities using the structure of the university.

AdL7=The research leaders are good at developing the research capacity of the academics.

AdL8=The research leaders are good at resource mobilization from different sources.

AdL9=The research leaders are effective in managing research projects.

AdL10=The research leaders are effective in managing innovation projects.

AdL11=The research leaders are good at quality control of the research activities.

AdL12=The research leaders are effective in resolving conflicts.

AdL13=The research leaders are effective in managing the performance of the researchers.

AdL14=The research leaders are good at commercialising the research project results.

AdL15=The leaders are effective in incorporating learning, creativity and adaptability while managing the research and innovation activities of the university.

AdL16=The research leaders are good at establishing networking and partnership with different organisations.

While formulating the research policy of the University, the research leaders should ensure that the policy is in line with the national higher education research and technology framework and the STI policy by incorporating important elements from continental- and global-related

policies. As shown in Table 5.2, of the 170 participants who completed the structured questionnaire, 77.1% of them agreed while 22.9% disagreed on the fact that the University research policy was developed in line with national related policies, and 73.6% of the participants also agreed while 26.4% disagreed that the research policy incorporated important experiences from Africa and world-related policies. As policies are dynamic, the leaders of Fignu University should revise and modify the research policy of the University periodically. Participants were asked to indicate their opinion on whether leaders of Fignu University perceive the research policy as a finished document. Among the participants, 64.8 % disagreed while 35.3% agreed on perceiving the policy document of the University as an absolute document. The research priority areas of Fignu University should be in line with the priority areas of the two national policy documents. In this regard, 72.3% of the participants agreed while 27.6% disagreed on the fact that priority areas of the University are developed to be aligned to national priority areas.

In order to arrange for the research priority areas of the University to transpire into meaningful practice, a research strategic plan should be developed. In this regard, 78.2 % of the participants agreed while 21.7% disagreed on the presence of a research strategic plan. To implement Fignu University's research priority areas practically, research leaders at university level should be effective in managing research and innovation projects. The majority of participants (78.8%) disagreed while 21.2% agreed on the research project management competencies of the leaders, while 84.1% participants disagreed and only 15.8% agreed on the presence of adequate innovation project management competencies among research leaders at Fignu University. In managing the research projects effectively, the leaders at university level should facilitate rather than control the day-to-day activities of their followers. In this regard, the clear majority of participants (95.3%) disagreed while 4.7% agreed on the research leaders' positive influence on researchers by providing facilitative guidance to them on a constant basis.

Managing research projects effectively, leaders should be good at resource mobilisation, developing the capacity of researchers and managing researchers' performance in order to resolve conflict and control the quality of the projects. In this regard, 66.5% of the participants disagreed while 33.4% agreed on leaders' competency in mobilising resources effectively for the different research projects, 78.9% of participants disagreed while only 21.1% agreed on leaders' ability to develop the capacity of researchers and 87% disagreed while 13% of participants agreed on leaders' ability to provide direction and encouragement with regard to

the performance of the researchers. Also 75.3% of participants disagreed while 24.7% agreed on leaders' potential to resolve conflict among members of the research team, and 88.8% of the participants disagreed while only 11.2% were of the opinion that leaders perform well in ensuring good quality with research activities carried out in the different research projects. Research leaders at university level should be good at networking and partnering with different organisations. In this regard, three quarters of the participants (75.9%) disagreed while only one quarter (24.1%) agreed on research leaders' ability to establish networks and partnerships with other higher education institutions and industry to realise common goals collaboratively. Research leaders at university level are responsible for management of the research process and the commercialisation of research outcomes of the research projects. However, the clear majority of participants (95.9%) disagreed while a minority (4.1%) agreed on leaders carrying out their responsibility of making research results known to possible consumers.

To improve their research and innovation management and leadership skills, research leaders should incorporate their creativity and flexibility with managing research endeavour through adaptive leadership into the formal research governance structure of the University. In this regard, 88.2% of participants disagreed while only 11.8% were of the opinion that leaders are successful in combining their administrative and adaptive leadership skills for improved performance. What follows are the findings of the quantitative data regarding adaptive leadership at university level at Fignu University

Adaptive leadership at university level

Table 5.3 provides the research findings based on the data collected considering items in Part I of the structured questionnaire about the extent of agreement and disagreement of participants on the practice of adaptive leadership at university level at Fignu University (Appendix F).

Table 5.3: Agreement and disagreement of participants on matters pertaining to adaptive leadership at university level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdL10	AdL11	AdL12	AdL13	AdL14	AdL15	AdL16	AdL17	AdL18	AdL19	AdL20
Participants having	Disagreement	1	N	16	24	9	7	7	14	16	8	20	19	15	12	21	23	25	17	21	16	12	22
			%	9.4	14.1	5.3	4.1	4.1	8.2	9.4	4.7	11.8	11.2	8.8	7.1	12.4	13.5	14.7	10.0	12.4	9.4	7.1	12.9
		2	N	29	25	25	23	27	68	39	20	12	52	32	35	43	43	49	29	26	37	44	42
			%	17.1	14.7	14.7	13.5	15.9	40.0	22.9	11.8	7.1	30.6	18.8	20.6	25.3	25.3	28.8	17.1	15.3	21.8	25.9	24.7
		3	N	67	68	47	75	93	47	69	74	86	57	87	66	68	71	66	83	84	57	80	70
			%	39.4	40.0	27.6	44.1	54.7	27.6	40.6	43.5	50.6	33.5	51.2	38.8	40.0	41.8	38.8	48.8	49.4	33.5	47.1	41.2
		Sum	N	**112**	**117**	**81**	**105**	**127**	**129**	**124**	**102**	**118**	**128**	**134**	**113**	**132**	**137**	**140**	**129**	**131**	**110**	**136**	**134**

			%	**65.9**	**68.8**	**47.6**	**61.7**	**74.7**	**75.8**	**72.9**	**60**	**69.5**	**75.3**	**78.8**	**66.5**	**77.7**	**80.6**	**82.3**	**75.9**	**77.1**	**64.7**	**80.1**	**78.8**
	Agreement	**4**	**N**	8	50	81	38	37	39	41	59	37	38	21	51	38	33	26	38	36	34	18	29
			%	28.2	29.4	47.6	22.4	21.8	22.9	24.1	34.7	21.8	22.4	12.4	30.0	22.4	19.4	15.3	22.4	21.2	20.0	10.6	17.1
		5	**N**	9	2	6	25	6	2	5	9	15	4	9	6	0	0	4	3	3	19	10	2
			%	5.3	1.2	3.5	14.7	3.5	1.2	2.9	5.3	8.8	2.4	5.3	3.5	0	0	2.4	1.8	1.8	11.2	5.9	1.2
		6	**N**	1	1	2	2	0	0	0	0	0	0	6	0	0	0	0	0	0	7	6	5
			%	.6	.6	1.2	1.2	0	0	0	0	0	0	3.5	0	0	0	0	0	0	4.1	3.5	2.9
		Sub-	**N**	**58**	**53**	**89**	**65**	**43**	**41**	**46**	**68**	**52**	**42**	**36**	**57**	**38**	**33**	**30**	**41**	**39**	**60**	**34**	**36**
			%	**34.1**	**31.2**	**52.3**	**38.3**	**25.3**	**24.1**	**27.1**	**40**	**30.6**	**24.8**	**21.2**	**33.5**	**22.4**	**19.4**	**17.7**	**24.2**	**23**	**35.3**	**20**	**21.2**
	Total		**N**	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL=Adaptive leadership
AdaL1=The research leaders see the practice of research policy as learning by producing new knowledge through participation.
AdaL2=The leaders see the practice of research policy as producing new knowledge to solve real world problems through dynamic interaction.
AdaL3=The research leaders of the university see the research policy as continuous learning.
AdaL4=The research leaders see research leadership as a process.
AdaL5=The research leaders exercise research leadership as context specific.
AdaL6=The research leaders lead the research activities focusing on innovation by facilitating interaction outside the university.
AdaL7=There is collaborative leadership in the innovation system of the university.
AdaL8=The research leaders are good at setting direction.
AdaL9=The leaders are leading the research and innovation activities of the university in line with the needs of the local community.
AdaL10=The leaders are leading the research and innovation activities of the university in line with the needs of the nation.
AdaL11=The leaders are leading the research and innovation activities of the university to address their own internal teaching problems.
AdaL12=The leaders lead the research teams to find solutions to solve local problems.
AdaL13=The leaders are good at collecting information about the weaknesses of their policies and competencies from their stakeholders.
AdaL14=The leaders use the information they gathered to fill their gaps in line with the needs of the stakeholders.
AdaL15=The leaders accommodate emergent ideas into the university research structure to facilitate innovation.
AdaL16=The leaders lead the research and innovation activities of the university to develop new ideas and find innovative solutions to develop new products and services for the local context.
AdaL17=The research leaders emphasise leading basic research with a context of application.
AdaL18=The leaders prioritise applied research for real problem solving.
AdaL19=The leaders focus on action based on learning and creativity.
AdaL20=The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the university.

As adaptive leaders, the research leaders at university level at Fignu University should perceive the University's research policy as a guiding document for continuous development of research and innovation knowledge and skills. As indicated in Table 5.3, nearly half of the participants (47.6%) disagreed while over half of them (52.3%) agreed on the fact that research leaders should perceive the research policy of the University as a document pursuing continuous betterment with regard to research endeavour. Research leaders should also consider the research policy document as a guiding document for producing new knowledge through

innovative endeavour, however, 65.9% of participants disagreed while only 34.1% perceived the research policy of the University as a guiding document directing the what and how of research activity endeavour.

Research leaders should refer to the research policy to produce new knowledge to solve real problems through dynamic interaction, though 68.8% participants disagreed while 31.2% agreed on the function of the research policy as a directing tool for knowledge production endeavour to address real problems. In this regard, research leaders should be skilled at setting direction on how to implement research policy formulations. 60% of participants disagreed while 40% agreed on the competency of leaders to interpret policy formulations applicably in order to provide appropriate direction with regard to implementing the research policy functionally for societal improvement. In managing the implementation of the research policy, research leaders should approach their research and innovation leadership responsibilities as a process, being focused on context specific research endeavour in collaboration with industry for societal improvement. Only 38.3% of participants perceived the research leadership at Fignu University as being successful in managing research endeavour as a process, 25.3% of participants being satisfied that research leaders are focused on context specific research and 27.1% that research leadership is successful in ensuring collaboration with applicable stakeholders.

Addressing context specific problems by producing new and practical knowledge and technology, research leaders at Fignu University should prioritise either basic or applied research. In this regard, 22.9% of participants (77.1% opposing) were of the opinion that research leaders are more inclined to promoting basic research whereas 35.3% (64.7% opposing) thought applied research are carried out at their University. Research leaders should lead the research and innovation projects of Fignu University in line with real problems of the local community, the University and the country. In this regard, 30.6% of participants (69.5% opposing) believed leadership to arrange for research endeavour that is focused on community-related problems, 21.2% (78.8% opposing) that research is focused on solving University problems and 24.7% of participants (75.3% opposing) that research endeavour contributes to solving problems for the nation.

To address problems according to aforementioned foci, research leaders should focus on leading research projects by incorporating innovation and ensuring collaboration with

beneficiaries, however 75.8% of participants did not believe that innovation and collaboration were taking place whereas only 24.1% were satisfied that innovation and collaboration are considered and carried out. Leaders should lead research teams to solve local problems, although 66.5% of participants disagreed while only 33.5% agreed that research leadership addresses local problems. Leaders should lead research and innovation activities of the University to develop new ideas and innovative solutions for the local context. Three quarters of the participants (75.9%) disagreed while one quarter (24.2%) were of the opinion that leadership is successful in encouraging the development of innovative solutions to complex problems in the local community.

In improving the research policy and actual research practice of the University, research leaders of Fignu University should be good at facilitating dynamic interactions among key stakeholders of the University though 78.8 % of participants disagreed and only 21.2% agreed on the competencies of the leadership in cooperating with stakeholders to improve research policy and practice at the University. Research leaders should focus on encouraging actions related to improved teaching and learning and creativity though 80.1% of the participants disagreed while only 20% believed that research actions are focused on improving teaching and learning through creative endeavour at the University. Research leaders should collect information and feedback and use this information to overcome shortcomings regarding research conduct and accommodate emerging ideas from the interactions they engage with. In this regard, 77.7% of participants disagreed and 22.4% agreed regarding leadership's pursuit of collecting information and feedback to understand leadership practice comprehensively, and 80.6% participants disagreed and 19.4% agreed on leadership's focus on using gathered information to improve their leadership and management skills, and 82.3% of the participants disagreed while 17.7% agreed with regard to leadership's intent to accommodate emerging ideas to adjust and innovate their leadership practice.

In order to incorporate learning, creativity and adaptability into the formal governance structure of Fignu University, research and innovation management and leadership should use enabling leadership. Findings from the quantitative data regarding enabling leadership at university level at Fignu University are presented next.

Enabling leadership at university level

Table 5.4 compares the research findings based on the data collected using items in Part I of the structured questionnaire about the degree of disagreement and agreement of participants with regard to the practice of enabling leadership at Fignu University (Appendix F).

Table 5.4: Agreement and disagreement of participants on matters pertaining to enabling leadership at university level

Items				EnL1	EnL2	EnL3	EnL4	EnL5	EnL6	EnL7	EnL8	EnL9	EnL10	EnL11	EnL12	EnL13	EnL14	Enl15
Participants having	Disagreement	1	N	32	30	12	26	14	30	43	37	28	17	21	24	24	22	51
			%	18.8	17.6	7.1	15.3	8.2	17.6	25.3	21.8	16.5	10.0	12.4	14.1	14.1	12.9	30
		2	N	36	53	23	39	61	34	60	58	68	53	57	55	40	36	54
			%	21.2	31.2	13.5	22.9	35.9	20.0	35.3	34.1	40.0	31.2	33.5	32.4	23.5	21.2	31.8
		3	N	75	58	88	72	78	67	39	50	63	75	71	68	81	87	53
			%	44.1	34.1	51.8	42.4	45.9	39.4	22.9	29.4	37.1	44.1	41.8	40.0	47.6	51.2	31.2
		Sub-total	N	**143**	**141**	**123**	**137**	**153**	**131**	**142**	**145**	**159**	**145**	**149**	**147**	**145**	**145**	**158**
			%	**84.1**	**82.9**	**72.4**	**80.6**	**90**	**77**	**83.5**	**85.3**	**93.6**	**85.3**	**87.7**	**86.5**	**85.3**	**85.3**	**93**
	Agreement	4	N	20	21	39	29	9	37	16	14	11	23	20	20	20	24	12
			%	11.8	12.4	22.9	17.1	5.3	21.8	9.4	8.2	6.5	13.5	11.8	11.8	11.8	14.1	7.1
		5	N	7	8	7	4	7	2	4	3	0	1	1	3	4	1	0
			%	4.1	4.7	4.1	2.4	4.1	1.2	2.4	1.8	0	0.6	0.6	1.8	2.4	0.6	0
		6	N	0	0	1	0	1	0	8	8	0	1	0	0	1	0	0
			%	0	0	0.6	0	0.6	0	4.7	4.7	0	0.6	0	0	0.6	0	0
		Sub-total	N	**27**	**29**	**47**	**33**	**17**	**39**	**28**	**25**	**11**	**25**	**21**	**23**	**25**	**25**	**12**
			%	**15.9**	**17.1**	**27.6**	**19.5**	**10**	**23**	**16.5**	**14.7**	**6.5**	**14.7**	**12.4**	**13.6**	**14.8**	**14.7**	**7**
	Total		N	170	170	170	170	170	170	170	170	170	170	170	170	170	170	170
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

EnL=Enabling leadership

EnL1=The leaders inspire researchers to engage in research-based innovation.

EnL2=The leaders encourage the researchers to adapt technologies from foreign countries.

EnL3=The leaders are effective in building research teams having different skills with shared identity.

EnL4=The leaders interconnect research activities to facilitate the production, dissemination, and utilisation of new knowledge or technologies.

EnL5=The leaders promote an interactive relationship among education, research, and innovation.

EnL6=There is an environment conducive to undertake research and innovation activities in the university.

EnL7=There are adequate funds for research undertakings in the university.

EnL8=There are adequate funds for innovation in the university.

EnL9=There is strong linkage between the university and the industry for collaborative research and innovation.

EnL10=The leaders facilitate dynamic interaction between and among researchers from different disciplines.

EnL11=The leaders motivate the researchers to engage passionately in the research task by providing resources to come up with new and innovative results.

EnL12=The leaders put managerial pressure on the university research system to adjust and bring the required change.

EnL13=The leaders are good at using the structure of the university to address challenges to research and innovation activities.

EnL14=The leaders are good at establishing functional networks across stakeholders that engage in research and innovation activities.

Enl15=There is a functional innovation system that comprises researchers, the government, the industry, and the local community

As enabling leaders, research leaders at Fignu University should create enabling conditions so that they can inspire and encourage researchers and build effective research teams that have different skills but a shared identity. However, as indicated in Table 5.4, 84.1% of the participants disagreed and 15.9% agreed on research leader zest to inspire researchers to engage

in research-based innovation. 82.9% of participants disagreed while 17.1% agreed on research leaders' actions of encouraging researchers to adopt foreign technologies, and 72.4% disagreed and 27.6% of participants agreed that research leaders do establish effective research teams. In creating enabling conditions to encourage researchers to improved performance, research leaders should coordinate research activities at the University to facilitate production, dissemination, and application of new knowledge and technology, however, 80.6% of participants disagreed and 19.5% agreed on the competency of the leadership in coordinating research for improved achievements. In countering shortcomings related to knowledge, skill and technology, leaders have to link teaching, research, and innovation activities for improved functioning although the majority of participants (90%) disagreed while a minority (10%) agreed on leadership's ability and intention to ensure interrelated teaching and research undertakings for application of research outcomes for improved conditions.

To make the research and innovation projects of Fignu University productive, leaders should facilitate interaction among researchers, motivate researchers to engage passionately in their research tasks, and exert managerial pressure on the University research system for improved performance by facilitating required resources and demanding research results. The majority of participants (85.3%) disagreed while the minority (14.7%) agreed on leaders' zest to arrange constructive interaction among researchers, to motivate researchers to engage in their research passionately engendering new and innovative ideas (87.7% disagreed; 12.4% agreed) and to exert managerial pressure on the University research system to ensure improvement (86.5% disagreed; 13.6% agreed). In this regard, one of the key enabling conditions for research endeavour is a conducive environment entailing enough funds, time and creativity for outstanding performance. 77% of participants disagreed and 23% agreed on leadership's ability to create such an environment conducive for research endeavour. Providing an adequate budget for research endeavour is paramount though the majority of participants (83.5%) disagreed while only 16.4% were satisfied with budget arrangements for research endeavour.

In order to counter the constraints related to people, knowledge, skills, technology, and financial and material resources at Fignu University, leaders should establish strong linkage between the University and industry for collaborative research and innovation projects, though 93.6% of participants disagreed while only 6.4 % agreed that leadership is pursuing such collaboration endeavours. With regard to establishing functional networks with key stakeholders who engage in research and innovation activities, 85.3% of participants disagreed

and 14.7% agreed that such functional networks exist at the University. To achieve the research and innovation goals of the University effectively, leaders should establish a functional innovation system at the University that consists of researchers, government, industry, and the local community contributing collaboratively to such functionality, though 93% of participants disagreed while only 7% agreed on the presence of a practical innovation system at the University considering and incorporating all relevant stakeholders. To alleviate the challenges encountered with research and innovation endeavour at Fignu University, leaders should use the University research governance structure for constructive betterment of research outputs though 85.2% of participants disagreed and 14.8% agreed on the competency of management to respond to the challenges encountered in the research and innovation project of the University. One of the challenges pertains to allocating adequate budget for research and innovation projects. In this regard, to describe the practice at Fignu University relating to research budgeting, the five-year annual performance reports for the period 2012/2013 to 2016/2017 of the University were analysed and are discussed next.

Table 5.5 provides the research findings regarding the budget share for research and community engagement for the five-year period 2012/2013 to 2016/2017 at Fignu University as per checklist indicators (Appendix H).

Table 5.5: Annual budget and the budget share for research and community engagement at Fignu University

Academic Year	Annual budget planned in Ethiopian Birr	Annual budget for research and community engagement planned	Percentage of the research and community budget	Annual budget achieved	Annual budget for research and community engagement achieved	Percentage of the research and community budget
2012/13	990,223,295.00	26,804,250.00	2.7	976,232,450.57	24,727,495.00	2.5
2013/14	1,153,196,000.00	37,393,000.00	3.2	1,205,204,008.93	35,982,022.00	2.9
2014 /15	1,331,218,798.20	69,251,753.00	5.2	1,328,956,041.64	67,420,374.72	5.1
2015/16	1,603,911,073	91,943,000	5.7	1,511,405,437.46	90,416,802.88	5.9
2016/17	2,067,551,557.66	122,338,300.00	5.9	2,011,683,834.52	113,865,154.00	5.7

Sources: Fignu University Annual Performance Reports (2012/13 -2016/17)

As shown in Table 5.5, the data from the annual performance reports of the University about budget performance for research and community engagement depicts an increase from 2.7% to

5.2% for research endeavour during the first three years, namely 2012/2013 to 2014/2015. There was a continuous increase in the budget plan for research activity from 2.7% to 5.9% for the period 2012/2013 to 2016/2017, which was then reduced from 5.9% to 5.7% for the period 2015/2016 to 2016/2017 to suffice with a minimum of 5% budget allocation for research endeavour.

Competency of research leaders at university level to manage research and innovation - a critical interpretation

A close analysis of the results of the quantitative data about the administrative, adaptive and enabling leadership at Fignu University showed that research leaders have competency shortcomings in managing and leading the research and innovation policy and practice of the University. As administrative leaders, the research leaders of Fignu University should be competent at planning and implementing the research and innovation policy of the University. In implementing the policy objectives of the University, the research leaders should be skilled at research and innovation project management though more than three quarters of the participants (78.8%) opined that the research leaders encounter project management competency shortcomings at Fignu University. As adaptive leaders, the research leaders of the University should lead the research and innovation projects as per the specific and real problems of the local community, the University, industry and the country, though more than two-thirds of the participants (69.5%) indicated that the leaders were not competent in project leadership as per the specific context to produce relevant knowledge and adapt or develop applicable technology. To improve knowledge and technology to the benefit of everyone concerned, research leaders should be competent in creating enabling conditions and environments for researchers using enabling leadership. However, most participants (83.5%) indicated that the research leaders of the University had shortcomings in motivating researchers by allocating enough budget for the research and innovation projects.

Administrative (management), adaptive, and enabling leadership should also be exercised at college level, and the findings of the quantitative data regarding the practice of administrative leadership at college level are presented next.

Administrative leadership at college level

Table 5.6 reveals the research findings based on the data collected using the items in Part II of the structured questionnaire where participants indicated the extent of their agreement and disagreement regarding the practice of administrative leadership at college level at Fignu University (Appendix F).

Table 5.6: Agreement and disagreement of participants on matters pertaining to administrative leadership at college level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13
Participants having	Disagreement		N	1	1	26	5	20	32	21	25	17	35	26	60	39
			%	.6	.6	15.3	2.9	11.8	18.8	12.4	14.7	10.0	20.6	15.3	35.3	22.9
		2	N	25	29	7	36	23	31	39	44	39	45	63	58	47
			%	14.7	17.1	4.1	21.2	13.5	18.2	22.9	25.9	22.9	26.5	37.1	34.1	27.6
		3	N	39	46	45	65	49	67	80	61	69	65	64	48	79
			%	22.9	27.1	26.5	38.2	28.8	39.4	47.1	35.9	40.6	38.2	37.6	28.2	46.5
		Sub-total	N	**65**	**76**	**78**	**106**	**92**	**130**	**140**	**130**	**125**	**145**	**153**	**166**	**165**
			%	**38.2**	**44.8**	**45.9**	**62.3**	**54.1**	**76.4**	**82.4**	**76.5**	**73.5**	**85.3**	**90**	**97.6**	**97**
	Agreement	**4**	N	62	59	50	32	72	26	24	37	35	23	11	1	5
			%	36.5	34.7	29.4	18.8	42.4	15.3	14.1	21.8	20.6	13.5	6.5	0.6	2.9
		5	N	33	30	36	12	6	14	6	3	10	0	6	1	0
			%	19.4	17.6	21.2	7.1	3.5	8.2	3.5	1.8	5.9	0	3.5	0.6	0
		6	N	10	5	6	20	0	0	0	0	0	2	0	2	0
			%	5.9	2.9	3.5	11.8	0	0	0	0	0	1.2	0	1.2	0
		Sub-total	N	**105**	**94**	**92**	**64**	**78**	**40**	**30**	**40**	**45**	**25**	**17**	**4**	**5**
			%	**61.8**	**55.2**	**54.1**	**37.7**	**45.9**	**23.5**	**17.6**	**23.6**	**26.5**	**14.7**	**10**	**2.4**	**2.9**
	Total		N	170	170	170	170	170	170	170	170	170	170	170	170	170
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The research leader (coordinator) of the college manages the college research activities in line with the university research policy.
AdL2=The research leader of the college manages the college innovation activities in line with the university research policy.
AdL3=The leader is good at communication with the researchers.
AdL4=The leader focuses on managing the schedules and budgets of the projects.
AdL5=The leader is good at delegating managerial responsibilities for improved performance.
AdL6=The research leader is good at research project management.
AdL7=The research leader is good at managing the performance of the researchers.
AdL8=The research leader is good at resources mobilization for the projects.
AdL9=The research leader is good at resolving conflict among researchers.
AdL10=The research leader is effective in managing the qualities of applicability outcomes of the research projects.
AdL11=The research leader is good at managing research-based innovation.
AdL12=The research leader is struggling in innovation project management.
AdL13=The leader is good at incorporating learning, creativity and adaptability while managing research and innovation activities of the college.

Research leaders at college level should manage research and innovation activities of colleges in line with the University research policy. Among the participants, 61.8% of them agreed while 38.2% disagreed regarding the research management of the colleges to manage research and innovation activities to be aligned with the university's research policy. Also 55.2% of participants agreed while 44.8% disagreed regarding college leadership's ability to manage

research endeavour innovatively. To translate the research and innovation activities of the colleges into practices, research leaders should be competent at research and innovation project management; however 76.4% of participants disagreed while only 23.5% believed college leadership to be competent at managing research projects successfully. Nearly all the participants (97.6%) disagreed while 2.4% agreed on innovation project management competency of research leaders. Research leaders should manage research-based innovation but most participants (90%) disagreed while only 10% were satisfied with leadership's skill of managing research-based innovation outcomes. As research managers, leaders should be good at communication, resource mobilisation, and conflict resolution. 45.9% of participants disagreed and 54.1% were satisfied with leadership's communication skills, 76.5% were not satisfied and 23.6% satisfied about leadership's mobilizing of necessary resources for research and innovation activities with 73.5% mistrusting and 26.5% participants trusting leadership's capacity to resolve conflict adequately.

Research leaders at college level should manage research projects in terms of good quality outcomes, proper budgeting and realistic time-frames. Among participants, 62.3% disagreed while 37.7% agreed on college leadership's ability to arrange proper budgeting and realistic frameworks for goal setting and the realizing of those set goals. Most of the participants (85.3%) disagreed while 14.7% agreed on leadership's zest to ensure good quality research conduct for good quality outcomes. Leaders should manage researcher performance and delegate managerial responsibilities for improved performance, though most participants (82.4%) disagreed while only 17.3% were impressed with leaders' management of researchers. 92% of participants disagreed while 8% were satisfied with the leadership practice of delegating authority as and when appropriately important. To improve research and innovation activities at colleges, leaders should incorporate learning, creativity, and adaptability relating to adaptive leadership into the formal research management governance of colleges but almost all the participants (97%) disagreed while only 3% believed college leaders to be able to achieve these incorporating capacities. The findings of the quantitative data regarding adaptive leadership at college level follow next.

Adaptive leadership at college level

Table 5.7 compares the research findings about the extent of agreement and disagreement of participants using the items in Part II of the structured questionnaire regarding the practice of adaptive leadership at college level at Fignu University (Appendix F).

Table 5.7: Agreement and disagreement of participants on matters pertaining to adaptive leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
AdaL1	37	21.8	42	24.7	75	44.1	**154**	**90.6**	14	8.2	2	1.2	0	0	**16**	**9.4**	170	100
AdaL2	33	19.4	28	16.5	87	51.2	**148**	**87.1**	22	12.9	0	0	0	0	**22**	**12.9**	170	100
AdaL3	24	14.1	47	27.6	66	38.8	**137**	**80.5**	30	17.6	3	1.8	0	0	**33**	**19.4**	170	100
AdaL4	17	10.0	28	16.5	101	59.4	**146**	**85.9**	22	12.9	2	1.2	0	0	**24**	**14.1**	170	100
AdaL5	63	37.1	42	24.7	13	7.6	**118**	**69.4**	7	4.1	9	5.3	36	21.2	**52**	**30.6**	170	100
AdaL6	27	15.9	56	32.9	64	37.6	**147**	**86.4**	23	13.5	0	0	0	0	**23**	**13.5**	170	100
AdaL7	26	15.3	37	21.8	86	50.6	**149**	**87.7**	19	11.2	2	1.2	0	0	**21**	**12.3**	170	100

Keys:

AdaL1=The college puts more value on areas of research applicable to the internal development of the college.
AdaL2=The leader is leading the researchers to research their own teaching to address the internal problems of the college.
AdaL3=The leader is leading the researchers to research and address the problems of the local communities.
AdaL4=The leader is leading the researchers to research and produce new knowledge for the socio-economic development of the country.
AdaL5=The research leader is struggling in innovation project leadership.
AdaL6=The leader focuses on action based on learning and creativity.
AdaL7=The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the college.

As depicted in Table 5.7, using adaptive leadership, leaders at college level should lead research and innovation projects for the internal development of the colleges though the majority of participants (90.6%) disagreed while 9.4% of them agreed on the ability of leadership at college level to lead research and innovation projects adaptively to ensure the internal development of the college. Leaders should lead the research and innovation projects to address the internal problems of the college, the local community and the socio-economic problems of the country. 87.1% of participants disagreed and 12.9% agreed that leadership ensures that internal problems are addressed with research endeavour. 80.5% of participants disagreed and 19.4% agreed that leadership ensures that local community problems are addressed with research project endeavour. 80.5% of participants disagreed and only 19.4%

agreed that leadership is successful in arranging that country needs are addressed by research endeavour.

In order to address problems relating to the local community, the colleges, the University and industry, leaders should be skilled at innovation project leadership although 69.4% of participants disagreed while 30.6% agreed on leaders' competency to motivate innovation endeavour with research projects. Learning, creativity, and adaptability are the qualities of adaptive leadership that help research leaders to lead research and innovation activities of the colleges aligned to the needs and inadequacies of the specific context. Consequently, research leaders at college level should take actions based on learning and creativity but 86.4% of participants disagreed and 13.5% agreed on the actions of leaders to improve learning and creativity with research project endeavour. To improve their leadership practice through learning and creativity, leaders should facilitate dynamic interactions among key stakeholders though 87.7% of participants did not think leaders are achieving this kind of facilitation with only 12.4% of participants being satisfied with research leaders' ability to facilitate stakeholder interaction. To incorporate the learning, innovation, creativity and adaptability relating to adaptive leadership into the administrative leadership of the colleges, leaders have to apply enabling leadership. The findings of the quantitative data on enabling leadership at college level at Fignu University are presented next.

Enabling leadership at college level

Table 5.8 provides the research findings based on the data collected using the items in Part II of the structured questionnaire about the extent of agreement and disagreement among participants about the practice of enabling leadership at college level at Fignu University (Appendix F).

Table 5.8: Agreement and disagreement of participants on matters pertaining to enabling leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
EnL1	35	20.6	45	26.5	74	43.5	**154**	**90.6**	13	7.6	1	.6	2	1.2	**16**	**9.4**	170	100
EnL2	23	13.5	16	9.4	87	51.2	**126**	**74.1**	40	23.5	1	.6	3	1.8	**44**	**25.9**	170	100
EnL3	21	12.4	55	32.4	78	45.9	**154**	**90.7**	12	7.1	1	0.6	3	1.8	**16**	**9.5**	170	100
EnL4	33	19.4	27	15.9	61	35.9	**121**	**71.2**	44	25.9	2	1.2	3	1.8	**49**	**28.9**	170	100

EnL5	21	12.4	35	20.6	66	38.8	**122**	**71.8**	41	24.1	4	2.4	3	1.8	**48**	**28.3**	170	100
EnL6	26	15.3	50	29.4	57	33.5	**133**	**78.2**	25	14.7	9	5.3	3	1.8	**37**	**21.8**	170	100
EnL7	29	17.1	70	41.2	38	22.4	**137**	**80.7**	33	19.4	0	0	0	0	**33**	**19.3**	170	100
EnL8	30	17.6	29	17.1	79	46.5	**138**	**81.2**	27	15.9	5	2.9	0	0	**32**	**18.8**	170	100

Keys:

EnL1=The research leader motivates the researchers to undertake problem-solving research.
EnL2=The leader is good at team building having different skills.
EnL3=The leader is good at inspiring and motivating researchers.
EnL4=The research leader encourages disciplined-based research to produce improved discipline –based knowledge.
EnL5=The research leader encourages interdisciplinary research to solve real problems.
EnL6=The research leader encourages collaborative research with external bodies that promote research-based innovation.
EnL7=The leader is good at establishing functional networks across stakeholders that engage in research and innovation activities.
EnL8=The leader is good at using the structure of the college to address challenges to research and innovation activities.

In creating enabling conditions for researchers, project leaders should employ enabling leadership. Consequently, leaders have to motivate and inspire researchers, and build research teams consisting of team members all having different research-related skills contributing to reaching improved goals with research and having a shared identity. As indicated in Table 5.8, the vast majority of participants (90.6%) disagreed while 9.4% agreed about leadership's zest to motivate researchers to passionate problem-solving research. 90.7% of participants disagreed while 9.3% agreed on leaders' ability to inspire researchers to consistent endeavour in engaging in problem-solving research actions. 74.1% of participants disagreed while 25.9% agreed on leaders' competency to build effective research teams for good quality research conduct.

Research leaders should encourage researchers to undertake discipline-based research to produce improved discipline-based knowledge, conduct interdisciplinary research to solve real problems and undertake collaborative research to promote research-based innovation. 71.2% of participants disagreed while 28.9% believed that research leaders encourage researchers to conduct discipline-based research to produce relevant discipline-based knowledge. 71.8% of participants disagreed while 28.3% agreed research leaders motivating researchers to undertake interdisciplinary research in solving real problems. 78.2% of participants disagreed while 21.8% them agreed that research leaders encourage researchers to collaborative research endeavour to stimulate research-based innovation. Sharing resources, knowledge, skills and technology within and outside the University, research leaders have to establish functional

networks with stakeholders that engage in research and innovation activities. Most participants (80.7%) disagreed while the minority (19.3%) agreed on leadership success with establishing functional networks with stakeholders to improve the research and innovation endeavour of research projects of the colleges. In addressing the research and innovation challenges of the colleges, the leaders have to use the research governance structure of the colleges although the majority of the participants (81.2%) disagreed while a minority (18.8%) agreed on the administrative leadership capacity of leaders to respond to the challenges of the research and innovation leadership at college level at Fignu University.

Competency of research leaders at college level to manage research and innovation - a critical interpretation

A critical interpretation of the findings on administrative, adaptive and enabling leadership at college level depicted that the research leaders encounter competency shortcomings in managing and leading research and innovation activities of colleges to be aligned with the research thematic areas of the University. To translate the research and innovation activities of the colleges into practice, research leaders should have adequate competency in research and innovation project management though 76.4% of participants did not believe leaders to be competent in research project management and 97.6% participants revealed misgivings about leaders' ability to manage innovation with their research project. Although research and innovation leadership is context specific, the research leaders of the college were found to have competency shortcomings in leading the research and innovation projects of the colleges as per the colleges' own internal problems, the problems of the local community and the socio-economic development of the country as concurred by more than 80% of participants. In order to achieve the research and innovation goals of the colleges effectively, the research leaders should encourage researchers to undertake discipline-based or interdisciplinary research aligned to the needs of beneficiaries and stakeholders but more than 70% of the participants opined that research leaders at college level were not competent in enabling leadership to ensure alignment between research conduct and stakeholder need at college level at Fignu University.

Administrative, adaptive and enabling leadership should also be exercised at project level, and the findings of the quantitative data regarding administrative leadership at project level at Fignu University are presented next.

Administrative leadership at project level

Table 5.9 represents the research findings based on the data collected using the items in Part III of the structured questionnaire to describe the extent of agreement and disagreement of participants regarding the practice of administrative leadership at project level at Fignu University (Appendix F).

Table 5.9: Agreement and disagreement of participants on matters pertaining to administrative leadership at project level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14
Participants having	Disagreement	1	N	21	9	21	16	56	25	11	9	9	14	36	8	36	19
			%	12.4	5.3	12.4	9.4	32.9	14.7	6.5	5.3	5.3	8.2	21.2	4.7	21.2	11.2
		2	N	63	39	30	36	33	65	33	36	24	29	28	32	55	42
			%	37.1	22.9	17.6	21.2	19.4	38.2	19.4	21.2	14.1	17.1	16.5	18.8	32.4	24.7
		3	N	51	83	98	97	7	59	95	101	60	54	72	70	59	87
			%	30.0	48.8	57.6	57.1	4.1	34.7	55.9	59.4	35.3	31.8	42.4	41.2	34.7	51.2
		Sub-total	N	**135**	**131**	**149**	**149**	**96**	**149**	**139**	**146**	**93**	**97**	**136**	**110**	**150**	**148**
			%	**79.5**	**77**	**87.6**	**87.7**	**56.4**	**87.6**	**81.8**	**85.9**	**54.7**	**57.1**	**80.1**	**64.7**	**88.3**	**87.1**
	Agreement	4	N	30	32	14	12	3	18	28	19	52	66	33	53	19	20
			%	17.6	18.8	8.2	7.1	1.8	10.6	16.5	11.2	30.6	38.8	19.4	31.2	11.2	11.8
		5	N	4	6	5	7	29	2	2	3	9	6	1	6	0	2
			%	2.4	3.5	2.9	4.1	17.1	1.2	1.2	1.8	5.3	3.5	.6	3.5	0	1.2
		6	N	1	1	2	2	42	1	1	2	16	1	0	1	1	0
			%	.6	.6	1.2	1.2	24.7	.6	.6	1.2	9.4	.6	0	.6	.6	0
		Sub-total	N	**35**	**39**	**21**	**21**	**74**	**21**	**31**	**24**	**77**	**73**	**34**	**60**	**20**	**22**
			%	**20.6**	**22.9**	**12.3**	**12.4**	**43.6**	**12.4**	**18.3**	**14.2**	**45.3**	**42.9**	**20**	**35.3**	**11.8**	**13**
	Total		N	170	170	170	170	170	170	170	170	170	170	170	170	170	170
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The project leader (principal investigator) sets realistic and functional objective(s) to a project in collaboration with the project stakeholders.
AdL2 =The project leader is good at communication.
AdL3=The project leader is effective in research project management.
AdL4=The project leader is good at managing resources.
AdL5=The project leader is struggling in managing the quality of the research project in terms of producing new and relevant knowledge.
AdL6=The project leader is effective in innovation project management.
AdL7=The project leader is a good problem solver.
AdL8=The project leader manages project progress effectively.
AdL9=The project leader manages the success of the project in terms of time and budget.
AdL10=The project leader manages his or her team effectively.
AdL11=There is effective risk-assessment in the research and innovation projects.
AdL12=The project leader is good at conflict resolution.
AdL13=The project leader is effective in obtaining research grants.
AdL14=The project leader is good at incorporating learning, creativity and adaptability while managing research or innovation project.

As good administrative leaders, the project leaders should be good at setting realistic and functional objectives for the research and innovation projects in collaboration with beneficiaries and key stakeholders though 79.5% of the participants disagreed while 20.6% of them agreed on project leaders' ability of setting practical objectives for the research and

innovation projects. In setting realistic objectives for research projects, the leaders should be skilled in research and innovation project management. In this regard, most of the participants (87.6%) disagreed while 12.4% believed project leaders to be skilled in research and innovation project management. As skilled project managers, project leaders should manage resources, research progress, and the research teams of the projects. While most participants (87.7%) do not perceive project leaders as managing the resources of the research projects effectively and the progression with the research projects (85.9%) satisfactorily, 12.4% participants were satisfied with the resource management of the projects and 14.2% with the progress with research project activities. Over half of the participants (57.1%) disagreed and 42.9% agreed on project leadership's ability of managing research teams adequately. To secure financial resources for research projects, project leaders have to obtain research grants although the majority of participants (88.3%) disagreed while 11.7% of them agreed on project leaders' success rates with obtaining research grants.

As competent leaders, project leaders should manage the quality of research outcomes of the projects though 56.4% of participants disagreed while 43.6% of them were satisfied with project leaders' competency in ensuring good quality with research project outcomes. Project leaders should be eloquent communicators, skilled problem solvers, and competent in conflict resolution though 77% of participants disagreed while 22.9% agreed on project leaders' effective communication skills, 81.8% disagreed while 18.3% agreed on project leaders' abilities to solve research problems adequately while managing the research projects, and 64.7% of participants disagreed while 35.3% agreed on project leaders' capacity to resolve conflict functionally. To implement research projects as planned successfully, project leaders should manage the projects' time-frames and budgets convincingly, though 54.7% of participants disagreed and 45.3% agreed on project leaders' successes with ensuring adequate budgeting.

In order to identify factors that contribute to research projects not being successful and taking appropriate countering measures, project leaders should be good at project risk management. With regard to effective project risk assessment that pertains to human resources, management and leadership, project costs, project schedule, and general demands of the project, 80.1% of participants disagreed while 20% agreed on the capacity of project leaders to engage in successful project risk management. In improving project leadership aligned to the specific context, project leaders should incorporate learning, creativity and adaptability relating to their

adaptive leadership actions into administrative leadership though the majority of participants (87.1%) disagreed while the minority (12.9%) agreed on project leaders practising leadership as a process that is focused on continued progress and improvement. Project leaders should lead their research and innovation projects to be aligned to internal and external needs. In so doing, they have to apply adaptive leadership, and the findings of the quantitative data regarding adaptive leadership at project level at Fignu University are provided next.

Adaptive leadership at project level

Table 5.10 compares the research findings based on the quantitative data collected using the questions in Part III of the structured questionnaire on the extent of agreement and disagreement of participants regarding the practice of adaptive leadership at project level (Appendix F).

Table 5.10: Agreement and disagreement of participants on matters pertaining to adaptive leadership at project level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdaL10	AdaL11
Participants having	Disagreement	1	N	29	26	13	16	9	26	19	17	17	27	44
			%	17.1	15.3	7.6	9.4	5.3	15.3	11.2	10.0	10.0	15.9	25.9
		2	N	43	40	56	66	45	46	53	56	44	50	49
			%	25.3	23.5	32.9	38.8	26.5	27.1	31.2	32.9	25.9	29.4	28.8
		3	N	83	85	70	73	78	82	54	78	86	76	46
			%	48.8	50.0	41.2	42.9	45.9	48.2	31.8	45.9	50.6	44.7	27.1
		Sub-total	N	**155**	**151**	**139**	**155**	**132**	**154**	**126**	**151**	**147**	**153**	**139**
			%	**91.2**	**88.8**	**81.7**	**91.1**	**77.7**	**90.6**	**74.2**	**88.8**	**86.5**	**90**	**81.8**
	Agreement	4	N	13	15	30	14	29	9	34	18	23	11	28
			%	7.6	8.8	17.6	8.2	17.1	5.3	20.0	10.6	13.5	6.5	16.5
		5	N	1	4	0	1	9	6	9	1	0	6	3
			%	.6	2.4	0	.6	5.3	3.5	5.3	.6	0	3.5	1.8
		6	N	1	0	1	0	0	1	1	0	0	0	0
			%	.6	0	.6	0	0	.6	.6	0	0	0	0
		Stub-total	N	**15**	**19**	**31**	**15**	**38**	**16**	**44**	**19**	**23**	**17**	**31**
			%	**8.8**	**11.2**	**18.2**	**8.8**	**22.4**	**9.4**	**25.9**	**11.2**	**13.5**	**10**	**18.3**
	Total		N	170	170	170	170	170	170	170	170	170	170	170
			%	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL1=The project leader is effective in research project leadership.
AdaL2=The project leader is effective in leading innovation projects to develop unique products and services for commercialization.
AdaL3=The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the local communities.
AdaL4=The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the country.
AdaL5=The project leader assigns difficult tasks and facilitates collaboration.
AdaL6=The project leader facilitates teamwork, creates room for interaction and exchange of ideas.
AdaL7=The project leader builds research teams based on the competencies of the researchers.
AdaL8=The project leader focuses on action based on learning and creativity.
AdaL9=The project leader leads researchers to produce new knowledge to address the challenges of the industry.

AdaL10=The project leader leads researchers to produce new knowledge to address the challenges of the local community.
AdaL11=The project leader leads researchers to produce new knowledge to address the challenges of the university itself.

In contextualising research and innovation projects, project leaders should be effective in leading research and innovation projects as a process by considering the specific context and being motivated by collaborative endeavours. Regarding leading their research projects to be aligned to the specific context, the vast majority of participants (91.5%) disagreed while only 8.5% agreed on project leaders' endeavour to lead projects to be in line with the specific needs of beneficiaries and stakeholders of the projects. 88.8% of participants disagreed while 11.2% agreed on leading the innovation projects' outputs to be commercialised, 81.7% of participants disagreed while 18.2% agreed on leading the projects innovatively to solve local community problems, and 91.1% of participants disagreed while 8.8% agreed on leading projects innovatively to address national problems. In leading research projects successfully, project leaders should build research teams based on competency requirements, facilitate teamwork through interaction, assign difficult tasks and facilitate collaboration. While 74.2% of participants disagreed and 25.9% agreed on project leaders' skill to build competent research teams, 77.7% disagreed and 22.4% participants agreed on project leaders' ability to facilitate teamwork effectively with most participants (90.6%) disagreeing and only 9.4% agreeing that project leaders do have the ability to assigning difficult tasks successfully based on collaboration endeavour.

As research represents the essence for innovation, project leaders should inspire researchers to produce new knowledge to address the challenges of industry, the local community, and the University. However, most of the participants (86.5%) disagreed and 13.5% agreed on project leaders' ability to act inspiringly on producing new knowledge to solve the problems of industry, 90% disagreed and 10% agreed on leader competency to motivate researchers to solve the problems of the local community, and 81.8% of participants have misgivings while 18.3% believed in project leadership to engender the solving of University problems through research project endeavour. Leadership of research and innovation projects should ensure that knowledge and technology are produced to address real problems by pursuing continuous learning for creativity endeavour. Most participants (88.8%) disagreed while 11.2% agreed on project leaders' ability to pursue learning for creativity ensuring constant progress with research project activity. To integrate adaptive leadership with administrative leadership at project level, project leaders should apply enabling leadership to create enabling conditions for

researchers. What follows are the findings from the quantitative data regarding enabling leadership at project level at Fignu University.

Enabling leadership at project level

Table 5.11 provides the research findings based on the data collected using the items in Part III of the structured questionnaire about the extent of agreement and disagreement of participants on enabling leadership practice at project level at Fignu University (Appendix F).

Table 5.11: Agreement and disagreement of participants on matters pertaining to enabling leadership at project level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
EnL1	11	6.5	64	37.6	73	42.9	**148**	**87**	15	8.8	7	4.1	0	0	**22**	**12.9**	170	100
EnL2	8	4.7	47	27.6	65	38.2	**120**	**70.5**	43	25.3	7	4.1	0	0	**50**	**29.4**	170	100
EnL3	11	6.5	42	24.7	77	45.3	**130**	**76.5**	37	21.8	3	1.8	0	0	**40**	**23.6**	170	100
EnL4	14	8.2	47	27.6	59	34.7	**120**	**70.5**	28	16.5	22	12.9	0	0	**50**	**29.4**	170	100
EnL5	14	8.2	71	41.8	59	34.7	**144**	**84.7**	21	12.4	5	2.9	0	0	**26**	**15.3**	170	100
EnL6	19	11.2	34	20.0	66	38.8	**119**	**70**	41	24.1	10	5.9	0	0	**51**	**30**	170	100
EnL7	18	10.6	51	30.0	84	49.4	**153**	**90**	16	9.4	1	.6	0	0	**17**	**10**	170	100
EnL8	16	9.4	31	18.2	82	48.2	**129**	**75.8**	34	20.0	6	3.5	1	.6	**41**	**24.2**	170	100

Keys:

EnL1=The project leader is good at motivating his/her research team.
EnL2=The project leader is able to promote good quality research and innovation.
EnL3=The project leader encourages creative researchers.
EnL4=The project leader is effective in using ICT for research and innovation management.
EnL5=The project leader has the quality of a broker to create a linkage between teaching, research, and innovation.
EnL6=The project leader is very good at team building.
EnL7=The project leader injects tension into his/her research team to come up with innovative ideas.
EnL8=The project leader is good at using the structure of the college to address challenges to research and innovation activities.

As enabling leaders, project leaders should inspire, motivate, and encourage their research teams to creative conduct. As depicted in Table 5.11, the majority of participants (87%) disagreed while 12.9% agreed on project leader competency to motivate research teams to sterling performances with their research project activities. 76.5% of participants disagreed

while 23.6% felt inspired by project leaders to engage in creative research conduct. Project leaders should be good at team building, promote good quality research conduct for innovative outcomes and use information technology applicably in research endeavour. Among the participants, 70% disagreed while 30% agreed on project leaders' competencies to establish research teams constructively, 70.5% disagreed while 29.4% agreed on project leaders' qualities to manage research activities to good quality outcomes and 70.5% of participants disagreed while 29.4% agreed on project leaders' capacity to motivate the application of technology appropriately.

Project leaders should also have broker qualities insofar as arranging that teaching, research, and innovation are integrated though the majority of participants (86.6%) disagreed while 13.4% agreed on project leaders' intent to ensure that research and innovation transpires into tuition to students. When there are problems that need urgent or innovative solutions, project leaders should inspire their team members to provide new and innovative ideas, though the majority of participants (90%) disagreed while a minority (10%) was satisfied with leadership actions to inspire team members to sterling performances. To address the challenges relating to budget and research infrastructure to contribute to knowledge and technology for improved societal functioning, project leaders should apply the research governance structure of colleges. In this regard, 75.8% of participants disagreed while 24.1% agreed on project leadership capacity to respond adequately to the challenges of research endeavour using administrative leadership at Fignu University.

Competency of research leaders at project level to manage research and innovation - a critical interpretation

Critically analysing the findings on administrative, adaptive and enabling leadership at project level, it is clear that the research projects encounter inadequacies in research and innovation project management and leadership. Project leaders should be competent in setting practical objectives for the research and innovation projects while managing research project conduct to satisfactory outcomes though 79.5% of participants believed project leaders were not able to set realistic objectives for their projects. In order to plan and implement the research and innovation projects effectively, project leaders should be competent in research and innovation project management although 87.6% of participants indicated that the project leaders were not competent in research and innovation project management. As adaptive leaders, the project

leaders should be competent in leading research and innovation projects to be aligned to the needs of the University, the local community and industry though more than 80% of participants indicated that the project leaders were not able to engage in effective research leadership to answer to the needs of the University, the local community and industry. To develop researchers' level of productivity with their research and innovation project research involvement, project leaders should motivate their research teams and inspire motivated and creative researchers to outstanding performance but 76.5% of participants were of the opinion that project leaders were not competent in enabling leadership at project level at Fignu University.

Considered comprehensively, the major goal of research and innovation projects are to contribute to either theoretical knowledge to address shortcomings with regard to discipline-based knowledge or practical knowledge and the right technology to address institutional, industry and national problems, and to prepare competent graduates for university, industry or other employment. In this regard, the contributions of the research and innovation projects of Fignu University are presented next.

The contributions of the research and innovation projects of Fignu University for improved internal and external functioning

Table 5.12 provides the data collected using the questions in Part IV of the structured questionnaire where participants indicated the extent to which research and innovation projects at Fignu University contribute to research outcomes for improved functioning internally and externally (Appendix F).

Table 5.12: The contributions of the research and innovation projects of Fignu University

Items				Ct1	Ct2	Ct3	Ct4	Ct5	Ct6	Ct7	Ct8	Ct9	Ct10	Ct11	Ct12	Ct13
Contributions of the projects	insignificant	1	N	40	51	26	33	48	43	33	18	34	22	30	27	30
			%	23.5	30.0	15.3	19.4	28.2	25.3	19.4	10.6	20.0	12.9	17.6	15.9	17.6
		2	N	55	47	70	52	41	60	47	40	53	40	44	44	34
			%	32.4	27.6	41.2	30.6	24.1	35.3	27.6	23.5	31.2	23.5	25.9	25.9	20.0
		3	N	55	55	57	70	61	58	81	69	56	59	67	46	65
			%	32.4	32.4	33.5	41.2	35.9	34.1	47.6	40.6	32.9	34.7	39.4	27.1	38.2
		Sub total	N	**150**	**153**	**153**	**155**	**150**	**161**	**161**	**127**	**143**	**121**	**141**	**117**	**129**
			%	**88.3**	**90**	**90**	**91.2**	**88.2**	**94.7**	**94.6**	**74.7**	**84.1**	**71.1**	**82.9**	**68.9**	**75.8**
	significant	4	N	13	8	12	15	15	6	6	34	27	35	28	37	31
			%	7.6	4.7	7.1	8.8	8.8	3.5	3.5	20.0	15.9	20.6	16.5	21.8	18.2
		5	N	7	9	5	0	5	3	3	7	0	13	1	16	10
			%	4.1	5.3	2.9	0	2.9	1.8	1.8	4.1	0	7.6	.6	9.4	5.9

		6	**N**	0	0	0	0	0	0	0	2	0	1	0	0	0
			%	0	0	0	0	0	0	0	1.2	0	.6	0	0	0
		Sub total	**N**	**20**	**17**	**17**	**15**	**20**	**9**	**9**	**43**	**27**	**49**	**29**	**53**	**41**
			%	**11.7**	**10**	**10**	**8.8**	**11.7**	**5.3**	**5.3**	**25.3**	**15.9**	**28.8**	**17.1**	**31.2**	**24.1**
	Total		**N**	170	170	170	170	170	170	170	170	170	170	170	170	170
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

1=no contribution, 2=very low contribution, 3=low contribution, 4=average contribution, 5=high contribution or 6=very high contribution

Ct=Contribution

Ct1=To what extent do you feel that the research projects you have engaged in so far have contributed to address the problems of the local community?

Ct2=To what extent do you feel that the innovation projects you have engaged in so far have contributed to solve the problems of the local community?

Ct3=To what extent do you feel that the research projects you have engaged in so far have contributed to address the university's own internal problems?

Ct4=To what extent do you feel that the innovation projects you have engaged in so far have contributed to address the university's own internal problems?

Ct5=To what extent do you feel that the research projects you have engaged in have contributed to fill the knowledge or technology needs of the country?

Ct6=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the technological advancement of the country?

Ct7=To what extent do you feel that the research projects you have engaged in so far have contributed to the knowledge-based economy of the country?

Ct8=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the knowledge-based economy of the country?

Ct9=To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the university?

Ct10=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the university?

Ct11=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the industry?

Ct12= To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the nation at large?

Ct13= To what extent do you feel that the innovation projects of your team have contributed to the human capital development of the nation at large?

The fourth aim of this study was to examine the extent to which contributions of research and innovation goals address institutional, local and national problems. In this regard, participants were requested to indicate the extent of contributions of their research and innovation projects to address the problems of the local community and the University. The contributions of the research projects were insignificant to address the problems of the local community (88.3%) and the University (90%). This implies that the contributions of the projects were significant to address the problems of the local community (11.7%) and the University (10%). The contributions of the innovation projects in terms of research outcomes were insignificant for local community development (90%) and for University improvement (91.2%) implying that research outcomes' significance for the local community were 10% and for the University 8.8%. Regarding the contributions of the research projects to fulfill the technology needs of the country, the majority of participants (88.2%) indicated that the contributions were insignificant

and a minority of 11.8% indicated that the contributions were significant to address the knowledge and technology inadequacies of the country.

The contributions of the innovation projects for technological advancement of the country were perceived insignificant to the vast majority of participants (94.7%) and significant to only 5.3% of participants. The contributions of the research projects towards developing a knowledge-based economy for the country were insignificant for 94.6% of participants and significant for only 5.4% of participants. The contributions of the innovation projects for the economy of a knowledge-based society were insignificant for the majority of participants (74.7%) and significant for only 25.3% of participants. With regard to the contributions of the research projects to human capital development for University employment, the majority of participants (84.1%) indicated that the contributions were insignificant and 15.9% indicated the contributions to be significant. With regard to the contributions of the research projects to the human capital development of the country, 68.9% of the participants stated that the contributions were insignificant while 31.1% saw the contributions as significant. With regard to the contributions of the innovation projects for human capital development for employment at University, industry and the country in non-specific employment positions, the two categories of participant opinion indicated that the contributions for the University were insignificant (82.9%) and significant (17.15%), the contributions for industry were insignificant (71.1%) and significant (28.9%), and the contributions for the country were insignificant (75.8%) and significant (24.2%).

Table 5.13 represents the data collected using a checklist with indicators pertaining to the five-year annual performance reports of Fignu University for the period 2012/13 to 2016/17 entailing the contributions in terms of research outcomes of research and innovation projects (Appendix H).

Table 5.13: Achievements in different areas as contributions to the research and innovation projects

S/N	Planned and achieved activities	Academic years				
		2012/13	2013/14	2014 /15	2015/16	2016/17
1	Number of research projects planned to be completed	N/A	N/A	N/A	80	N/A
2	Number of research projects completed	N/A	N/A	N/A	80	N/A
3	Number of technologies planned to be transferred	13	N/A	N/A	1	4
4	Number of technologies transferred	13	7	N/A	5	6

5	Number of articles planned to be published	N/A	N/A	N/A	N/A	350
6	Number of articles published	N/A	N/A	N/A	N/A	380
7	Number of collaborations and partnerships planned	4	12	12	4	60
8	Number of collaborations and partnerships achieved	7	8	12	4	64

Key: N/A- Not Available in the report.

Sources: Fignu University Annual Performance Reports (2012/13-2016/17)

As shown in Table 5.13, Fignu University had some achievements in terms of research collaborations and partnerships with local and international organisations. Completed research projects and published articles in peer-reviewed journals in 2016/17 are encouraging. Data for the period 2012/13-2015/16 were not available in the performance reports of the University. There were technology transfer efforts though they were not consistent and progressive as the budget allocations. There were no data regarding graduated postgraduate students which complicates judgement on University contribution in terms of producing skilled human capital.

To understand the performance of leadership and management of research and innovation policy and practice at Fignu University comprehensively as this performance manifests in functioning at university, college and project level, the results of the qualitative and quantitative data on Fignu University are integrated and discussed next.

5.2.4 An integrated interpretation of the results of the qualitative and quantitative data

As discussed in paragraph 4.6.2, the rationale to integrate the quantitative and qualitative data was to explore and explain complex research questions that cannot be answered using either quantitative methods or qualitative research methods, and to understand the research problem comprehensively. In doing so, the results of the qualitative data collected by document analysis and semi-structured individual interviewing are integrated with the results of quantitative data collected by the structured questionnaire and document analysis.

The results of the qualitative data from the document analysis with regard to vision, mission, objectives and priority areas revealed that there were differences and similarities between the national STI policy, the framework for higher education research and technology transfer, and Fignu University research thematic areas document. It was also found that the focus of the

research and innovation leadership and management among the three policy documents were different. The results of the qualitative data from the semi-structured individual interviewing revealed that the research thematic areas document of Fignu University was developed in consultation with many of the national policies, and the thematic areas of the University were developed in line with national priority areas though there was not a research strategic plan prepared separately. The results from the quantitative data indicated that three quarters of the participants agreed on the development of the research thematic areas of the University as per national policies (77.1%) and national priority areas (72.3%). However, the results of the qualitative data contradicts the results of the quantitative data more than three quarters of the participants (78.2 %) agreed about the presence of a research strategic plan while the qualitative data revealed that there was no research strategic plan at Fignu University. Regarding implementing the research priority areas of the University at college level, the results of the qualitative data showed that the colleges did not have their own priority areas, whereas among the participants, 61.8% agreed while 38.2% disagreed on the research management of the colleges as per the University research thematic areas.

As competent administrative leaders that strive to translate the research priority areas of the University into practice, leaders at university, college and project level should be effective in managing the research and innovation projects. However, the results of the quantitative data showed that more than three quarters of the participants (76.4%) disagreed that the research leaders at university and college levels and the project leaders were not competent at research and innovation project management. Concurring with the quantitative results, the results of the qualitative data from individual interviewing and from the open-ended questions of the structured questionnaire revealed that there were shortcomings with regard to the capacity of leaders to manage research and innovation projects at university, college and project level insofar as aligning research endeavour with the real needs of the local community, the University, industry, and the country.

As adaptive leaders, the research and innovation leaders of Fignu University on different levels of governance should lead the research and innovation projects to be aligned to the demands of the local community, the University, and the country. The results of the quantitative data at university level showed that more than two thirds of participants (69.5%) felt that the research leaders were not competent at leading the research and innovation projects in line with specific contexts and real problems to be solved. Similarly, the results of the qualitative data showed

that the research and innovation projects were in line with the thematic areas of the University, but they were not aligned with the real problems encountered at the local community, industry, and the University itself. The qualitative data collected from the community leaders also indicated that there were real and specific problems related to agriculture, education and health that were not addressed by the research and innovation projects of Fignu University.

At college level, the results of the quantitative data showed that more than three quarters of the participants (78.5%) believed that the research leaders were not competent at leading the research projects to address the teaching-learning problems of the colleges, and the problems of the local community insofar as producing new knowledge for the socio-economic development of the country. The results of the qualitative data showed that the leaders did not arrange for any research and innovation projects to address their own teaching-learning problems. However, they have tried to address some of the problems of the local community like infant mortality, agricultural productivity and animal nutrition. At project level, the results of the qualitative data from the open-ended questions and individual interviewing revealed that there were problems in identifying real research problems and undertaking research to address problems of the local community, the University and industry as the academic researchers believed that research and innovation activities were additional burdens added to their teaching function. The results from the quantitative data confirmed that project leaders were not leading the research projects to produce new knowledge to address the challenges of industry, the local community and the University as indicated by more than 80% of the participants. The results of the quantitative data also indicated that the project leaders were not effective in leading innovation projects to solve local and national problems and to commercialise research outcomes as opined by more than 81% of participants.

In improving the research and innovation policy and practice of Fignu University by practising leadership as a process focused on continuous betterment, leaders at different levels of University governance should take actions based on learning, creativity and adaptability for improved performance though the majority of the participants felt that leadership did not engage in such activity at university level (80.1%), at college level (86.4%) or at project level (91.5%). The results of the qualitative data from individual interviewing showed that the culture of learning, creativity and adaptability was not developed well. Leaders should also accommodate emerging ideas engendered by dynamic interactions within and outside the University to adjust the research and innovation leadership practice though 82.3% of the

participants believed that the leadership at university level was not able to engage in such endeavour. University research leadership practice changed from small-scale basic research into interdisciplinary applied mega research though this move emerged from the interactions within and adapted from other universities as conveyed by the results of the qualitative data both at university and college level but with 87.7% of the participants believing that this change has not been implemented adequately at college level. However, at project level, the change from small-scale basic research to interdisciplinary endeaovur was perceived as prescription from top-bottom actions by the research leaders of Fignu University.

As enabling leaders, the research leaders at different levels of governance at Fignu University should create enabling conditions. Among the key conditions for quality research and innovation undertaking, the leaders should allocate adequate budgets. However, the results of the qualitative data at different levels revealed that there was a lack of having adequate budgets. The results of the quantitative data at university level also disclosed that more than 83% of participants felt that adequate budgeting for research and innovation projects was a fallacy. To create enabling conditions at university, college and project level, research leaders should facilitate interactions and interdependence among researchers, industry, government, the local community, and project beneficiaries through establishing a functional innovation system at the University though the vast majority of participants (93%) opined that this was not happening. The results of the qualitative data revealed that although the University had a structural arrangement to work with industry, there were no well-established functional innovation system arrangements addressing this intent.

Generally, the main objective of research and innovation leadership and management at Fignu University was to contribute relevant knowledge, the right technology and competent human capital to address the problems of the local community, the University, industry and the country at large. In this regard, the results from the qualitative data revealed that there were some contributions to the local community in reducing neonatal death and in providing improved crop varieties to improve agricultural productivity. The results of the quantitative data from the document analysis of the annual performance reports of Fignu University indicated that there were some contributions in terms of technology and knowledge transfer as shown in Table 5.13. However, the results of the quantitative data from the structured questionnaire depicted that the contributions were in general insignificant as stated by more than 88% of the participants as shown in Table 5.12.

5.3 RESEARCH AND INNOVATION LEADERSHIP AND MANAGEMENT AT SEGNU UNIVERSITY

5.3.1 Profile of the research site as a second-generation university in Ethiopia

Established in 2007, Segnu University is one of the second-generation universities in Ethiopia. It operates on one campus, and has been teaching, undertaking research and providing community engagement in ten colleges. In its teaching functions, it has 53 undergraduates, 43 masters and two doctoral programmes. The vision of the University is to become one of the best universities in Ethiopia by 2020 (Segnu University, 2018:1).

To understand the performance of the research and innovation leadership and management of Segnu University at policy and practice level, both qualitative and quantitative data were collected using document analysis, semi-structured individual interviewing, and a structured questionnaire. The findings from each method are presented separately and integrated at the end.

5.3.2 Results of the qualitative data analysis

The research findings from the document analysis are provided, followed by the research findings from the semi-structured individual interviewing, with data from the open-ended questions of the structured questionnaire incorporated into the data from interviewing.

5.3.2.1 Results from document analysis

This sub-paragraph focuses on the analysis of the research policy document of Segnu University in line with the guiding questions developed for document analysis (Appendix H).

Segnu University research policy

The results of the document analysis are presented comparing the vision, mission, objectives and priority areas of the national STI policy and the national higher education research and technology transfer framework with the vision, mission, objectives and the priority areas of Segnu University. In this regard, the research and innovation leadership and management

discussions of the national policy documents and of the University research policy document are compared.

Performing an analysis of the policy documents, it was found that Segnu University had a research policy and some guidelines on research conduct. However, the research policy of Segnu University did not have a vision while the STI policy focused on transferring foreign technology and the framework for higher education research and technology transfer focused on producing knowledge and transferring technology. It was found that the University research policy did not have a mission, whereas the national STI policy mission focused on foreign technology transfer for manufacturing and service-providing enterprises. It was found that the mission of the framework for higher education research and technology transfer document emphasised addressing the development problems of the country by developing the research and technology transfer capacity of higher education institutions as discussed in paragraph 5.2.2.1.

With regard to an analysis of the objectives of the three policy documents, the national STI policy emphasised establishing a national innovation system by creating linkages with national key stakeholders. One of the objectives of the research and technology transfer framework for higher education was to "*create and strengthen external linkages that enable universities to conduct collaborative research and technology transfer"* (MoE, 2016:14). Different to the national STI policy's focus on liaison with stakeholders, the Segnu University research policy did not have any objective on establishing a University innovation system collaboratively with its local key stakeholders like the government, industry and the community. One of the objectives of the research policy of Segnu University related to the national STI policy objective, namely of developing the capacity of the University to adapt and transfer technology. Although one of the objectives of the national STI policy emphasised science and technology capacity development, this relates to knowledge development because science capacity refers to the ability to produce scientific knowledge through research which is equivalent to technology capacity as the ability to translate the scientific knowledge into technology transfer to address real problems that requires research.

Unlike its vision that concentrated on transfer of foreign technologies, one of the objectives of the national STI policy emphasised developing, transferring and commercialising indigenous knowledge and technology. One of the focuses of the research and technology transfer

framework for higher education suggests that higher education institutions be custodians for indigenous knowledge and technology through research, protection and utilisation of indigenous knowledge. The University research policy, however, focused on adapting and transferring foreign technology to address local problems though one of the main functions of the University was to produce new knowledge and develop the right technology that fits the specific needs of the local community. The Segnu University research policy has important elements that are not emphasised in the national STI policy objectives relating to improving the quality of education at all levels of learning including the curriculum, and teaching and learning while the framework document focused on higher education tuition exclusively. The direction and strategies of the STI policy are technology transfer, human resource development, research, university-industry linkage, and embracing an intellectual property system (FDRE, 2012:5). It was found that Sengu University research policy has its own priority areas that agreed with the priority areas of the national STI policy like technology transfer and tuition for human resource development though the University gave higher priority to applied research, knowledge and technology transfer.

In reference to the analysis of the three policy documents regarding research and innovation leadership and management, it was found that the research policy of the Segnu University emphasised research management (Segnu University, 2011:6-11,13). However, it was found that research leadership and innovation leadership and management were not discussed in the research policy document of Segnu University. The national STI policy document focuses on financial management for stakeholders who engaged in technology transfer effectively. With regard to research budgets, it was found that the research and technology transfer framework for higher education institutions suggested that higher education institutions should allocate "*at least 5% of their total annual budget for research"* (MoE, 2016:64). Both the framework for higher education research and technology transfer document and the University research policy did not discuss a budget for innovation purposes.

From the analysis of the three policy documents, namely the national STI policy, the framework for higher education research and technology transfer and the research policy of Segnu University, it was found that there are inadequacies between the national policy documents and the Segnu University research policy document. In order to understand the actual practice of research and innovation leadership and management at Segnu University, qualitative data was collected through semi-structured individual interviewing and answers to

open-ended questions in the structured questionnaire were incorporated into the data from individual interviewing. The findings from this data are presented next.

5.3.2.2 Results from the semi-structured individual interviews

The qualitative data from individual interviewing was collected from 12 participants at Segnu University, and two community leaders at zone level, and two industry managers around the University. To ensure confidentiality, anonymity and confidential discussion when using verbatim excerpts to show important findings, participants were represented using labels similar to Fignu University as discussed in paragraph 5.2.1.2, namely RLU1 to RLU3 for research leaders at university level, RLC1 to RLC3 for research leaders at college level, PL1 to PL3 for project leaders, CI1 to CI3 for co-investigators, CL1 to CL2 for community leaders and IM1 to IM2 for industry managers. The results of the qualitative data from the individual interviewing of the participants at university, college, project level, and from the community leaders and industry managers are analysed and synthesised under administrative, adaptive and enabling leadership.

Administrative leadership at university, college and project levels

Research leaders at university level are responsible for facilitating the formulation and implementation of the research policy of the University in line with the higher education research and technology transfer framework and the national STI policy. One of the research leaders at university level confirmed that "*the institution's research policy and guidelines are related to the national research policy but are improved based on the contexts of the environment and the standard of the university"* (RLU1). The other research leader at university level commented on the influence of change on national research policy level and the lack of response to these changes at institutional level. The research leader explained:

> *"Even the national policies are changed from time to time considering the actual change of the national issues. We have now to change our research policy and guidelines but that is not the case in our university" (RLU2).*

Based on the research policy of the University, the research leaders, in collaboration with key stakeholders, have to develop a research strategic plan so that everyone can have a shared vision

and joint goals. The research leaders were asked if the University had a strategic plan for its research and innovation activities. Three of the research leaders (RLU1, RLU2 & RLU3) answered that the University had a five-year strategic plan that was developed for all the functions of the University, and that the research and community engagement vice president's office partake in this University strategic plan. However, one of the research leaders commented on the discrepancy between the two documents of the University, namely the research policy and the strategic plan. The leader described:

> "*The university research policy was developed before seven years and the strategic plan was developed after the development of the research policy. What I was expected that the research policy should be amended while the strategic plan is implemented, that is the gap*" (RLU2).

The University research priority areas should also be aligned to the national STI policy priorities. One of the research leaders responded that the University had six thematic areas like quality education, food security, technology transfer, ecotourism, alternative power and cross cutting issues. These thematic areas are determined based on the socio-economic and political status of the zone, the region and the country having discussions with the University community, based on a need assessment of the community and finally approved by the University board. One of the leaders confirmed the match between the national and the University priority areas but disclosed the implementation shortcomings related to not having realised set goals yet. The leader described:

> "*Our priority areas are in line with national priority areas. We know that thematic areas should be revised every five years, but we did not revise because still they are the basic needs of the society as we could not solve the problems of the community*" (RLU1).

However, leader RLU2 stated that, though the priority areas of the University were not formally revised yet, to get some additional inputs for the new mega research approach, a needs assessment was done in 2017 and shared with all researchers.

As administrative leaders, college level research leaders should also select their own priority areas in line with the priority areas of the University. In this regard, two of the leaders pointed

out that the colleges did not have their own priority areas. One of the leaders stated that the priority areas of the college were some of the priority areas of the University. The project leaders should also select appropriate research and innovation themes or research problems in line with the priority areas of the colleges. The project leaders and co-investigators were questioned about priority area setting, and they answered that research themes were determined by the University and based on the interests of the University. After being informed about the research theme, the research project leader should select and establish a research team with the required qualifications, skills, and expertise in the designated research area. In this regard, project leaders and co-investigators confirmed that the team members were selected based on the interest of the project leader and co-investigators, and the know-how regarding the project idea and experience in undertaking research. However, one of the project leaders described friendship as the main criterion for team selection because "*I give due attention for friendship particularly"* (PL1).

To translate the priority areas of the University into practice, the research leaders at different levels of governance at Segnu University are responsible for managing research project identification, planning, implementation, and innovation. In this regard, leaders RLU1, RLU2 and RLU3 claimed that each proposal should be written by starting with the research problem that the researchers identified and should be related to the thematic areas of the University, evaluated at department and college levels and approved by the standing committee at university level. The budget should then be allocated after which implementation follows. However, leader RLU2 indicated that the evaluation for mega thematic interdisciplinary research proposals was centralised with RLU1 admitting shortcomings of the research management of the University relating to a lack of monitoring and control because "w*e are not doing the monitoring and evaluation activities in a strong way. We follow up if the money is utilised properly or not but we have gaps to follow up the activities seriously"* (RLU1). In this regard, college level research leaders RLC1, RLC2 and RLC3 answered that they tried to facilitate researchers' proposals with researchers submitting and defending their proposals at college level, which, after evaluation, the successful research proposals are submitted to the University research directorate. Project leader PL2 judged the selection of research thematic areas and the practice at university and college levels as subjectively marginalised endeavours for research conduct because:

> "*We are doing very marginalised research as the stakeholders did not activity involved in selecting thematic areas of the university rather the leaders of certain offices may raise some issues and taken as thematic areas. But they could not really raise the real problems of the local community in the zone as they were subjective*" (PL2).

According to the co-investigators, most of the time the research expected to be conducted are determined at university level because, when proposals are approved at university level, research leaders modify or ask researchers to modify their proposals, and adapt or change the title to be aligned to the general thematic areas of the University. As a result, researchers do not have much authority to decide about the topics to be researched.

While implementing the research and innovation projects, research leaders at Segnu University should manage the progress of the projects. Leaders at university level explained that they request progress reports, and perform some supervision, field visits, and discussions with the beneficiaries. Similarly, research leaders at college level reported that they request progress reports and periodically have meetings to follow up on the research process and to evaluate the progress of the projects with the research team. While monitoring implementation, leaders are also expected to manage the quality of the research and innovation projects. Regarding this, the leaders at college level responded that they try to manage the quality of the projects by evaluating the research process from the beginning to the end in teams that comprised of representatives from each department at college level. In this regard, one of the project leaders and the co-investigators explained the challenges relating to providing good quality research and questioned the intentions of leaders and researchers to maintain good quality research in the face of lacking criteria to evaluate good quality conduct. Co-investigator CI2 described, "*We try but there is no such hard and fast rule to manage the quality of the research projects. We use procedures, but we do not have specific criteria to maintain the quality of the projects*" (CL2). According to project leader PL2, the problem with producing good quality research pertains to limited hours for research endeavour, because "*We are teachers and even we have some position. We are expected to engage in research only 25% of our time and we are facing some problems about the quality of the work*" (PL2).

To manage the quality of the projects, leaders at Segnu University are expected to manage the implementation of success criteria of the projects. In this regard, leaders at university, college

and project level reported that they do not have any measurable success criteria. However, leader RLU1 disclosed the trial and error success criteria arrangement used to monitor research and innovation project implementation relating to attempting to avoid misfits between community needs and real research conduct. The leader stated:

> *"If we conducted a research whose outcome was accepted by the community that was one of the mechanisms to check success of the implementation of the research projects. In this regard, we adapted some vegetables and disseminated to the community but failed to be accepted as the vegetables were not familiar with the feeding culture of the community. Whereas, the communities were interested in the outcomes of other research projects and collected chaff, pond fishing, and crops like maze and malt barely, and bread wheat"* (RLU1).

This confirms that there are inadequacies in funding research projects by assessing their feasibility and relevance for beneficiaries during project progression.

To implement the projects effectively, research leaders at Fignu University are responsible for managing resources like the researchers and the financial and material resources of the projects that are available and that will be required. In this regard, leaders at university level stated that the amount of money for each phase is released based on the performance and progress reports of the researchers at college level. However, leader RLU2 questioned the purpose of evaluating the quality of the performance management of the college level leaders because "*how much the research and community engagement coordinator of the respective college follows up and evaluates the status of the work properly is questionable for me"* (RLU2). At college level, leaders RLC1 and RLC3 described that managing the human, material, and financial resources is the mandate of the project leaders, whereas leader RLC2 ascribed this function to the University managers in that *"the university research managers manage the financial and material resources centrally"* (RLC2*).*

With regard to the difficulty of managing the researchers, one of the project leaders emphasised the prolonged nature of the challenge insofar as "*managing the researchers is our problem and still we are facing this problem*" (PL2). To manage the researchers to be effective in their research and innovation engagement, leaders should manage their performance. In this regard, one of the leaders responded to the way of carrying out this performance management task,

stating that, "*they submit reports on their accomplishment, challenges and problems, and I check communicating with the project leaders and the co-investigators*" (RLC1). In this regard, project leader PL1 described the persistence and lack of visible successes with these challenges *"a very serious problem, we may blame each other that we are not actively engaged in the research but there are no clear-cut criteria to evaluate our active engagement in research projects*" (PL1).

Sharing a similar experience with PL1, co-investigator CI2 commented, *"We do not have criteria for evaluating the performance of researchers, other than simply based on moral and mental agreement believing that we have to be involved actively"* (CI2). In addition to managing the performance of the researchers, the project leaders should also manage conflict arising in their teams. The project leaders stated that conflict is a natural phenomenon which could be resolved through discussions and through managerial measures incorporating mediators.

Leaders are not only responsible for managing research conduct but also the application of the research outcomes to the genuine solving of encountered problems as research managers are also innovation managers. It was clear from the interviews that research outcome application to solve real problems does not occur because, according to leader RLU2, "*there were 300 research outputs since the establishment of the university though very small of them were changed into projects and implemented"* (RLU2). With regard to managing the development of innovation projects from the completed research projects, leaders at university level said that, like research project proposals, based on competition, they had considered some research findings that had value or impact for the community and for industry. The selection of the best research outcomes begins at college level by the research and community engagement coordinators and is finalised at university level, and finally a budget would be allocated and implemented by the researchers at college level with the help of the community engagement directorate. Research leaders at college level claimed that researchers had developed innovation projects based on their research findings but they did not implement the projects due to the lack of relevance of the research outcomes to the end users and because of budget constraints.

To address the research and innovation management shortcomings at Segnu University and to make the research and innovation projects relevant to the end users, research leaders at different levels of governance should use adaptive leadership that emphasises leadership engagement

based on specific contexts and leadership conduct as a process. Results of the qualitative data regarding adaptive leadership follow.

Adaptive leadership at university, college and project level

The research and innovation projects of Segnu University should be aligned to the context of the local community problems, the problems of the University, industry and the country. In so doing, leaders of the University should use adaptive leadership. In this regard, leaders were asked about how they lead research policy implementation at the University in line with the specific context of each stakeholder. Leader RLU1 stated that one of the functions of the University is to rather proactively act on the needs of the specific community. The leader described, "*the log of the university is from the community to the community, and it has the mandate and the responsibility to serve the community"* (RLU1). Leader RLU2 commented on the shortcomings of the academic researchers in terms of teaching competency, rather than inadequacies relating to adaptive research leadership in researching and improving teaching endeavour. The leader clarified:

> *"We have conducted many researches that are directly in line with the problems of the university like the curriculum, the teaching and learning, and the quality of the building. However, our staffs themselves have a capacity and skill problems to run research-based quality education*" (RLU2).

As an adaptive leader, one of the leaders at college level commented on waste management as a research problem they identified with the intention to solve the problem. The leader described:

> "*The selected research is on integrated solid waste management systems. Urban and industrial wastes are problems in our town. We have wastes from industries and from the urban. And I believe we will solve the problem of the local community in this regard*" (RLC1).

Leader RLC2 disclosed the inefficiencies in leading the research projects according to the seriousness of the specific problem for the University and the broader community. He described as follows: "*We have many problems within the organisation and around. So if*

problems are problems really, we should do more according to the intensity of the problem but not" (RLC2). In using adaptive leadership, project leader PL2 reacted on how the research problem was identified by reading about the matter. The leader stated, "*I read literature on the base of my observation. I shared what I read to my friends so that they agreed to undertake research on this area*" (PL2). Project leader PL1 critically commented on the challenge relating to perceived and actual practice by stating that "*I believe that to certain extent we are thinking that we are touching the problems of the farmers but we have already missed their problems"* (PL1). This confirms that there is an inadequacy in research problem identification to be aligned to the problems of the local community, the University, industry and the nation at large and which needs to be resolved. The zone community leaders also confirmed that there are serious problems related to agriculture and natural resource management, and the quality of education at school. Community leader CL1 described that:

> "*Quality is the basic problem in our education system, and it is associated with input, process and outputs. Teachers are the main input for quality education at any level. We do have different problems regarding teachers' qualifications, teaching competencies, and educational wastages*" (CL1).

Problems of the community relating to agriculture are also "*low productivity due to degradation, acidic soil, and managing natural resources in a sustainable way"* (CL2). The industry managers around the University identified problems relating to industry to be technical and soft skill inadequacies of their employees because of not being issued with skilled graduates from the universities. One of the managers explained the dissonance between the University and industry based on his practical experience in which he questions the industry-related competency of academics. The manager said:

> "*What I am working in this company is not by the skills and knowledge developed from a university. What we learnt in the university and what we are facing technically in the industry is completely different, and I do not think that academics can address this gaps*" (IM1).

Since the problems in the community and in industry are context specific requiring specific knowledge and technology, leaders should choose basic or applied research of an interdisciplinary collaborative nature to produce the type of technology to adopt or adapt in

order to develop new technology to address industry-related problems. In this regard, the leaders at Segnu University were asked about the type of research they preferred to undertake. The leaders at all levels of governance answered that interdisciplinary-applied-mega-research was their current preference as there were many problems with the numerous amount of basic research endeavours conducted at the University, in Ethiopia and in the world. Leader RLU3 stated, "*The main focus was on action research because there were lots of problems of the communities and the industries that required particular solutions" (RLU3).* Leader RLC3 pointed to the contradiction of researchers being involved in basic research albeit the need for applied research, namely "*the researchers focused on basic research, and in the context of the university and the nation at large, the emphasis was on applied research"* (RLC3).

The main goal of undertaking research is to address real problems of the local community, the University, and industry by producing knowledge and skilled human resources as required, developing the right technology, and changing the required behavior for labour force conduct in a knowledge-based dispensation. In this regard, the leaders of Segnu University were asked about the contributions of their research and innovation projects which related to food production albeit financial constraints. Leader RLU2 responded that "*the university had done adaptation of different varieties like barely, wheat, banana, and the like, and distributed quality malt barely, quality banana and other varieties that the community had benefited a lot"*. However, the leader commented that "*the problem is we do have small amount of staff members and agricultural research need high amount of money"* (RLU2). According to a third leader, the community had problems relating to knowledge inadequacies and economy well-being, and there were different agricultural products transferred to the community from which 200 farmers benefited. However, the leader noted that "*we are not able to address the larger community in fact, we are addressing very few"* (RLU3). In contrast, the leaders at college and project level agreed that the outcomes of the research projects were not contributing to societal development because they were conducted merely as a requirement of the University and the research reports *"were left on the shelf"* (RLU3). Leader RLC2 referred to the inadequacies from the side of the University and the researchers. The leader explained:

> "*Researches are conducted and shelved somewhere as there are no controlling and enforcing rules of the university whether they are implemented and contributed to the local community or not. It depends of the interest of the researchers, needs*

incentives for the researchers and budget for implementing the projects. And there should be guidelines to do so "(RLC2).

Despite sharing the shortcomings of commitment of the University to transfer the outcomes of the research projects to the community, one of the project leaders commented on the importance of research projects to improve teaching capacity. The project leader described that "*the first contribution is for the researchers that I got knowledge, experience, and skill. When I give lecture, the research activities I did give me much importance for good teaching*" (PL1). In this regard, one of the research leaders at college level reacted that two research projects were conducted to address some of the teaching problems of the college but the outcomes were not implemented as the researchers asked, "*What are the incentives to me to do so?"* In this regard, one of the project leaders opined that tuition remains the responsibility of lecturers. The project leader explained:

> "*I think this is the responsibility of college of education. We think that we simply teach and do research. We did not do any kind of project to address the teaching problems of the college and the university. But we have projects of action research to address the community problems*" (PL2).

Regarding the contributions of the research and innovation projects of the University to address the problems of the local community, community leaders at zone level reacted that the projects did not make any contributions to address real problems related to quality education, agricultural productivity and natural resource conservation except for different need-based training and material support from the University. In this regard, the industry managers around the University stated that the research projects of the University did not provide any practical contributions to industry. However, industries are contributing to internships and externship programmes for students and academics. One of the managers commented on the quality of the research outcomes of the University relating to studies on animal skin use for leather purposes. The manager stated:

> "*There are some researches done by the University but research for shelf is not important and research has to address problems that organisation is facing. It was completely impractical and not found in the ground. They told us that 90% of this*

> *area skins can be used for high quality leather, even 92%, but what we are getting is not more than 20%"* (IM1).

In order to improve the research and innovation project leadership of Segnu University to contribute to the right kind of knowledge and technology to solve real and specific problems, research leaders should understand that leadership is a process pertaining to constantly obtaining more knowledge through learning, innovation and adapting to change in leadership practice endeavour. Leaders reacted that they were not responsible for the research culture present in current research leadership practice at project, college and university level. One of leaders at college level commented that the culture of research is yet to be established because "*speaking the truth, this culture is at establishment phase"* (RLC2).

To adjust the present leadership practice, leaders should accommodate emerging ideas that resulted from the dynamic interactions within and outside the University. As discussed, Segnu University has moved its research endeavour from small-scale discipline-based research to mega thematic interdisciplinary research. Leaders were asked whether this move emerged from their interactions or was this move directed by University management. In this regard, one of the leaders reacted that "*the leaders proposed to the University's higher management, discussed with senior staffs like PhD holders, and finally the senate decided to be practiced"* (RUL1). The leaders at college and project levels and the co-investigators also confirmed that the change was a top-down decision, which was not from the University but from government. Leader RLU3 stated that "*mega research emerged from experience of some first generation universities that became effective in researching mega problems of the community instead of handling in a fragmented and an ineffective way in terms of human and finance resources"* (RLU3). Leader RLU2 explained the reasons for the move to mega research as pertaining to challenges with managing fragmented research activities with no significant outcomes, namely "*the number of small scale and fragmented research projects were growing year by year that could not be managed easily and bring holistic change in the community"* (RLU2). A research leader at college level opposed the absolute move from small-scale basic research to interdisciplinary mega research without first testing the adequacy of such a move. The research leader suggested that:

> "*Both types of research should be practiced, and the leaders at the university level should not close the room for small scale and discipline-based research, and began*

> *to manage mega research project where they had not first tested it as a pilot"* (RLC3).

In this regard, project leader PL2 criticised the lack of flexibility of research leaders in introducing a mega research approach without sustaining basic research. PL2 explained the challenges observed in mega research projects from his practical experience and the importance of sustaining basic research for breadth and depth of knowledge development. The project leader described:

> "*In agriculture, we believe that some problems require small-scale research. If we do base on the need of the community, the small-scale research can be better than the mega one but the door is closed entirely and open for only mega research project. Also, I am part of a mega research project. The problem I have seen is that there are so many persons, around 36 researchers, but managing those persons is very difficult. There is no communication and there is reluctance to work, and it needs effective principal investigators*" (PL2).

Similarly, one of the co-investigators commented on the lack of authority of research leaders to suggest the sustaining of different research approaches such as small-scale research while introducing a mega research approach. The co-investigator explained:

> "*The decision was not made by the involvement of different stakeholders and did not emerge from the interactions. Rather it was adopted from somewhere by the research managers at university level. I remember there was a recommendation from the standing committee to engage in both small scale and mega researches before moving to the mega research, but the leaders could not listen*" (CI2).

An implication of this lack of flexibility to accommodate both kinds of research endeavour demands that researcher leaders at Segnu University focus on constant learning in order to be creative in their research and innovation leadership practice to ensure their research projects are productive incorporating basic research in mega interdisciplinary research conduct. Research leaders have to exercise leadership as a process to integrate their learning and innovation into administrative (management) leadership. In doing so, leaders should use

enabling leadership. The results from qualitative data from the semi-structured individual interviewing pertaining to the Segnu University case are provided next.

Enabling leadership at university, college and project level

Enabling leadership helps research leaders at Segnu University to create enabling conditions for researchers to engage in their research and innovation projects successfully. In doing so, the leaders at Segnu University should facilitate interactions among researchers, the local community, government, and industry. One of the conditions for interaction is to arrange for education, research and innovation actions to be interrelated. In this regard, a leader commented on the inevitable co-existence of teaching, research and innovation. The leader stated, "*We cannot separate the three things, especially education and research cannot be separated. If there is research, there should be technology innovation or technology transfer"* (RLU1). However, the anticipation that research always results in innovation is not necessarily the case in all situations.

In order to create an effective relationship among education, research and innovation, leaders should facilitate linkage among the University, the local community, industry, and the government. Leaders were asked about how they managed the linkage among these parties. One of the leaders commented on the lack of intent, namely *"very few industries were trying to work with the University while the majority did not"*. The leader explained the reason as relating to industry not valuing what universities can contribute in terms of knowledge and skills, and the engagement of the local community in the linkage.

> "*While we go to industries to make relationships, they do not respect and accept us to work together. They have negative attitude to the university because they believe that universities have null experience and knowledge. And the local communities are not participating in the linkage. But we understand that without the local communities, we cannot go far. We have the beginnings but it is not satisfactory*" (RLU1).

One leader described the only factor for working with industry to be industry's willingness to engage in such a working relationship. The leader explained that "*the university had close connection with industries for students' internship and academic staffs' externship*

programmes for practical attachment, and it has been strongly claimed by the industries that our students lack technical skills" (RLU3).

Regarding the linkage and collaborative leadership among the University, industry the local community and government, the community leaders at zone level and the industry managers around the University commented that they did not have collaborative research and innovation projects and they did not engage in the research and innovation projects of the University. One of the managers from industry questioned the capacity of the University to engage in collaborative research and innovation projects. The manager described, "*We undermine these university academics…. Research has to be practical and understandable, showing the practical way of doing….It has not been ideal"* (IM1). To strengthen and sustain the linkage among stakeholders for mutual benefit, there should be an established and a functional innovation system at the University. Leaders at university and college level replied that Segnu University did not have an established innovation system.

Interrelating education, research and innovation with the active involvement of industry, government, and the community helps to address the challenges pertaining to human resources, funds, skills and technology. Regarding this intent, leaders at Segnu University were asked about the conditions that they facilitated in this regard. Understanding enabling conditions in terms of incentives, leaders RLU1 and RLU3 described that there were very few incentives for researchers so that they are not interested in conducting research and transferring technology. Addressing the research capacity of academics as an enabling condition, a leader stated, "*What we did so far is giving training to the staffs on how to develop grant research proposal for funding. However, international linkage of our university is very weak" (RLU2).* The leaders at college level answered that they do not have any special conditions that they arrange for research, except for three credit hours workload reduction for project leaders. As enabling leaders, the project leaders should facilitate enabling conditions for co-investigators in terms of what con-investigators can do to be effective and productive in their research and innovation project engagement. In this regard, one of the project leaders responded by pointing to his endeavours of sharing experience and engaging in dialogue with his researchers:

> "*As principal investigators, making the conditions fair and friendly for the researchers is unusual and uncommon. The only thing that I can do for the co-investigators is sharing my experience and consulting them. I have not arranged any*

conditions to take training. Even the three credit hours' load reductions are not mandated to the co-investigators" (PL1).

In order to facilitate conditions conducive to research conduct for co-investigators, project leaders should have personal qualities and competencies. However, one of the project leaders commented that "*the university did not have much attention as what quality should the principal investigators possess. There were no criteria and nobody assessed if they have managerial and research skills, and research experience or not"* (PL1). According to project leaders and co-investigators, project leaders should be hardworking people, should have good leadership qualities, should have experience in research and in teaching, should have skill in coordinating and managing co-investigators, and should be committed to the research project. From the results of the qualitative data analysis, it was found that there were efforts and shortcomings in exercising administrative, adaptive and enabling leadership with the research and innovation leadership and management conduct at Segnu University. Participants partaking in individual interviewing and who have completed the open-ended questions of the structured questionnaire were requested to indicate the strengths and weaknesses of the leadership and management of research and innovation policy and practice at Segnu University. The results are discussed next.

Strengths and weaknesses with research and innovation leadership and management practice at Segnu University

The results revealed that there are strengths and weaknesses with the research and innovation management and leadership practice at Segnu University. At project level, strengths related to project leaders being committed to implementing research projects within the project timeframe and budget. Project leaders were also good at assigning, reviewing and exchanging tasks. Co-investigators were also willing to undertake research to overcome the teaching challenges they face. At college level, strengths related to the presence of a research coordinator, the commitment of research leaders, team-based approval of research proposals, and good communication between coordinators and researchers. Leaders encouraged academic researchers to participate in interdisciplinary mega research to solve real problems, and to try to change research findings into innovation projects. At university level, strengths are the existence of a research policy and a research unit. Leaders identified informed research

thematic areas for researchers, but these thematic areas are not inclusive although interdisciplinary applied mega research is introduced to solve the problems of the community.

Weaknesses were identified at project, college and university level with regard to research management and leadership practice. At project level, there was a lack of motivation, transparency, cooperation, and experience in doing research encompassing all disciplines. At college level, the main weakness was that research leaders' task description pertained mainly to facilitating information to researchers. Leaders lacked motivation to inspire members to become engaged in teamwork and they lacked commitment and the ability to communicate in clear terms to researchers about advantages and disadvantages pertaining to interdisciplinary research and to staying focussed with regard to carrying out good quality research. There was a problem of selecting the best mega research proposal fairly and there was a lack of effective coordination and monitoring and of establishing networks effectively. There was a lack of application of the research results and an inability to solve societal problems.

At university level, the main problems related to leaders that were incompetent insofar as not having a vision for research conduct and not having adequate research leadership skills in general. Research leaders at university level lacked commitment, experience and skill on how to motivate and inspire researchers. Leaders stuck to government policies as they were ordered rather than generating new ideas and knowledge to address real problems of the community. Leaders lacked the basic and practical knowledge and skills of research and innovation management. Their main weakness pertained to poor planning, poor coordination, poor communication, and poor controlling of research projects. There was a shortage of internal funds with no possibilities of external funding for research projects. There was a lack of well-organised research centres and laboratories and there was no capacity-building training. There was no dedicated and strict monitoring of researchers' activities with the result that the quality of research conduct was questionable with research outcomes not having any meaning for stakeholders.

Suggestions of participants to improve the research and innovation leadership and management practice at Segnu University

In order to overcome the weaknesses and improve the management and leadership practice at project, college and university level, the participants suggested the following.

At project level, it was proposed that project leaders should have experience in doing research and having qualities pertaining to research and innovation project management and leadership. At project, college and university level, it was suggested that the research projects should emanate from real problems of the local community and stakeholders. The University, stakeholders, beneficiaries and researchers should have contract agreements starting with collaborative research problem identification so that beneficiaries can use the outcomes of the research projects and implement them easily. As research leaders have not received any training related to their position, it was suggested that training that refreshed and increased the capacity of research leaders at different levels of governance should be provided. At university level, it was suggested that the research philosophy of the University should entail from the community to the community and should engender practically applied research from the university to the community.

Research leaders at university level should have commitment to research accompanied by appropriate knowledge and skills to engage in successful research and innovation management and leadership. Research leaders should be individuals who are well-qualified with specialised training and significant experience in their areas of research and they should be honest, not subject to corruption, impartial, industrious, exemplary, and innovative. There should be harmony in structures of research and innovation leadership and management among universities to share experience. In this regard, the University should strengthen international partnerships to expand PhD training and create access to research grants so that problems related to skills and budget constraints are addressed. The government of Ethiopia should establish a system that obliges industries to allocate some amount of money from their annual profit to help universities to engage in both effective tuition and research conduct for mutual benefit

In summary, from the results of the qualitative data analysis about the research and innovation leadership and management policy and practice at Segnu University, it was clear that there were efforts taken to improve research conduct albeit encountering challenges with this conduct. To understand and confirm the research and innovation management and leadership conduct at Segnu University at policy and practice level, quantitative data were collected using a structured questionnaire with document analysis of the five-year annual performance reports of Segnu University (Appendix F & H). The results are presented next

5.3.3 Findings of the quantitative data analysis

Of the total of 89 participants at Segnu University approached to complete the structured questionnaire, 75 (84.3%) returned the completed questionnaire. Table 5.1 represents the demographic information of the participants who returned the questionnaire.

Table 5.14: Demographic information of the research participants at Segnu University

Demographic information	Categories	N	%	Demographic information	Categories	N	%
Gender	Male	70	93.3	Experience in the specific position	1-3 years	30	40.0
	Female	5	6.7		4-6	28	37.3
	Total	75	100		7-10	5	6.7
Qualification	PhD	15	20.0		Above 10	2	2.7
	MA/MEd/MSc	60	80.0		Not indicated	10	13.3
	Total	75	100		Total	75	100
Academic ranks	Professor	0	0	Total years of work experience as an academic	1-5 years	2	2.7
	Associate professor	3	4.0		6-10	46	61.3
	Assistant professor	15	20.0		11-15	9	12.0
	Lecturer	57	76.0		16-20	0	0
	Total	75	100		Above 20	7	9.3
Training related to responsibilities	Yes	15	20.0		Not indicated	11	14.7
	No	60	80.0		Total	75	100
	Total	75	100				

As depicted in Table 5.14, male researchers (93.3%) were the main participants compared to female researchers (6.7%) at Segnu University. Among the researchers, there were no professors, and only 4% were associate professors and 20% assistant professors. Most of the researchers had lecturer academic ranks (76%). In terms of qualification, only 20% of the participants had doctoral degrees whereas 80% held master's degrees. Regarding getting training in relation to their specific position, 80% did not get training while 20 % did. With regard to the experience of academics in their specific position, 40% had one to three years, 37.3% of them had four to six years, 6.7% of them had between seven to ten years and 2.7% of them had above ten years work experience in their current position. 13.3 % of the academics did not indicate their work experience in the specific position. Regarding total years of work experience as academics, it was found that 2.7% of them had one to five years, 61.3% had six to ten years, 12% of them 11 to 15 years, and 9.3% of them had above 20 years of work experience. 14.7% failed to indicate their total years of work experience as academics. From the demographic data, it is clear that the majority of researchers and research leaders at Segnu University were males and relatively young in their specific positions and lacked academic work experience in general. This possibly hampered their competency with research conduct

based on a lack of a reasonable number of years' experience needed to be competent in research and innovation project management and leadership.

To describe the research and innovation leadership of Segnu University at both policy and practice level, quantitative data was collected at university, college and project level governance using the structured questionnaire comprising foci on administrative, adaptive and enabling leadership. The findings regarding administrative leadership at university level are provided next.

Administrative leadership at university level

Table 5.15 provides the research findings based on the data collected using the structured questionnaire where participants indicated their agreement and disagreement on the practice of administrative leadership at university level (Appendix F).

Table 5.15: Agreement and disagreement of participants on matters pertaining to administrative leadership at university level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14	AdL15	AdL16
Participants having	Disagreement	1	N	6	2	6	2	31	18	6	11	16	14	16	17	15	17	13	12
			%	8.0	2.7	8.0	2.7	41.9	24.3	8.0	14.7	21.3	18.7	21.6	22.7	20.0	22.7	17.3	16.2
		2	N	3	4	4	12	9	9	22	23	20	21	19	15	16	23	17	18
			%	4.0	5.3	5.3	16.0	12.2	12.	29.3	30.7	26.7	28.0	25.7	20.0	21.3	30.7	22.7	24.3
		3	N	10	17	17	15	1	0	22	24	26	30	24	21	26	29	28	19
			%	13.3	22.7	22.7	20.0	1.4	0	29.3	32.0	34.7	40.0	32.4	28.0	34.7	38.7	37.3	25.7
		Sub-total	**N**	**19**	**23**	**27**	**29**	**41**	**27**	**50**	**58**	**62**	**65**	**59**	**53**	**57**	**69**	**58**	**49**
			%	**25.3**	**30.7**	**36.3**	**38.7**	**55.5**	**36.3**	**66.6**	**77.4**	**82.7**	**86.7**	**79.7**	**70.7**	**76**	**92**	**77.4**	**66.2**
	Agreement	4	N	16	33	28	30	1	8	21	13	10	9	13	20	15	5	15	23
			%	21.3	44.0	37.3	40.0	1.4	10.8	28.0	17.3	13.3	12.0	17.6	26.7	20.0	6.7	20.0	31.1
		5	N	32	13	15	13	7	11	4	4	2	1	2	2	3	1	2	2
			%	42.7	17.3	20.0	17.3	9.5	14.9	5.3	5.3	2.7	1.3	2.7	2.7	4.0	1.3	2.7	2.7
		6	N	8	6	5	3	25	28	0	0	1	0	0	0	0	0	0	0
			%	10.7	8.0	6.7	4.0	33.8	37.8	0	0	1.3	0	0	0	0	0	0	0
		Sub-sub-total	**N**	**56**	**52**	**48**	**46**	**34**	**48**	**25**	**17**	**13**	**10**	**16**	**22**	**18**	**6**	**17**	**26**
			%	**74.7**	**69.3**	**63.7**	**61.3**	**44.5**	**63.7**	**33.4**	**22.6**	**17.3**	**13.3**	**20.3**	**29.3**	**24**	**8**	**22.6**	**33.8**
	Total		N	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:
1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree and 6=strongly agree
AdL=Administrative Leadership
AdL1=The research policy of the university is developed in line with national STI and related higher education policies.
AdL2=The research policy of the university incorporates important elements from national, continental and international science, technology and innovation policies.
AdL3=The university research leaders are managing the policy in line with national priority areas.
AdL4=The research leaders are managing the research policy by developing a research strategic plan.
AdL5=The research leaders of the university see the research policy as a finished document.

AdL6=The research leaders influence their followers by controlling their day-to-day activities using the structure of the university.
AdL7=The research leaders are good at developing research capacity of the academics.
AdL8=The research leaders are good at resource mobilization from different sources.
AdL9=The research leaders are effective in managing research projects.
AdL10=The research leaders are effective in managing innovation projects.
AdL11=The research leaders are good at quality control of the research activities.
AdL12=The research leaders are effective in resolving conflicts.
AdL13=The research leaders are effective in managing the performance of the researchers.
AdL14=The research leaders are good at in commercialising the research project results.
AdL15=The leaders are effective in incorporating learning, creativity and adaptability while managing the research and innovation activities of the university.
AdL16=The research leaders are good at establishing networking and partnership with different organisations.

As administrative leaders, the research leaders of Segnu University should facilitate the formulation of the University research policy in line with national policies by including important elements from national and global policies. As shown in Table 5.15, 74.7% of the participants agreed while 25.3% of them disagreed that the University policy was developed in line with the national framework for higher education research and technology transfer and the national STI policy. 69.3% of the participants disagreed while 30.7% of them agreed regarding the incorporation of important elements from national and international research policy experiences. The leaders should not perceive the research policy of the University as a finished document that cannot be improved continuously though 55.5% of the participants disagreed while 44.7% of them agreed that leaders adhere to not perceiving the policy document as a final publication. Leaders should set priority areas for the research policy of the University in line with the priority areas of the national policy documents. 63.7% of the participants were satisfied with the alignment of University and national priority areas while 36.3% did not believe that alignment was arranged. To translate the policy directions into practice, leaders of the University should prepare a research strategic plan for the University, and among the participants, 61.3% believed this was happening while 38.7% were not sure of the existence of a research strategic plan for the University. The implication is that the University research policy may not have a clear and shared vision to be embraced by research project leaders and researchers.

To implement the priority areas, research leaders should be effective in managing research and innovation projects. However, 82.7% of participants disagreed while only 17.3% believed that research leaders are competent managers of research endeavour and only 13.3% (86.7% opposing) perceived leaders to have innovation capacity. To manage the research projects

effectively, research leaders should be good at resources mobilisation, quality control, conflict resolution, managing the performances of researchers, and establishing functional networks and partnerships. In this regard, 77.4% (as opposed to 22.6%) of the participants were not of the opinion that research leaders are mobilising resources for the research projects effectively. 79.7% of participants (as opposed to 20.3%) distrusted research leaders' management of good quality research conduct and 70.7% of participants (as opposed to 29.3%) had misgivings about leaders' ability to resolve conflict among the members of research teams convincingly. 76% of participants (as opposed to 24%) were not sure of research leaders' skill in encouraging researchers to outstanding research conduct. To improve their performance as researchers, research leaders should develop the capacity of researchers though 66.6% of participants (as opposed to 33.3%) denied such endeavour from research leaders.

Research leaders should be good at networking and creating partnerships but 66.2% of participants (as opposed to 33.8%) opined that leaders are not efficient in arranging networking and creating partnerships. While managing the research projects, research leaders should inspire researchers by facilitating opportunities for outstanding research conduct, not by controlling researchers' day-to-day activities. In this regard, 63.5% of the participants (as opposed to 36.3%) agreed that the leaders control rather than facilitate opportunities for improved research conduct. The research leaders of the University are also expected to commercialise the results of the research projects, and improve their research and innovation management through continues learning, creativity and adaptability, and integrating their improved skills into administrative (management) leadership. With regard to the commercialising of research outputs, the vast majority of the participants (92.1%) (as opposed to 7.9%) did not believe that research results are made known to stakeholders whereas 77.4% of participants (as opposed to 22.7 %) denied research leaders' pursuit of continuous learning and being creative and adaptable in order to integrate adaptive leadership into administrative leadership. Continuous learning, creativity and adaptability are qualities of adaptive leadership, and the findings of the quantitative data regarding adaptive leadership at university level at Segnu University are discussed next.

Adaptive leadership at university level

Table 5.16 provides the research findings based on the data collected using the structured questionnaire where participants indicated their extent of agreement or disagreement regarding the practice of adaptive leadership at university level at Segnu University (Appendix F).

Table 5.16: Agreement and disagreement of participants on matters pertaining to adaptive leadership at university level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdL10	AdL11	AdL12	AdL13	AdL14	AdL15	AdL16	AdL17	AdL18	AdL19	AdL20
Participants having	Disagreement	1	N	11	8	10	11	9	8	20	14	10	12	14	10	17	13	15	14	13	13	9	13
			%	14.7	10.7	13.3	14.9	12.0	10.8	26.7	18.7	13.3	16.0	18.7	13.3	22.7	17.3	20.0	18.7	17.3	17.3	12	17.3
		2	N	9	15	14	13	14	14	18	18	18	21	16	19	20	16	19	18	18	12	13	16
			%	12.0	20.0	18.7	17.6	18.7	18.9	24.0	24.0	24.0	28.0	21.3	25.3	26.7	21.3	25.3	24.0	24.0	16.0	17.3	21.3
		3	N	30	22	27	14	25	28	28	29	26	23	27	18	25	29	23	27	24	26	28	24
			%	40.0	29.3	36.0	18.9	33.3	37.8	37.3	38.7	34.7	30.7	36.0	24.0	33.3	38.7	30.7	36.0	32.0	34.7	37.8	32.0
		Sub-	N	**50**	**45**	**51**	**38**	**48**	**50**	**66**	**61**	**54**	**56**	**57**	**47**	**62**	**58**	**57**	**59**	**55**	**51**	**50**	**53**
			%	**66.7**	**60**	**68**	**51.4**	**64**	**67.5**	**88**	**81.4**	**72**	**74.7**	**76**	**62.6**	**82.7**	**77.3**	**76**	**78.7**	**73.3**	**68**	**67.1**	**70.6**
	Agreement	4	N	20	26	21	30	22	18	6	9	15	15	15	22	10	10	14	12	19	17	17	17
			%	26.7	34.7	28.0	40.5	29.3	24.3	8.0	12.0	20.0	20.0	20.0	29.3	13.3	13.3	18.7	16.0	25.3	22.7	22.6	22.7
		5	N	5	4	3	6	4	6	3	4	5	4	3	5	3	7	4	4	0	3	6	5
			%	6.7	5.3	4.0	8.1	5.3	8.1	4.0	5.3	6.7	5.3	4.0	6.7	4.0	9.3	5.3	5.3	0	4.0	8.1	6.7
		6	N	0	0	0	0	1	0	0	1	1	0	0	1	0	0	0	0	1	4	2	0
			%	0	0	0	0	1.3	0	0	1.3	1.3	0	0	1.3	0	0	0	0	1.3	5.3	2.3	0
			N	**25**	**30**	**24**	**37**	**27**	**25**	**9**	**14**	**21**	**19**	**18**	**28**	**13**	**17**	**18**	**16**	**20**	**24**	**25**	**22**
			%	**33.4**	**40**	**32**	**48.6**	**35.9**	**32.4**	**12**	**18.6**	**28**	**25.3**	**24**	**37.3**	**17.3**	**22.6**	**24**	**21.3**	**26.6**	**32**	**33**	**29.4**
	Total		N	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL=Adaptive leadership

AdaL1=The research leaders see the practice of research policy as learning by producing new knowledge through participation.

AdaL2=The leaders see the practice of research policy as producing new knowledge to solve real world problems through dynamic interaction.

AdaL3=The research leaders of the university see the research policy as continuous learning.

AdaL4=The research leaders see research leadership as a process.

AdaL5=The research leaders exercise research leadership as context specific.

AdaL6=The research leaders lead the research activities focusing on innovation by facilitating interaction outside the university.

AdaL7=There is collaborative leadership in the innovation system of the university.

AdaL8=The research leaders are good at setting direction.

AdaL9=The leaders are leading the research and innovation activities of the university in line with the needs of the local community.

AdaL10=The leaders are leading the research and innovation activities of the university in line with the needs of the nation.

AdaL11=The leaders are leading the research and innovation activities of the university to address their own internal teaching problems.
AdaL12=The leaders lead the research teams to find solutions to solve local problems.
AdaL13=The leaders are good at collecting information about the weaknesses of their policies and competencies from their stakeholders.
AdaL14=The leaders use the information they gathered to fill their gaps in line with the needs of the stakeholders.
AdaL15=The leaders accommodate emergent ideas into the university research structure to facilitate innovation.
AdaL16=The leaders lead the research and innovation activities of the university to develop new ideas and find innovative solutions to develop new products and services for the local context.
AdaL17=The research leaders emphasise leading basic research within a context of application.
AdaL18=The leaders prioritise applied research for real problem solving.
AdaL19=The leaders focus on action based on learning and creativity.
AdaL20=The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the university.

In applying adaptive leadership, research leaders at Segnu University should translate the research policy of the University to be aligned to specific socio-economic needs and problems of the local community, the University, industry and the country at large. In doing so, the leaders should perceive the research policy as a learning document to produce new knowledge to address real world problems in collaboration with concerned stakeholders. As indicated in Table 5.16, 66.5% of participants (as opposed to 33.4%) did not believe that leaders perceive the research policy as a document for learning with 60% of participants (as opposed to 40%) not experiencing any continuous learning engendering the production of new knowledge to solve real problems. Research leaders should be good at setting direction to implement the research policy but 67.5% of participants (as opposed to 32.4%) did not encounter any direction setting by research leaders. While implementing the research policy of the University, research leaders should see research and innovation leadership as a process focused on solving context specific problems through collaborative endeavour. 51.4% of participants (as opposed to 48.6%) doubted leaders' perception of research as a process with 64% of participants (as opposed to 35.9%) not experiencing this process to be focused on the solving of context specific problems and 88% of participants (as opposed to 12%) not encountering any collaborative intent with research endeavour at Segnu University.

Depending on the type of knowledge they intend to produce or the technology they intend to develop, the research leaders of Segnu University should prioritise basic or applied research in line with the specific contexts of the University to address needs and real problems. Nearly three quarters of the participants (73.3%) (as opposed to 26.7%) did not think that leaders facilitate the undertaking of basic research to address knowledge inadequacies, and 68% of

participants (as opposed to 32%) denied that leaders are focused on facilitating applied researches to solve internal problems relating to the University or external problems relating to the community and industry. To achieve the formulated goals of research and innovation of the University, research leaders should lead research and innovation activities to be specifically aligned to the problems of the local community, or the problems of the University, or the problems of industry. However, 72% of participants (as opposed to 28%) denied leadership's focus on solving local community problems, 76% of participants (as opposed to 24%) denied leadership's focus on University problems, and 74.7% of participants (as opposed to 25.3%) denied leadership's focus on problems from industry.

In order to address the problems of the aforementioned stakeholders, research leaders should focus on leading research activities of the University in such a way that these activities can be changed into innovative projects in collaboration with concerned beneficiaries and stakeholders. However, 67.5% of participants (as opposed to 32.5%) were of the opinion that research leaders are not able to link research activities with innovative projects collaborating with applicable stakeholders. With regard to leading research projects to be aligned to local community problems, 62.5% of participants (as opposed to 37.3%) did not believe that solving local community problems was part of leadership intent. Research leaders should lead research and innovation activities of the University to develop new ideas and innovative solutions for the local context but 78.7% of participants (as opposed to 21.3%) doubted leadership's ability to engage in innovative solutions for local problems.

With regard to improving the research policy and practice of the University, research leaders should be good at facilitating dynamic interactions among key stakeholders of the University, though 70.6% of participants (as opposed to 29.4%) had misgivings on leaders' competency to facilitate interactions with stakeholders of research projects in a constructive way. Research leaders should focus on actions based on pursuing continuous learning and creativity, but 73.4% of participants (as opposed to 26.6%) doubted leadership's capacity to engage in creative research-related actions. Research leaders should collect information and feedback from stakeholders of research projects to improve their research leadership practice and accommodate emerging ideas from these interactions with stakeholders. However, 87.7% of participants (as opposed to 12.3%) did not believe that research leaders collect information from stakeholders and 77.3% of participants (as opposed to 22.7%) doubted leadership's consideration of stakeholder feedback with 76% of participants (as opposed to 24%) being sure

that research leaders do not promote the accommodation of emerging ideas in research conduct. To facilitate interactions and interdependence within and outside the University, research leaders should apply enabling leadership. The findings of the quantitative data on the competencies of leaders at university level at Segnu University to realise enabling leadership, are discussed next.

Enabling leadership at university level

With regard to the analysis of the quantitative data collected using the structured questionnaire regarding enabling leadership at university level, Table 5.17 compares the research findings about the extent of agreement and disagreement of participants on matters relating to enabling leadership at university level at Segnu University (Appendix F).

Table 5.17: Agreement and disagreement of participants on matters pertaining to enabling leadership at university level

Items				EnL1	EnL2	EnL3	EnL4	EnL5	EnL6	EnL7	EnL8	EnL9	EnL10	EnL11	EnL12	EnL13	EnL14	EnI15
Participants having	Disagreement	1	N	12	7	5	6	5	10	17	19	12	5	7	6	10	7	11
			%	16.0	9.5	6.7	8.0	6.7	13.3	22.7	25.7	16.0	6.7	9.3	8.0	13.5	9.3	15.1
		2	N	7	19	13	8	13	13	24	23	29	16	16	13	14	15	14
			%	9.3	25.7	17.3	10.7	17.3	17.3	32.0	30.7	38.7	21.3	21.3	17.3	18.9	20.0	19.2
		3	N	25	24	12	29	12	20	24	23	20	20	31	33	23	23	23
			%	33.3	32.4	16.0	38.7	16.0	26.7	32.0	30.7	26.7	26.7	41.3	44.0	30.7	30.7	31.5
		Sub-total	**N**	**44**	**50**	**30**	**43**	**30**	**43**	**65**	**65**	**61**	**41**	**54**	**52**	**45**	**45**	**48**
			%	**58.6**	**67.6**	**40**	**57.4**	**40**	**57.3**	**86.7**	**86.7**	**81.4**	**54.7**	**71.9**	**69.3**	**60**	**60**	**65.8**
	Agreement	4	N	22	16	28	23	28	23	9	7	14	25	18	18	25	25	22
			%	29.3	21.6	37.3	30.7	37.3	30.7	12.0	9.5	18.7	33.3	24.0	24.0	33.3	33.3	30.1
		5	N	7	8	17	8	17	8	1	3	0	9	3	3	4	4	2
			%	9.3	10.8	22.7	10.7	22.7	10.7	1.3	4.0	0	12.0	4.0	4.0	5.3	5.3	2.7
		6	N	2	0	0	1	0	1	0	0	0	0	0	2	1	1	1
			%	2.7	0	0	1.3	0	1.3	0	0	0	0	0	2.7	1.3	1.3	1.3
		Sub-total	**N**	**31**	**25**	**45**	**32**	**45**	**32**	**10**	**10**	**14**	**34**	**21**	**23**	**30**	**30**	**27**
			%	**41.3**	**32.4**	**60**	**42.7**	**60**	**42.7**	**13.3**	**13.3**	**18.7**	**45.3**	**28**	**30.7**	**39.9**	**39.9**	**34.1**
	Total		N	75	75	75	75	75	75	75	75	75	75	75	75	75	75	75
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

EnL=Enabling leadership

EnL1=The leaders inspire researchers to engage in research-based innovation.

EnL2=The leaders encourage the researchers to adapt technologies from foreign countries.

EnL3=The leaders are effective in building research teams having different skills with shared identity.

EnL4=The leaders interconnect research activities to facilitate the production, dissemination, and utilisation of new knowledge or technologies.

EnL5=The leaders promote interactive relationship among education, research, and innovation.

EnL6=There is an environment conducive to undertake research and innovation activities in the university.

EnL7=There are adequate funds for research undertakings in the university.

EnL8=There are adequate funds for innovation in the university.

EnL9=There is a strong linkage between the university and the industry for collaborative research and innovation.

EnL10=The leaders facilitate dynamic interaction between and among researchers from different disciplines.

EnL11=The leaders motivate the researchers to engage passionately in the research task by providing resources to come up with new and innovative results.
EnL12=The leaders put managerial pressure on the university research system to adjust and bring the required change.
EnL13=The leaders are good at using the structure of the university to address challenges to research and innovation activities.
EnL14=The leaders are good at establishing functional networks across stakeholders that engage in research and innovation activities.
Enl15=There is a functional innovation system that comprises researchers, the government, industry, and the local community

In exercising enabling leadership, leaders have to inspire and encourage researchers, and build research teams that have different research skills but a shared identity in order to produce and apply new knowledge and technology for improved results. However, as depicted in Table 5.17, 58.6% of participants (as opposed to 41.3%) doubted research leadership's ability to inspire research-based innovation, and 67.6% of participants (as opposed to 32.4%) had misgivings on research leaders' intent to adapt foreign technology for tailormade use. In inspiring innovation with research while adopting applicable foreign technology, research leaders should establish effective research teams. In this regard 40% of participants thought leaders are not able to develop a vibrant research team while 60% of participants were satisfied with leaders' collating of proper research teams. Leaders should arrange for interconnection of research activities of the University to facilitate the production, dissemination, and application of new knowledge and technology. 57.4% of participants (as opposed to 42.7%) were not sure that leaders do facilitate research undertaking to engender meaningful research outcomes.

In order to make the research and innovation activities of Segnu University productive in terms of contributing to improved performance internally and externally, research leaders have to integrate the practice of tuition, research and innovation. 60% of participants (as opposed to 40%) were satisfied that research leaders achieve the action of integrating the three pillars of University conduct, namely tuition, research and innovation (community engagement) for improved knowledge. Research leaders have to establish a strong link between the University and industry based on collaborative research and innovation, but 81.4% of participants (as opposed to 19.6%) questioned leaders' arranging of such a link with industry. With regard to establishing functional networking with key stakeholders who engage in research and innovation activities, 60% of participants (as opposed to 39.9%) had misgivings on the capability of research leaders to establish constructive networks with applicable stakeholders for positive research results.

Implementing the research policy of the University effectively, leaders should establish a functional innovation system at the University, though 65.8% of participants (as opposed to 34.2%) did not believe that a practical innovation research system was developed at the University. As enabling leaders, research leaders should facilitate constructive interaction among researchers, and motivate them to ensure researchers are passionately engaged with their research tasks. Among the participants, 54.7% (as opposed to 45.3%) concurred that the facilitation of interaction among researchers are taking place, however 71.9% of participants (as opposed to 28.1%) did not experience any motivation from leadership to ensure researchers engage with innovative solutions to core problems. 69.3% of participants (as opposed to 30.7%) questioned leadership capacity to engender a University research system facilitating adequate resources for meaningful research conduct.

Research leaders should also use the University research governance structure to address the challenges of research and innovation project leadership though 59.4% of participants (as opposed to 40.6%) did not perceive such actions taking place to address research challenges aligned to research governance structures. Research leaders should create an environment that is conducive for researchers to engage optimally with their research endeavours. In this regard, 57.3% of participants (as opposed to 42.7%) were not satisfied with the creation of an environment conducive to optimal research conduct. Leaders should allocate adequate budgets for research and innovation projects at the University but the majority of participants (86.7%) (as opposed to 13.3%) were not satisfied with the adequacy of budgets for research and innovation projects.

To understand the budgeting practice for research and community engagement as proportion of the total annual budget for Segnu University, the performance reports of the University for the five-year period of 2012/13 to 2016/2017 were analysed.

Table 5.18 provides the research findings on data from the five-year annual performance reports of Segnu University based on indicators included with a checklist approach (Appendix H).

Table 5.18: Annual budget of Segnu University and the budget share for research and community engagement, 2012/2013 to 2016/2017

	Annual budget panned in Ethiopian Birr	Annual budget for research and community engagement planned	Percentage of the research and community budget	Annual budget achieved	Annual budget for research and community engagement achieved	Percentage of the research and community budget
2012/13	264243069	2468350	0.9	227097828.6	2365440.15	1.0
2013/14	513182910	5630721.95	1.1	417204444.5	5202224.01	1.3
2014 /15	529537977.6	6692100	1.3	474517876.5	6156446.77	1.3
2015/16	642751857.4	7288700	1.1	618389621	4554146.22	0.7
2016/17	856581131.9	10457200.48	1.2	745059986.6	10298340.85	1.4

Sources: Segnu University Annual Performance Reports (2012/13 -2016/17)

As shown in Table 5.18, the performance of Segnu University in planning the budget share for research and community engagement represents a small increment from 0.9% to 1.2%, and in utilising the budget allocated for research and community engagement an increase from 1.0% to 1.4% for the five-year period 2012/13 to 2016/17. However, the increased increment remained inadequate insofar as not reaching the minimum budget of 5% suggested by the framework for higher education research and technology transfer document to be spent on research endeavour at higher education institutions on a yearly basis.

Competency of research leaders at university level to manage research and innovation – a critical interpretation

A close examination of the research findings on administrative, adaptive and enabling leadership at Segnu University depicted that the research leaders at university level had competency shortcomings in research and innovation management and leadership. As competent administrative leaders, the research leaders should be skilled at research and innovation project management though more than 82% of participants believed research leaders not to be competent in research and innovation project management and leadership. As adaptive leaders, the research leaders should lead the research and innovation projects to be aligned to the specific context and real problems of the local community, the University's own problems, the problems of industry and the country. More than 70% of participants were of the opinion that the research leaders had competency shortcomings with regard to research and innovation leadership to arrange such alignment with beneficiaries and stakeholders of research and innovation projects. In making the research and innovation projects productive, the research leaders should create enabling conditions by motivating researchers to passionately engage in their research conduct, but 71.9% of the participants indicated that the research

leaders at university level were not competent in enabling leadership and management at Segnu University.

In knowledge producing organisations like universities, the three leadership functions of complexity leadership theory, namely administrative (management), adaptative and enabling leadership should be exercised at college level. The findings of the quantitative data regarding administrative leadership at college level at Segnu University are presented next.

Administrative leadership at college level

Table 5.19 presents the research findings based on the data collected using the structured questionnaire about participants' opinions on leaders at college level's capacity to be effective administrative leaders at Segnu University (Appendix F).

Table 5.19: Agreement and disagreement of participants on matters pertaining to administrative leadership at college level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13
Participants having	Disagreement	1	N	6	2	6	2	1	8	11	6	11	16	14	16	17
			%	8.0	2.7	8.0	2.7	1.4	10.7	14.7	8.0	14.7	21.3	18.7	21.6	22.7
		2	N	3	4	4	12	7	11	14	22	23	20	21	19	15
			%	4.0	5.3	5.3	16.0	9.3	14.7	18.7	29.3	30.7	26.7	28.0	25.7	20.0
		3	N	10	17	17	15	25	28	23	22	24	26	30	24	21
			%	13.3	22.7	22.7	20.0	33.3	37.3	30.7	29.3	32.0	34.7	40.0	32.4	28.0
		Sub-total	**N**	**19**	**23**	**27**	**29**	**33**	**47**	**48**	**50**	**58**	**62**	**65**	**60**	**53**
			%	**25.3**	**30.7**	**36**	**38.7**	**44**	**62.7**	**64.1**	**66.6**	**77.4**	**82.7**	**86.7**	**79.7**	**70.7**
	Agreement	4	N	16	33	28	30	31	18	22	21	13	10	9	13	20
			%	21.3	44.0	37.3	40.0	41.3	24.0	29.3	28.0	17.3	13.3	12.0	17.6	26.7
		5	N	32	13	15	13	9	9	4	4	4	2	1	2	2
			%	42.7	17.3	20.0	17.3	12.0	12.0	5.3	5.3	5.3	2.7	1.3	2.7	2.7
		6	N	8	6	5	3	1	0	1	0	0	1	0	0	0
			%	10.7	8.0	6.7	4.0	1.3	0	1.3	0	0	1.3	0	0	0
		Sub-total	**N**	**56**	**52**	**48**	**46**	**42**	**28**	**27**	**25**	**17**	**13**	**10**	**15**	**22**
			%	**74.7**	**69.3**	**64**	**61.3**	**54.6**	**36**	**35.9**	**33.3**	**22.6**	**17.3**	**13.3**	**20.3**	**29.4**
	Total		F	75	75	75	75	75	75	75	75	75	75	75	75	75
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The research leader (coordinator) of the college manages the college research activities in line with the university research policy.
AdL2=The research leader of the college manages the college innovation activities in line with the university research policy.
AdL3=The leader is good at communication with the researchers.
AdL4=The leader focuses on managing the schedules and budgets of the projects.
AdL5=The leader is good at delegating managerial responsibilities for improved performance.
AdL6=The leader is good at research project management.
AdL7=The leader is good at managing the performance of the researchers.
AdL8=The leader is good at resources mobilization for the projects.
AdL9=The leader is good at resolving conflict among researchers.

AdL10=The leader is effective in managing the qualities of the applicability outcomes of the research projects.
AdL11=The leader is good at managing research-based innovation.
AdL12=The leader is struggling in innovation project management.
AdL13=The leader is good at incorporating learning, creativity and adaptability while managing the research and innovation activities of the college.

As administrative leaders, research leaders at college level should manage the research and innovation activities of the colleges in line with the University's research policy. In this regard, 74.7% of participants (as opposed to 25.3%) believed that this alignment is taking place with 69.3% of participants (as opposed to 30.7%) being satisfied with the management of innovation endeavour at college level. To translate the research and innovation activities of the colleges into functional practice, the leaders should be good at research and innovation projects management so that they can manage project identification, project development, project implementation, the monitoring of project progress and the evaluation of project outcomes. Among the participants, 62.7% of them (as opposed to 36%) did not believe research projects to be managed effectively with regard to identification, development, implementation, monitoring and evaluation measures. 79.7% of participants (as opposed to 20.3%) mistrusted research leaders' capacity to arrange for innovation actions with research conduct.

Competent project managers have adequate communication skills to mobilise resources optimally and resolve conflict functionally. 64% of participants (as opposed to 36%) believed research leaders to have eloquent communication skills, but 66.6% of participants (as opposed to 33.4%) did not think research leaders are successful in moblising resources for the research projects optimally. With regard to conflict resolution, 77.4% of participants (as opposed to 22.6%) questioned research leaders' competency to resolve conflict in research teams functionally. Research leaders should manage their research projects in terms of enough budgeting, realistic timeframes, and good quality research outcomes. Among the participants, 61.3% (as opposed to 38.7%) were satisfied that research projects were adequately managed with regard to budgeting and realistic timeframes, but the majority of participants (82.7%) (as opposed to 17.3%) questioned the quality of research outcomes for application for improved performance. In this regard, 77.4% of participants (as opposed to 22.6%) did not think research leaders are able to manage and inspire research-based innovation. As research managers, the research leaders at college level should manage the overall performance of researchers though 65.8% of participants (as opposed to 34.1%) perceived the management performance of research leaders at college level at Segnu University as inadequate.

To make the research and innovation projects of the colleges productive, research leaders should accommodate continuous learning to inspire creativity and adaptability based on adaptive leadership to be part of the formal research governance structure of the colleges. In this regard, 70.7% of participants (as opposed to 29.3%) were not satisfied with colleges' research leadership to integrate adaptive leadership with administrative (management) leadership at college level at Segnu University. To describe the practice of adaptive leadership at college level, the research findings on adaptive leadership based on data quantitatively collected is discussed next.

Adaptive leadership at college level

Table 5.20 provides the research findings on the data collected using the structured questionnaire about the extent of agreement and disagreement of participants regarding the practice of adaptive leadership at college level (Appendix F).

Table 5.20: Agreement and disagreement of participants on matters pertaining to adaptive leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
AdaL1	6	8.0	14	18.7	27	36.0	**47**	**62.7**	21	28.0	6	8.0	1	1.3	**28**	**37.3**	75	100
AdaL2	12	16.0	18	24.0	31	41.3	**61**	**81.3**	14	18.7	0	0	0	0	**14**	**18.7**	75	100
AdaL3	7	9.3	32	42.5	21	28.3	**60**	**80.1**	11	14.7	3	3.9	1	1.3	**15**	**19.9**	75	100
AdaL4	12	16.0	25	37.3	27	36.0	**64**	**84.9**	8	10.7	3	3.9	0	0	**11**	**14.3**	75	100
AdaL5	13	17.3	33	44	28	37.3	**74**	**98.6**	1	1.3	0	0	0	0	**1**	**1.3**	75	100
AdaL6	7	9.3	21	28.0	25	33.3	**53**	**70.6**	19	25.3	3	4.0	0	0	**22**	**29.3**	75	100
AdaL7	13	17.3	20	26.7	20	26.7	**53**	**70.7**	18	24.0	3	4.0	1	1.3	**22**	**29.3**	75	100

Keys:

AdaL1=The college puts more value on areas of research applicable to the internal development of the college.
AdaL2=The leader is leading the researchers to research their own teaching to address the internal problems of the college.
AdaL3=The leader is leading the researchers to research and address the problems of the local communities.
AdaL4=The leader is leading the researchers to research and produce new knowledge for the socio-economic development of the country.
AdaL5=The research leader is struggling in innovation project leadership.
AdaL6=The leader focuses on action based on learning and creativity.
AdaL7=The leaders is good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the college.

In exercising adaptive leadership, the leaders at college level should lead research and innovation activities to be aligned to the specific context of the college, the local community, industry and the nation at large. As depicted in Table 5.20, 62.7% of participants were not satisfied that the colleges placed enough emphasis on research project endeavour to benefit their own internal development with 37.3% of participants being satisfied that the research focused on internal development. The majority of participants (81.3%) (as opposed to 18.7%) did not think that research leadership and management was adequate in focusing on real problems encountered in colleges. Among the participants, 80.1% (as opposed to 19.9%) did not perceive problems of the local community to be addressed by research endeavour with 84.9% of participants (as opposed to 14.1%) questioning the success of research outputs to address problems encountered by the nation.

In order to address internal problems, the problems of the local community and the nation at large, and research leaders should be competent in innovation leadership, but almost all of the participants (98.6%) (as opposed to 1.3%) questioned research leadership and management to respond in an innovative way to address contextual problems in a tailor-made way. To improve the research and innovation leadership of the colleges, the leaders should facilitate dynamic interaction with their key stakeholders but 70.7% of participants (as opposed to 29.3%) did not think that such interactions were facilitated effectively. By facilitating interactions constructively incorporating key stakeholders, research leaders should base their actions on continuous learning to engender creativity. However, 70.6% of participants (as opposed to 29.3%) did not experience research leadership as being engaged in continuous learning in pursuit of creative research conduct and creative research outcomes.

In creating enabling conditions for project leaders and researchers to be effective in their research and innovation project engagement, research leaders at college level should apply enabling leadership. The findings of the quantitative data regarding the practice of enabling leadership at college level at Segnu University are discussed next.

Enabling leadership at college level

Table 5.21 provides the research findings based on data collected using the structured questionnaire to describe the extent of agreement and disagreement of participants regarding the practice of enabling leadership at college level at Segnu University (Appendix F).

Table 5.21: Agreement and disagreement of participants on matters pertaining to enabling leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
EnL1	7	9.3	9	12.0	25	33.3	**41**	**54.6**	23	30.7	10	13.3	1	1.3	**34**	**45.3**	75	100
EnL2	8	10.7	17	22.7	20	26.7	**45**	**60**	24	32.0	5	6.7	1	1.3	**30**	**40**	75	100
EnL3	5	6.7	16	21.3	24	32.0	**45**	**60**	22	29.3	7	9.3	1	1.3	**30**	**39.9**	75	100
EnL4	7	9.3	15	20.0	19	25.3	**41**	**54.6**	24	32.0	9	12.0	1	1.3	**34**	**45.3**	75	100
EnL5	9	12.0	12	16.0	20	26.7	**41**	**54.7**	25	33.3	8	10.7	1	1.3	**34**	**45.3**	75	100
EnL6	9	12.0	16	21.3	27	36.0	**52**	**69.3**	14	18.7	7	9.3	2	2.7	**23**	**30.7**	75	100
EnL7	11	14.7	17	22.7	34	45.3	**62**	**82.7**	12	16.0	1	1.3	0	0	**13**	**17.3**	75	100
EnL8	7	9.3	10	13.3	26	35.1	**43**	**57.7**	25	33.3	5	6.7	2	2.7	**32**	**42.7**	75	100

Keys:

EnL1=The research leader motivates the researchers to undertake problem-solving research.
EnL2=The leader is good at team building having different skills.
EnL3=The leader is good at inspiring and motivating researchers.
EnL4=The research leader encourages disciplined-based research to produce improved discipline-based knowledge.
EnL5=The research leader encourages interdisciplinary research to solve real problems.
EnL6=The research leader encourages collaborative research with external bodies that promote research-based innovation.
EnL7=The leader is good at establishing functional networks across stakeholders who engage in research and innovation activities.
EnL8=The leader is good at using the structure of the college to address challenges to research and innovation activities.

As enabling leaders at college level, research leaders have to motivate, encourage and inspire researchers for their research conduct. As indicated in Table 5.21, 54.6% of participants (as opposed to 45.3%) did not experience motivation from their research leaders as inspiring them to passionate research endeavour, 54.6% of participants (as opposed to 45.3%) questioned research leaders' efforts for encouraged discipline-based research conduct to produce improved knowledge, and 54.7% of participants (as opposed to 45.3%) denied any encouragement from leadership to solve local problems with interdisciplinary research. Among the participants, 69.3% (as opposed to 30.7%) did not experience any encouragement with regard to engaging in collaborative research endeavour to promote research-based innovation. In order to facilitate interdependence among researchers, research leaders should be competent at establishing teams having different research-related skills. 60% of participants (as opposed to 40%) questioned this team building capacity of their research leaders. Counter the constraints relating to human, financial and material resources for research projects, research leaders should

establish functional networks with applicable stakeholders to engage collaboratively in research and innovation project endeavour. Most of the participants (82.7%) (as opposed to 17.3%) did not believe their research leaders to be competent in creating efficient networks with stakeholders. To address challenges of research and innovation leadership at college level, research leaders should apply the research governance structure of the colleges but 57.7% of participants (as opposed to 42.7%) had misgivings on leadership capacity to resolve research-related challenges through the research governance structure of the colleges.

Competency of research leaders at college level to manage research and innovation - a critical interpretation

From a critical interpretation of the research findings on administrative, adaptive and enabling leadership regarding the research and innovation management and leadership at college level at Segnu University, there were competency shortcomings. As skilled administrative (management) leaders, research leaders should be competent at research and innovation project management though more than two-thirds of the participants (69.3%) believed research leaders were not competent in research and innovation project management. As skilled adaptive leaders, research leaders should be competent at leading research and innovation projects aligned to real problems experienced at colleges, the local community and the University though more than 80% of participants indicated that the leaders were not competent in research and innovation leadership and management with regard to addressing internal or external demands. To ensure researchers are passionately engaged in their research projects, research leaders should motivate researchers to conduct discipline-based research inspiringly producing improved knowledge for the benefit of the colleges, or to partake in interdisciplinary research to solve problems collaboratively promoting research-based innovation. However, 54.6% of participants experienced shortcomings with leadership engendering such enabling conditions for research conduct at Segnu University.

Administrative, adaptive and enabling leadership should also be conducted at project level. The findings of the quantitative data regarding administrative leadership at project level at Segnu University are presented next.

Administrative leadership at project level

Table 5.22 represents the research findings on the data collected using the structured questionnaire pertaining to participant opinion on the competencies of administrative research leadership at project level at Segnu University (Appendix F).

Table 5.22: Agreement and disagreement of participants on matters pertaining to administrative leadership at project level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14
Participants having	Disagreement	1	N	14	16	12	9	15	8	8	15	21	11	10	11	13	10
			%	18.7	21.3	16.0	12.2	20.0	10.7	10.7	20.3	28.0	14.7	13.3	14.7	17.3	13.3
		2	N	19	14	13	14	8	21	11	10	11	12	12	8	22	14
			%	25.3	18.7	17.3	18.9	10.7	28.0	14.7	13.5	14.7	16.0	16.0	10.7	29.3	18.7
		3	N	18	21	26	22	0	23	28	23	0	24	34	22	27	29
			%	24.0	28.0	34.7	29.7	0	30.7	37.3	31.1	0	32.0	45.3	29.3	36.0	38.7
		Sub-total	N	**51**	**51**	**51**	**45**	**23**	**52**	**47**	**48**	**32**	**47**	**56**	**41**	**62**	**53**
			%	**68**	**68**	**68**	**60.8**	**30.7**	**69.4**	**62.7**	**64.9**	**42.7**	**62.7**	**74.6**	**54.7**	**82.6**	**70.7**
	Agreement	4	N	17	18	20	18	8	15	19	20	9	21	12	27	10	17
			%	22.7	24.0	26.7	24.3	10.7	20.0	25.3	27.0	12.0	28.0	16.0	36.0	13.3	22.7
		5	N	7	6	4	10	21	8	9	5	13	5	5	6	2	5
			%	9.3	8.0	5.3	13.5	28.0	10.7	12.0	6.8	17.3	6.7	6.7	8.0	2.7	6.7
		6	N	0	0	0	2	23	0	0	2	21	2	2	1	1	0
			%	0	0	0	2.7	30.7	0	0	2.7	28.0	2.7	2.7	1.3	1.3	0
		Sub-total	N	**24**	**24**	**24**	**30**	**52**	**23**	**28**	**27**	**43**	**28**	**19**	**34**	**13**	**22**
			%	**32**	**32**	**32**	**39.2**	**69.4**	**30.7**	**37.3**	**35.2**	**57.3**	**37.4**	**25.4**	**45.3**	**17.3**	**29.4**
	Total		N	75	75	75	75	75	75	75	75	75	75	75	75	75	75
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The project leader (principal investigator) sets realistic and functional objective(s) to a project in collaboration with the project stakeholders.
AdL2 =The project leader is good at communication.
AdL3=The project leader is effective in research project management.
AdL4=The project leader is good at managing resources.
AdL5=The project leader is struggling to manage the quality of the research projects in terms of producing new and relevant knowledge.
AdL6=The project leader is effective in innovation project management.
AdL7=The project leader is a good problem solver.
AdL8=The project leader manages project progress effectively.
AdL9=The project leader manages the success of the project in terms of time and budget.
AdL10=The project leader manages his or her team effectively.
AdL11=There is effective risk-assessment in the research and innovation projects.
AdL12=The project leader is good at conflict resolution.
AdL13=The project leader is effective in obtaining research grants.
AdL14=The project leader is good at incorporating learning, creativity and adaptability while managing research or innovation projects.

As administrative leaders, project leaders should be competent in setting realistic and functional objectives for research and innovation conduct with their research projects in collaboration with beneficiaries and key stakeholders. As Table 5.22 depicts, 68% of participants (as opposed to 32%) did not evaluate research objectives to be planned for meaningful improvement of internal or external performance. To set realistic objectives, research leaders should be skilled in research and innovation project leadership and

management, but 68% of participants (as opposed to 32%) questioned leadership capacity for realistic objective setting. 69.4% of participants (as opposed to 30.7%) had misgivings about project leadership competency to engender innovation with research endeavour in research projects. As competent project managers, project leaders should manage resources for the projects, ensure quality with research undertakings, manage the implementation and the progress of the research projects and ensure that research team members remain inspired and focused with their research projects. Among the participants, 60.8% (as opposed to 39.2%) did not think resources were managed effectively, 69.4% (as opposed to 30.7%) questioned the quality of the research conducted, 64.9% (as opposed to 35.1%) did not perceive project progress to be managed satisfactorily, and 62.7% (as opposed to 37.3%) did not experience research team management as inspiring for sustained focused research conduct.

In managing resources, project leaders should be skilled at obtaining research grants though the majority of participants (82.6%) (as opposed to 17.4%) questioned the competency of project leaders in obtaining research grants. Project leaders should also be skilled communicators and effective in problem solving and conflict resolution while managing their research projects. In this regard, 68% of participants (as opposed to 32%) perceived leaders' communication skills to be inadequate, 62.7% (as opposed to 37.3%) did not think project leaders were competent in solving research project-related problems and 54.7% (as opposed to 45.3%) perceived leaders' capacity to manage conflict functionally as inadequate. Project leaders should be effective in managing successful implementation of the research project while constantly managing possible risks associated with the specific research project. 57.3% of participants (as opposed to 42.7%) questioned leaders' capacity with regard to the proper management of project implementation and progress as this implementation and progress relate to sufficient budgeting and realistic timeframes for project completion. 74.6% of participants (as opposed to 25.4%) doubted project leaders' ability to manage project risks that affect project progress negatively.

In order to lead research projects to be aligned to the specific context, project leaders should engage in continuous learning to engender creativity with their adaptive leadership capacities for incorporation into their administrative (management)t leadership. 70.7% of participants (as opposed to 29.4%) questioned project leaders' competency to integrate adaptive leadership know-how into administrative leadership. To lead the research and innovation projects to be aligned to needs encountered in the local, institutional and national context, project leaders

should apply adaptive leadership. The findings of the quantitative data on project leaders' ability to apply adaptive leadership qualities in their research leadership and management endeavour, are discussed next.

Adaptive leadership at project level

Table 5.23 compares the research findings on the data collected using the structured questionnaire about the perception of participants on the practice of adaptive leadership at project level at Segnu University (Appendix F).

Table 5.23: Agreement and disagreement of participants on matters pertaining to adaptive leadership at project level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdaL10	AdaL11
Participants having	Disagreement	1	N	4	7	8	11	9	6	13	4	12	9	8
			%	5.4	9.3	10.7	14.7	12.0	8.0	17.3	5.3	16.0	12.0	10.7
		2	N	9	14	16	16	13	17	11	12	14	13	15
			%	12.2	18.7	21.3	21.3	17.6	22.7	14.7	16.0	18.7	17.3	20.0
		3	N	20	34	29	33	26	28	32	37	29	28	27
			%	27.0	45.3	38.7	44.0	35.1	37.3	42.7	49.3	38.7	37.3	36.0
		Sub-total	N	**34**	**55**	**53**	**60**	**48**	**51**	**56**	**53**	**55**	**50**	**50**
			%	**44.6**	**73.3**	**70.7**	**80**	**63.5**	**68**	**74.7**	**70.6**	**73.4**	**66.6**	**66.7**
	Agreement	4	N	32	16	18	12	24	16	16	21	17	20	23
			%	43.2	21.3	24.0	16.0	32.4	21.3	21.3	28.0	22.7	26.7	30.7
		5	N	7	4	4	3	3	6	3	1	2	5	2
			%	9.5	5.3	5.3	4.0	4.1	8.0	4.0	1.3	2.7	6.7	2.7
		6	N	2	0	0	0	0	2	0	0	1	0	**0**
			%	2.7	0	0	0	0	2.7	0	0	1.3	0	0
		Stub-total	N	**41**	**20**	**22**	**15**	**27**	**24**	**19**	**22**	**20**	**25**	**25**
			%	**55.4**	**26.6**	**29.3**	**20**	**36.5**	**32**	**25.3**	**29.3**	**26.7**	**33.4**	**33.4**
	Total		N	75	75	75	75	75	75	75	75	75	75	75
			%	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL1=The project leader is effective in research project leadership.
AdaL2=The project leader is effective in leading innovation projects to develop unique products and services for commercialization.
AdaL3=The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the local communities.
AdaL4=The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the country.
AdaL5=The project leader assigns difficult tasks and facilitates for collaboration.
AdaL6=The project leader facilitates teamwork, and creates room for interaction and exchange of ideas.
AdaL7=The project leader builds research teams based on the competencies of the researchers.
AdaL8=The project leader focuses on action based on learning and creativity.
AdaL9=The project leader leads researchers to produce new knowledge to address the challenges of industry.
AdaL10=The project leader leads researchers to produce new knowledge to address the challenges of the local community.
AdaL11=The project leader leads researchers to produce new knowledge to address the challenges of the university itself.

As adaptive leaders, project leaders should be effective in leading research and innovation projects to be aligned to the needs of project beneficiaries and stakeholders. With regard to research project leadership, 55.4% of participants (as opposed to 44.6%) believed project leaders to be competent in research leadership and management. In leading research projects innovatively to be commercialised, 73.3% of participants (as opposed to 26.6%) had misgivings about project leaders' ability to apply innovation for outstanding research results. 70.7% of participants (as opposed to 29.3%) did not think project leaders are managing research projects innovatively to solve local problems, and 80% of participants (as opposed to 20%) questioned the capacity to solve problems at national level. As research conduct is essential for innovation, research project leaders should encourage researchers to produce new knowledge to address the challenges of industry, the local community, and the University. 73.4% of participants did not think leadership at project level was able to address challenges of industry while 26.7% had confidence in project leadership skill to counter industry-related hindrances. 66.6% of participants had confidence in project leadership's competency to address local community needs while 33.4% were satisfied with project leadership to attend to community demands. Along the same lines, 66.6% of participants did not think project leadership addressed University requirements, whereas 33.4% were content with project leadership responses to University needs.

In order to ensure that research and innovation projects are productive in terms of delivering functional research outputs, project leaders should build research teams with members representing different research-related competencies, research leaders should facilitate teamwork, and they should assign challenging but realistic tasks and facilitate collaboration. In this regard, 74.7% of participants (as opposed to 25.3%) questioned project leaders' competency to build competent research teams, 68% of participants (as opposed to 36.5%) did not perceive project leaders to facilitate teamwork satisfactorily, and 63.5% (as opposed to 32%) questioned leadership capacity to arrange for realistically challenging tasks based on collaborative endeavour.

Improving their leadership practice, project leaders should engage in constant learning engendering creativity for improved performance though 70.6% of participants (as opposed to 29.3%) did not perceive project leaders to be creatively improving research project conduct. By integrating continuous learning for creativity with adaptive leadership into the formal research governance structure of colleges on research project level, project leaders should apply

enabling leadership. The findings of quantitative data on enabling leadership at project level at Segnu University are presented next.

Enabling leadership at project level

Table 5.24 depicts the research findings on data collected using the structured questionnaire about the perception of participants on the practice of enabling leadership at project level (Appendix F).

Table 5.24: Agreement and disagreement of participants on matters pertaining to enabling leadership at project level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
EnL1	12	16.0	9	12.0	24	32.0	**45**	**60**	20	26.7	10	13.3	0	0	**30**	**40**	75	100
EnL2	6	8.0	14	18.7	24	32.0	**44**	**58.7**	25	33.3	6	8.0	0	0	**31**	**41.3**	75	100
EnL3	10	13.5	10	13.5	29	39.2	**49**	**66.2**	15	20.3	10	13.3	1	1.3	**26**	**33.8**	75	100
EnL4	10	13.3	25	33.3	19	25.3	**54**	**71.9**	19	25.3	2	2.7	0	0	**21**	**28**	75	100
EnL5	16	21.3	15	20.0	34	45.3	**65**	**86.6**	9	12.0	1	1.3	0	0	**10**	**13.3**	75	100
EnL6	8	10.8	21	28.4	26	35.1	**55**	**74.3**	17	23.0	2	2.7	1	1.3	**20**	**25.7**	75	100
EnL7	16	21.3	12	16.0	33	44.0	**61**	**81.3**	14	18.7	0	0	0	0	**14**	**18.7**	75	100
EnL8	8	10.7	19	25.3	30	40.0	**57**	**76**	15	20.0	3	4.0	0	0	**18**	**24**	75	100

Keys:

EnL1=The project leader is good at motivating his/her research team.
EnL2=The project leader is able to promote good quality research and innovation.
EnL3=The project leader encourages creative researchers.
EnL4=The project leader is effective in using ICT for research and innovation management.
EnL5=The project leader has the quality of a broker to create linkage between teaching, research, and innovation.
EnL6=The project leader is very good at team building.
EnL7=The project leader injects tension in his/her research team to come up with innovative ideas.
EnL8=The project leader is good at using the structure of the college to address challenges to research and innovation activities.

In applying enabling leadership, project leaders should inspire and encourage researchers to outstanding research conduct. As is evident from Table 5.24, 60% of participants (as opposed to 40%) are not satisfied with project leader competency to inspire researchers to outstanding research performance. 66.2% of participants (as opposed to 33.8%) questioned project leader intent of encouraging team members to sustained and focused performance. Project leaders

should build competent research teams, promote good quality research engendering innovative outcomes, and apply appropriate information technology in research and innovation activity endeavour. Among the participants, 74.3% (as opposed to 25.7%) were not satisfied with project leaders' ability to arrange for research teams representing variety regarding research conduct capacity. 58.7% of participants (as opposed to 41.3%) were not sure project leaders are able to promote good quality research conduct and 71.9% of participants (as opposed to 28%) questioned project leaders' ability use information technology applicably in research endeavours.

To facilitate the interdependence among the three pillars of knowledge, project leaders should have broker qualities insofar as integrating tuition, research, and innovation though the majority of participants (86.6%) (as opposed to 13.4%) questioned project leaders' skill in arranging for the interrelated functioning of knowledge facilitation based on linking tuition, research and innovation. When there are problems that need urgent and innovative solutions, project leaders should motivate researchers to present innovative ideas for problem-solving though the majority of participants (81.3%) (as opposed to 18.7%) were not convinced of project leaders' capacity to motive and direct researchers to such innovative solutions. To address the challenges of research and innovation project leadership and management, project leaders should apply the research governance structure of the college though 76% of participants (as opposed to 24%) did not perceive project leaders to be competent in resolving research-related challenges by applying the college's research governance structure applicably.

Competency of research leaders at project level to manage research and innovation - a critical interpretation

From a critical interpretation of the research findings on administrative, adaptive and enabling leadership pertaining to research and innovation project management and leadership, it was clear that there were competency shortcomings regarding research leadership and management at project level. As competent project managers, project leaders should be competent in managing research and innovation projects distinctively. However, more than two-thirds of the participants (68%) perceived project leaders not to have adequate competencies in order to manage research and innovation conduct with the research projects of the college. As skilled research and innovation leaders, project leaders should be competent in leading research and innovation projects to be aligned with the specific and real problems of the local community, the University, industry and the country. However, 70% of participants were of the opinion

that the project leaders were not competent in research and innovation project leadership and management. In order to ensure researchers are engaged effectively in their research and innovation activities, project leaders should motivate researchers constantly to produce creative ideas and solutions in order to address local problems though 81.3% of participants were of the opinion that project leaders were not able to motivate and encourage their research teams at Segnu University.

The major goal of research and innovation management and leadership at project, college, and university level is to contribute with the production of relevant knowledge and technology to solve the problems of the local community, the University, industry, and the country. In this regard, the contributions of the research and innovation projects at Segnu University are presented next.

The contributions of research and innovation projects of Segnu University

Table 5.25 represents the research findings on data collected using the structured questionnaire on participant opinion about the significance of contributions of research and innovation projects at Segnu University to address local problems, to produce competent human capital and to address technology inadequacies experienced in the society (Appendix F).

Table 5.25: The contributions of research and innovation projects of Segnu University

Items				Ct1	Ct2	Ct3	Ct4	Ct5	Ct6	Ct7	Ct8	Ct9	Ct 10	Ct 11	Ct 12	Ct 13
Contributions of the research and innovation projects	Insignificant	1	N	11	17	17	14	15	12	12	14	10	15	11	14	10
			%	14.7	22.7	22.7	18.7	20.0	16.0	16.0	18.7	13.3	20.0	14.7	18.7	13.3
		2	N	25	22	25	27	23	22	23	20	17	19	17	21	22
			%	33.3	29.3	33.3	36.0	30.7	29.3	30.7	26.7	22.7	25.3	22.7	28.0	29.3
		3	N	24	25	19	21	27	33	23	25	28	25	32	21	31
			%	32.0	33.3	25.3	28.0	36.0	44.0	30.7	33.3	37.3	33.3	42.7	28.0	41.3
		Sub-total	N	**60**	**64**	**61**	**62**	**65**	**67**	**58**	**59**	**55**	**59**	**60**	**56**	**63**
			%	**80**	**85.3**	**81.3**	**82.7**	**86.7**	**89.3**	**77.4**	**78.7**	**73.3**	**78.6**	**80.1**	**74.7**	**83.9**
	Significant	4	N	14	9	14	12	7	5	14	12	17	12	11	18	11
			%	18.7	12.0	18.7	16.0	9.3	6.7	18.7	16.0	22.7	16.0	14.7	24.0	14.7
		5	N	0	1	0	1	3	3	2	4	3	4	4	1	1
			%	0	1.3	0	13	4.0	4.0	2.7	5.3	4.0	5.3	5.3	1.3	1.3
		6	N	1	1	0	0	0	0	1	0	0	0	0	0	**0**
			%	1.3	1.3	0	0	0	0	13	0	0	0	0	0	0
		Sub-total	N	**15**	**11**	**14**	**13**	**10**	**8**	**17**	**16**	**20**	**16**	**15**	**19**	**12**
			%	**20**	**14.6**	**18.7**	**17.3**	**13.3**	**10.7**	**22.7**	**21.3**	**26.7**	**21.3**	**20**	**25.3**	**16**
	Total		N	75	75	75	75	75	75	75	75	75	75	75	75	75
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

1=no contribution, 2=very low contribution, 3=low contribution, 4=average contribution, 5=high contribution or 6= very high contribution
Ct=Contribution
Ct1=To what extent do you feel that the research projects you have engaged in so far have contributed to address the problems of the local community?
Ct2=To what extent do you feel that the innovation projects you have engaged in so far have contributed to solve the problems of the local community?
Ct3=To what extent do you feel that the research projects you have engaged in so far have contributed to address the university's own internal problems?
Ct4=To what extent do you feel that the innovation projects you have engaged in so far have contributed to address the university's own internal problems?
Ct5=To what extent do you feel that the research projects you have engaged in have contributed to fill the knowledge or technology needs of the country?
Ct6=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the technological advancement of the country?
Ct7=To what extent do you feel that the research projects you have engaged in so far have contributed to the knowledge-based economy of the country?
Ct8=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the knowledge-based economy of the country?
Ct9=To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the university?
Ct10=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the university?
Ct11=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of industry?
Ct12=To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the nation at large?
Ct13=To what extent do you feel that the innovation projects of your team have contributed to the human capital development of the nation at large?

The research leaders of Segnu University should lead research and innovation projects to address the problems of the local community and the University. The majority of participants (80%) indicated that the contributions of the research projects in addressing the problems of the local community were insignificant while 20% reported them as significant. The contributions of the research projects to address the University's own problems were also insignificant (81.3%) while 17.7% of participants indicated them as significant. With regard to the contributions of the innovation projects in solving the problems of the local community, 85.3% of the participants indicated that the contributions were insignificant while 14.7% reported them to be significant. The majority of the participants (82.7%) opined that the contributions of the innovation projects to address the University's own problems were insignificant while 16.3% saw them as meaningful.

With regard to the contributions of the research projects to address knowledge and technology shortcomings, and to contribute to the knowledge-based economy of the country, 86.7% of participants did not believe this to happen while 13.3% considered the knowledge and technology contributions to be meaningful with 32.6% participants (as opposed to 77.4%)

considering the contributions of new knowledge and technology to counter existing shortcomings as significant engendering the improvement of a knowledge-based economy status for the country. With regard to the contributions of the innovation projects, 89.3% of the participants indicated them as insignificant while 10.7% as significant in addressing the knowledge and technology inadequacies of the country, and 78.7% participants reported the contributions of the innovation projects to become a basis for a solid knowledge-based economy as insignificant while 21.3% participants were positive about the capacity of higher education institutions' research and innovation leadership and management to arrange for innovation in pursuit of an improved knowledge-based dispensation.

Regarding the contributions of the research projects to human capital development for the University, industry and the country at large, 73.3% of participants indicated the contributions as not significant while 26.7% of participants believed the research projects to fair well with ensuring adequate human capital for the different stakeholders. With regard to ensuring innovation with the research projects, 78.6% of participants indicated that the contributions to developing human capital able to innovative ideas are not significant while 21.3% of participants were satisfied that human capital is developed that will be able to innovative endeavour. Participants (80.1%) had misgivings about the contributions of the innovation projects to ensure applicably trained human capital development for industry purposes with only 20% participants being satisfied that industry benefit from properly trained human capital from higher education institutions. Along the same lines, 83.9% participants were not sure the country at large is issued with properly trained human capital with only 16% of participants being sure that higher education institutions fulfil their task of delivering appropriately trained prospective labour force entrants.

The data collected from the annual performance reports of Segnu University for the five-year period 2012/2013 to 2016/2017 depicts the contributions of the research and innovation projects regarding numbers of projects, technology transfer endeavour and research outputs. In this regard, Table 5:26 provides the research findings based on the data pertaining to the contributions of the research and innovation projects of Segnu University for the period 2012/2013 to 2016/2017 as per indicators included with a checklist arrangement (Appendix H).

Table 5.26: Achievements in different areas as research and innovation contributions of Segnu University

S/N	Planned and achieved activities	Academic year				
		2012/13	2013/14	2014 /15	2015/16	2016/17
1	Number of research projects planned to be completed	N/A	N/A	30	40	47
2	Number of research projects completed	N/A	N/A	33	65	48
3	Number of technologies planned to be transferred	0	12	15	12	14
4	Number of technologies transferred	0	8	10	6	9
5	Number of articles planned to be published	N/A	N/A	N/A	6	16
6	Number of articles published	N/A	N/A	N/A	7	20
7	Number of collaborations and partnerships planned	8	12	15	24	28
8	Number of collaborations and partnerships achieved	6	12	11	17	10

Source: Segnu University Annual Performance Reports (2012/13-2016/17)

As shown in Table 5.26, the research projects were completed successfully but the data do not indicate whether the research projects were completed within the parameters of the allotted budget and the planned timeframe for the specific project. Collaborations and partnerships that were developed were encouraging on condition that they are implemented practically for stakeholder benefit. The application of the research outcomes is not implemented by comparing technology transfer and completed research projects. Disseminating the research outputs by publishing them in peer reviewed journals was at a starting phase because two years past before articles were published from 2015/2016 onwards.

In order to understand the performance of the leadership and management of research and innovation policy and practice at Segnu University comprehensively, the results of the qualitative and the quantitative data are integrated and discussed next.

5.3.4 An integrated interpretation of the results of the qualitative and quantitative data

As administrative leaders, the research leaders of Segnu University should be skilled at formulating and implementing the research policy of the University in line with national policies. The results of the documents analysis revealed that the research policy of Segnu University was not developed in line with the national STI policy and the framework for higher education research and technology transfer document. The results of the qualitative data from

the semi-structured individual interviewing showed that there were inadequacies with regard to the University policy not adhering to changes in the national policy because the University research policy was not revised to be aligned to the changes in the national policy on research endeavour. By contrast, the results from the quantitative data indicated that the majority of participants, namely 74.7%, agreed that the University research policy was developed and aligned to the two national policy documents with only 25.3% of participants having misgivings about Segnu University's research policy being aligned to national research policies.

Comparing qualitative and quantitative results, the results of the qualitative data revealed that the research priority areas of the University were developed in line with the national STI policy priority areas. The results from the quantitative data also showed that 64% of participants agreed (as opposed to 36%) that the University research priority areas are aligned to national research priority areas. At college level, the results of the qualitative data showed that the colleges did not have their own research priority areas as per the University priority areas. The results of the quantitative data also indicated that 74.7% of participants (as opposed to 24.3%) were not satisfied with the potential of research leadership and management at college level to ensure adequate research conduct. In order to translate the research policy of the University into practice, research leaders should develop research strategic plans in collaboration with key stakeholders though 61.3% of participants (as opposed to 38.7%) were not sure that this collaboration was taking place. The results from the qualitative data indicated that there was not a designated research strategic plan being implemented at Segnu University.

In order to translate the priority areas into practice, research leaders should be effective in managing research and innovation projects. However, the results of the quantitative data showed that 82.7%, 86.7% and 69.4% of participants were not satisfied with research leaders' competency to translate priority area decisions into practice at university, college and project level respectively. The results of the qualitative data also depicted that there were serious inefficiencies regarding project identification, project development, project implementation, and project monitoring and evaluation to be aligned to the needs of the local community, industry, the University and the country at large. Researchers rather focused on personal interests and previous experience with their research conduct as directed by their research and innovation leaders at Segnu University.

As adaptive leaders, the leaders at university level should use adaptive leadership to lead the research and innovation projects of the University according to the specific needs of the local community, industry, the University and the country. In this regard, most participants (72%; 80%; 73.4%) questioned research leaders' capacity at university, college and project level to respond adaptively to stakeholder needs. The results from the qualitative data also disclosed that the research and innovation projects were not aligned to the real problems of the local community, the University, industry and the country. The results from the qualitative data collected from individual interviewing with community leaders and industry managers confirmed that serious problems of local communities and industries that need solving were not researched and addressed by the University. To improve the research and innovation policy and practice endeavour at the University, research leaders should take actions based on constant learning engendering creativity for genuine solution of problems. However, 67.6% of participants at university level, 70.7% at college level and 70.7% at project level questioned research leaders' capacity for applying adaptive leadership engendering a focus on real problems encountered in the different stakeholder areas. The results of the qualitative data also showed that the culture of learning, creativity and adaptability was not developed satisfactorily in the research and leadership practice at university, college and project levels.

To adjust the management and leadership of research and innovation practice at Segnu University, research leaders should accommodate emerging ideas though 76%, 70.7% and 70.6 % of participants at university, college and project level respectively questioned research leaders' ability to manage and lead such adjustment requirements. The results from the qualitative data revealed that the University research practice moved from small-scale basic research to interdisciplinary applied mega research, though this move did not emerge from the interactions within and outside the University rather it was adopted from first-generation universities.

As enabling leaders, the research leaders of Segnu University should create enabling conditions for researchers. One of the important aspects for undertaking quality research and applying the research outcomes in practice is to allocate an adequate budget. However, one of the main problems encountered at Segnu University at university, college and project level was the lack of an adequate budget for research and innovation endeavour. The results from the quantitative data showed that the majority of participants (86.7%) emphasized the lack of adequate budgeting for research conduct. To facilitate interactions among key stakeholders of the

research and innovation projects of the University, research leaders should establish a functional innovation system, but 65.6% of participants questioned the successful establishment of such an innovation system which was confirmed by interviewing, namely that there was no established and functional innovation system functioning at the University albeit some initiatives of collaboration with industry. Although research leaders at college level should have functional networks with key stakeholders, most participants (82.7%) questioned research leaders' capacity to build such useful networks with stakeholders.

Comprehensively considered, the main aim of research and innovation leadership and management at project, college and university level at Segnu University is to contribute with new knowledge, technology and competent human capital to address the problems of the local community, the University, industry and the country. The results from the qualitative data indicated that the practical contributions to the aforementioned parties were limited to the dissemination of some improved crop varieties. The results of the quantitative data illustrated that the contributions of the research and innovation projects to stakeholder benefit were not significant as confirmed by more than 70% of participants as is evident from Table 5.25. However, according to information depicted in Table 5.26, there were some contributions relating to technology and knowledge transfer to the benefit of stakeholder use carried out at Segnu University.

5.4 SUMMARY

In order to understand the management and leadership of research and innovation policy and practice at Fignu and Segnu universities, both qualitative and quantitative data were collected using document analysis, semi-structured individual interviewing and a structured questionnaire, with research findings from both data collecting procedures integrated at the end of each case.

The results of the policy document analysis showed that there were differences in the vision, mission, objectives and thematic areas between the national STI policy and the framework for higher education research and technology transfer, and the research policy documents of Fignu and Segnu universities though they were some similarities. Analysing research and innovation management and leadership at policy and practice level in line with administrative, adaptive and enabling leadership at university, college and project levels, it was found that there were

shortcomings. These shortcomings pertained to inadequacies in translating the two national policy documents into the research policy documents of the two universities in order to manage and lead research and innovation projects to be aligned to the needs of the local community, the University, industry and the country by creating enabling conditions and environments.

Although research and innovation goals at national and university level were to contribute new and practical knowledge and the right kind of advanced technology to solve problems and to be commercialised as the basis for a knowledge-based economy, it was clear that the contributions of the research and innovation projects of the two universities were not significant enough for such endeavour. There were, however, some efforts for knowledge production and application relating to improved agricultural functioning in the community at both universities taking place.

Chapter 5 focussed on research and innovation leadership and management performance of the two selected higher education institutions representing a first - and a second-generation university. Chapter 6 discusses the performance of the research and innovation leadership and management of the two higher education institutions selected to represent third-generation universities.

CHAPTER 6
RESEARCH FINDINGS FROM AN ANALYSIS OF DATA OF THE THIRD-GENERATION UNIVERSITIES

6.1 INTRODUCTION

As introduced in paragraph 5.1, higher education intuitions in Ethiopia are organised based on their generations, namely first-, second- and third-generation universities, with the third-generation universities categorised into two groups, namely general universities and science and technology universities. Like the first- and second-generation universities, the third-generation universities should also perform teaching, research and community engagement functions. To understand and explain the performance of the leadership and management of research and innovation policy and practice of the third-generation higher education institutions in Ethiopia, Thgnu University representing the general universities and Thgnstu University representing the science and technology universities were studied as cases. Within each case, the qualitative and the quantitative data were analysed separately, integrated for each case and finally integrated comprehensively. Consequently, the research findings from the two third-generation universities are discussed in this chapter and an integrated perspective regarding research and innovation management and leadership at all four research sites is presented in Chapter 7. The following paragraphs present the research and innovation leadership and management performance of Thgnu University.

6.2 RESEARCH AND INNOVATION LEADERSHIP AND MANAGEMENT AT THGNU UNIVERSITY

6.2.1 Profile of the research site as a third-generation general university in Ethiopia

Eestablished in 2011, Thgnu University is one of the third-generation general universities in Ethiopia. The university has three functional campuses, six colleges, 42 departments, and offers 49 undergraduate, and 7 master's programmes. Performing the three functions of tuition, research and community engagements, the University strives to become a centre of excellence in East Africa by 2020 (Thgnu University, 2018:11).

In order to understand the research and innovation leadership and management of Thgnu University at policy and practice level, both qualitative and quantitative data were collected using document analysis, semi-structured individual interviewing and a structured questionnaire. The results of the qualitative and the quantitative data were analysed separately and integrated at the end. What follows are the results of the qualitative data analysis.

6.2.2 Results of the qualitative data analysis

The results of the qualitative data analysis were obtained from document analysis of the research policy of Thgnu University, and semi-structured individual interviewing of participants with data from the open-ended questions of the structured questionnaire incorporated into the data from interviewing.

6.2.2.1 Results from document analysis

To evaluate whether the research policy documents of Thgnu and Thgnstu Universities were formulated in line with the two national policy documents on research, namely the national Science, Technology and Innovation (STI) policy and the framework for higher education research and technology transfer document, data were collected in line with the guiding questions developed for policy document analysis (Appendix H). Following are the results of document analysis actions regarding Thgnu University.

Thgnu University research policy

The results of the document analysis were presented comparing the vision, mission, objectives, and priority areas of the national STI policy and the higher education research and technology transfer framework with the vision, mission, objectives, and priority areas for research as included in the research policy document of Thgnu University. In this regard, the research and innovation leadership and management actions included in the three policy documents were also compared.

It was found that Thgnu University did not have a research policy. Rather it had research and development guidelines that did not have a vision, mission, and objectives for research and innovation activities of the University so that it could not be compared with the vision, mission

and objectives of the two national policy documents. However, the University research and development guidelines annexed the research thematic areas of the University as "*natural resources management, food security and nutrition, public health issues, socio-economic and institutional aspects, human and social development, science and technology"* (Thgnu University, 2017:70-71). The guidelines also included emerging and crosscutting issues like "*gender, HIV/AIDS, climate change, inclusive education, special needs education, indigenous knowledge, migration, and culutre and heritage studies"* (Thgnu University, 2017:15).

Compared with the priority areas of the national STI policy, it was found that there were some similarities in relation to natural resource management, human resource development and indigenous knowledge although the national STI policy document set indigenous knowledge as one of the objectives to be achieved and the University guidelines as one of the crosscutting issues to be treated. While the priority areas of the national STI policy focused on research and technology transfer, Thgnu University's thematic areas focused on science and technology actions. The basis for science and technology actions at the University are either the University's own basic and applied research or the knowledge and technology to be transferred from other universities and research centres within and outside the country. It was also found that while the two national policy documents and the University research and development guidelines emphasised human resource development, the University research and development guidelines focused on "*the major economic activities* [agriculture and trade] *of the catchment areas of the university"* (Thgnu University, 2017:15).

With regard to the management and leadership of research and innovation activities at the University, it was found that the guidelines of the University focused mainly on actions from research management and leadership for calls for proposal submissions, proposal reviews, and proposal screenings from departmental to university level with these proposal actions based on the thematic areas of the University (Thgnu University, 2017:30-31). The guidelines also discussed funding, resource management, monitoring, evaluation and reporting of the funded projects, with the guidelines incorporating an innovative research fund as per the suggestions of the higher education research and technology transfer framework. The guidelines stated the focus of the fund as pertaining to societal upliftment and the manager in charge of the fund to be the executive leader of the University. It is described as follows:

> *"It is managed by the president of the university to stimulate young and women staff as well as staff who are proposing extraordinary and innovative research projects*

> *successfully. It is to initiate the creation of new products, services and technology processes, to advance the research community's competency and to develop innovations that can be commercialised and provide economic stimulus in the community"* (Thgnu University, 2017:44).

It was also found that the research leadership, innovation leadership and management, and even the type of research management to be exercised were not discussed in the guidelines, whereas the framework for higher education research and technology transfer suggested that the universities should use result-based professional research management and scientific leadership. To translate the research thematic areas of the University into action, there should be effective research and innovation leadership and management at Thgnu University. In order to understand the research and innovation leadership and management of the University at both policy and practice level, qualitative data was collected using semi-structured individual interviewing. The results of the qualitative data analysis are presented next.

6.2.2.2 Results from the semi-structured individual interviews

At Thgnu University, research leaders from different levels of governance, researchers, and community leaders at zone level were interviewed to represent a total of 15 participants. Although it was planned to collect qualitative data from two industry managers around the University, it was found that there were no manufacturing industries where the university was established. As discussed in paragraph 5.2.2.2, to ensure confidentiality of the presentation and interpretation of excerpts from the verbatim responses, the participants are distinguished by the labels RLU1 to RLU3 for research leaders at university level, RLC1 to RLC3 for research leaders at college level, PL1 to PL3 for project leaders, CI1 to CI3 for co-investigators, and CL1 to CL3 for community leaders. These labels are used for reporting on each university. The research findings interpreted from the analysed data collected via individual interviewing at Thgnu University are presented next under the themes of administrative, adaptive, and enabling leadership.

Administrative leadership at university, college, and project level

Research leaders at university level are responsible for facilitating the formulation of the research policy of Thgnu University in line with the higher education research and technology

transfer framework, and the national STI policy. In this regard, one of the research leaders perceived the research and development guidelines that did not have a vision, mission, and objectives as the research and innovation policy of the University. The leader described, "*Our University's research and community engagement policy is in line with national policies"* (RLU1). On the other hand, a second leader disclosed that the guidelines were assembled from other universities, and the leader described that "*the research and development guidelines of our university is drafted based on the national research and technology transfer directives, which is actually compiled from different university"* (RLU2). A third leader questioned the competency of the first-generation universities and questioned the potential of the third-generation universities to formulate the specific university's own research policy as per national related policies. The leader explained that *"even the first generation universities are struggling in translating national policies let alone our third generation university"*(RLU3).

As administrative (management) leaders, the research leaders of the University should develop the research and innovation priority areas of the University to be aligned to the national related policy priority areas. The leaders were asked whether the priority areas of the University were in line with the national priority areas. The leaders answered that they had eight thematic areas identified in line with the national government policies and strategies and based on the needs of the specific catchment areas using need assessment and baseline surveys, and consultative meetings with all department heads, deans, researchers and all the academic staff. It was clear, however, that although stakeholders were active in providing data they were not included in final decisions on thematic areas in consultative meetings, and the number of the thematic areas is not the same as listed in the research and development guidelines of the University. The research leaders at college level were also asked if the colleges have their own priority areas in line with the priority areas of the University. One of the leaders pointed out that "*the thematic areas of the colleges are in line with the thematic areas of the university"* (RLC3). However, Leader RLC1 said that the thematic areas were so numerous that they could not be managed due to the resource-constraints so that they chose the main areas based on the seriousness of the issue and based on political necessity. The leader explained:

> "*There are prioritised areas that are somewhat bulky that we cannot cover with the human and financial resources we have. So we have to select the most important ones in line with that of the political concern and urgency"* (RLC1).

In translating the thematic areas of the University into practice, the research leaders should develop a strategic plan for research and innovation activities of the University in collaboration with the active involvement of key stakeholders so that all can have a shared vision and goals. In this regard, the leaders responded that they had a strategic plan for the three functions of the University. Therefore, the vice president's office for research and community engagement considers the research and community engagement components from the main strategic plan of the University. To implement the thematic areas of the University, the research leaders should be good at research project management including research project identification, project planning, and project implementation, monitoring and evaluation. In this regard, the research leaders at university and college level explained that they posted calls for proposals. Researchers submitted proposals to college research and community engagement coordinators as per the thematic areas, defended their proposals in the presence of senior experts, and the college level review committee assessed the proposals, selected the best and sent them to the research directorate.

The leaders also described that they allocated a budget for the proposals submitted from the colleges based on a quota as per the allocated budget for the academic year. This implies that projects are not prioritised based on their significant contributions, but merely according to formula quota indicators. One of the leaders at university level disclosed that the lack of experience of researchers to develop good research projects is a more serious problem than financial constraints. The leader described that "*budget is not as such a serious problem rather matured ideas as experience is always a gap in young universities like ours as we are all beginners"* (RLU2). One of the leaders at college level explained that the budget is already determined at university level and there is no flexibility in allocating a budget according to the nature of the research project. The leader stated that "*a budget is fixed for research in our university, for experimental, 40,000 Birr"* (RLC3).

At grass-root level, the project leaders should manage the identification of research problems, research proposal development, knowledge production and the implementation of the research outcomes. The project leaders were asked about how they chose research themes. Project leaders PL2 and PL3 answered that it was based on their personal observation, familiarity with the topic and experience from the actual practice and what is not known from literature. For PL1 the reasons behind choosing some research themes included the seriousness of solving problems relating to "*the prevalence of the issue or the problem, the government commitment*

and concern that might initiate us" (PL1). After selecting a research theme with research problem, the project leaders should select and establish the right research teams that have the required qualifications, skills, and expertise as per the research themes selected. The project leaders and the co-investigators agreed that they built research teams based on the nature of the research project that required a professional mix of research capacity. However, one of the project leaders also acknowledged the importance of personal relationships in team compiling. The leader explained, "*I want to keep the professional mix but I do not deny that the intimacy of my colleagues is also one of the major aspects*" (PL1).

While implementing the research and innovation projects, the research leaders should manage the progress of the projects. The leaders at university and college level explained that they did this mainly through periodic reporting and some supervision. The project leaders are also responsible to manage the progress of the projects. In this regard, the project leaders responded that they monitored the implementation progress of the projects by collecting data from the team members who are then dealt with by meetings where reviewing, monitoring and evaluation measures are discussed. However, monitoring and evaluation of a project have different purposes. Monitoring focuses on collecting data through meetings, reports, or observation to manage the progress of the projects, whereas evaluation focuses on collecting data systematically usually by external bodies to judge and make decisions during and at the end of the project implementation.

To implement the research and innovation projects successfully, the research leaders should manage the resources of the projects properly. With regard to managing human resources, the leaders at university level commented on the challenges of managing the researchers and fostering a culture of research amongst academic personnel. RLU1 explained:

> "S*ince we have junior researchers, we have been struggling to bring the research culture into our university. It is a big challenge because most of the academic staff teach and go home, that is all. They do not have the interest to participate in research so we have had a big challenge to bring them on board*" (RLU1).

For research leader RLU2, managing the budget was very challenging since research projects terminated because academic researchers left the University for different reasons so that the projects would be transferred to the next academic year and that required additional budgeting. In managing the resources effectively, research leader RLC3 stated that both the human and

the financial resources were not organised to be managed at college level, but at university level. The leader stated that "*the finance and the human resources are managed at university level centrally"* (RLC3). Research leader RLC2 also described that "*I check and select the appropriate person for the appropriate task but as a structure, it is complicated for me to manage resources"* (RLC2). Research leader RLC1 responded that managing the human resource and the budgets of the projects was the responsibility of the project leaders, and stated, *"I follow only the overall activities of the projects*" (RLC1). With regard to resource management, one of the project leaders commented on the management of the resources of the projects. The project leader described, "*We may assign the already predesigned financial or human resources according to the proposal but sometime we face constraints of resources. However, the best way of managing resources is by sticking to the proposal document"* (PL1). In this regard, co-investigator CI1 emphasised that the project leaders manage the budget of the project. However, CI1 was dissatisfied with the utilisation of the budget and responded that "*most of the time, the principal investigator takes more than 75% of the budget"* (CI1).

In order to implement the projects effectively, the leaders should have project implementation success criteria. However, the leaders at university and college level responded that they had certain checklists developed in the research and development guidelines of the University, but they did not have specific criteria to assess the implementation successes of the projects. Even in funding a research project, the amount of budget is restricted by the Ministry of Education, and research leader RLU1 stated that "*if it is problem solving, the budget is 30,000 Birr*" (RLU1). In this regard, project leader PL1 described that "*when we develop proposal of a project, there are indicators of success that are used as a parameter to measure success and to evaluate the results"* (PL1). According to co-investigator CI1, no such indicators exist because, "*as a team, we do not have them"* (CI1).

It was clear from the responses that project budgeting and timeframe decisions seemed to be related to common project implementation success criteria. However, the quality and the relevance of the research outcomes from projects for the beneficiaries and stakeholders were not mentioned by participants and should be considered as main implementation success criteria. Leaders should manage the quality of the process and the outcomes of the research and innovation projects. In this regard, the leaders at college level responded that they have shortcomings in managing the quality of the research project. One of the leaders commented on the challenges to manage the quality of the research outputs because of pressing workloads.

The leader stated, "*I think the big challenge is the quality of the research findings, and it is very difficult to maintain quality of research by our very loaded academics"* (RLC3). According to the project leaders, they manage the quality of their projects by having thorough proposals, collecting the right data, and analyzing data using applicable software, whereas the co-investigators believed that if there were facilities and inputs for the research projects, they would expect quality outcomes resulting from implementation of the research and innovation projects.

To manage the quality of the research process as well as the research outcomes, the leaders have to manage the research performance at Thgnu University. Concerning this, the leaders at university, college, and project level concurred that they did not have any criteria for assessing and evaluating research performance of the researchers. In this regard, project leader PL1 said that "*we do not have any formal criteria or guidelines to assess and evaluate the performance of the co-investigators"* (PL1). The project leaders in particular should manage conflict that arises among the researchers in order to ensure effective project progress. The project leaders and two of the co-investigators acknowledged that there was no conflict so far, whereas co-investigator CI2 stated that "*conflicts are natural, and they can be resolved through discussions and sometimes through managerial measures"* (CI2).

As research managers are also innovation managers, the research leaders at different levels of governance at Thgnu University should manage the innovation projects. However, the leaders admitted that they had limitations in terms of implementing the research outcomes, as the University was very young, and one of the leaders working in the technology transfer directorate commented on the shortage of human resources to implement the outcomes of the research projects. The leader disclosed that "*this office lack human resources. I have done everything in this office alone so that I could not try to manage the implementation of the outcomes of the research projects* (RLU3). It became clear that main problems with research endeavour related to the shortage of human resources and the relevance of research project outcomes to address specific local community problems, the problems of the University and the country at large. These problems required the leaders to identify specific beneficiaries in specific contexts to address their specific problems. Therefore, the leaders should exercise adaptive leadership at university, college, and project level so that they can lead the research and innovation projects to be aligned to the specific needs and constraints of the local community, the University, and the country.

Adaptive leadership at university, college, and project level

In exercising adaptive leadership, the research leaders should encourage researchers to focus on the identification of real problems that need immediate action and solution. In this regard, the research leaders at university level responded that problem identification was the responsibility of the researchers. One of the research leaders at college level commented on the challenges of identifying real problems in the local community to relate to researcher experience. The leader described that "*we may not specifically deal with our community's problems. Just as an expert, we identify problems from our experience*" (RLC1). However, the leader from the College of Agriculture at Thgnu University described that they had tried to focus on local community problems like the acute shortage of animal feed and 'Enset' disease. Enset represents a vegetable that grows in the southern part of Ethiopia. Researchers at the College of Agriculture had adapted technology like improved animal feed, a disease resistant variety of Enset and improved seedlings of apple in collaboration with agricultural research centres and non-governmental organisations. In adapting the improved varieties, they relied on operational farms as explained by RLC2, namely that "*they have three or more farm centres that are managed by farm managers"* (RLC2). Co-investigator CI2 also stated that they have a research project on waste management as an acute problem of the town where the University was established. CI2 described:

> *"There are different kinds of wastes like liquid waste and solid waste but our research focuses on integrated solid waste management. The problem of solid waste is the problem of the town we live. Now, we are trying to implement the outcomes of the research to address the proble*m" (CI2).

The research project leaders and some co-investigators responded that the research projects were identified based on the interest and observation of the project leaders and not on the urgent problems of the local community, the University, and the country. With regard to tuition challenges at the University, the research leaders stated that there were research projects regarding methodological issues within the University, how to enhance females' classroom participation, and on the impact of Higher Diploma Programmes on academics' teaching abilities. However, the leaders at college and project level, and the co-investigators informed

that there was not any research project to improve the tuition challenges of the colleges and the University.

Confirming what the leaders at college and project level and the co-investigators said about stakeholder challenges and research endeavour responding to these challenges, the community leaders at zone level emphasised that there are different problems related to education, health and agriculture. With regard to school education challenges and according to community leader CL1, the problems related to providing good quality education in the face of resource constraints and teacher and parent indifference. CL1 explained the condition as "*providing quality education due to shortages of teaching and learning material, incompetent teachers and school principals, students lacked the effort to learn, and the parents' disengagement on their children learning"(*CL1). With regard to health, community leader CL2 described the health-related problems as pertaining to "*lack of human resources, especially trained and skilled professionals at different levels, problems of nutrition and accessibility of pure water"* (CL2). Regarding the different challenges with agriculture relating to crop diseases and climate change, community leader CL3 explained:

> *"The major problems are crop diseases, climate change that results in floods, and drought. There is also lack of knowledge and awareness regarding agricultural practices, and there is food security problem especially at household level. There are shortages of land and income, and low productivity due to shortage of improved varieties and fertilizers*" (CL3).

Since the problems of the local community, the problems of the University, and the problems of the country at large are context specific and require specific solutions, the research leaders should lead basic or applied research, and interdisciplinary, or collaborative research based on the nature of the research problem and the knowledge and technology they intend to produce to contribute to problem solution. In this regard, the research leaders were asked about the type of research they choose to undertake at Thgnu University. The leaders at university, college and project level answered that they were initially engaged in discipline-based research and after the introduction of thematic mega research; they chose to undertake interdisciplinary thematic applied research intending to solve real problems. However, research leader RLU2 commented on the importance of both basic and applied research, but pointed out that basic research is considered a luxury. RLU2 described:

> "*We need to know something about the basic to go to the applied one for intervention. However, this time discipline-based basic research will not be granted. We appreciate the interdisciplinary applied research that people should come from different areas and do research that can solve problem in a wider range*" (RLU2).

It was clear that the research leadership practice was changed from discipline-based research to interdisciplinary applied research. Research leader RLU2 related the reason for the change of research type to the fact that "*there are lot of problems related to agriculture, food security, and natural resource management" (*RLC2) which implies that the research projects should have practical contributions. Undertaking interdisciplinary applied thematic research, the research projects of the University should produce new and practical knowledge and adapt technology or develop the right technology to address the problems of the local community, the University, and the country. In this regard, the leaders were asked about the contributions of the research and innovation projects to new knowledge production and applicable technology use. The leaders at university, college and project level and the co-investigators responded that there were no valuable contributions except need-based training as the University is very young. However, participants indicated that there were some improved varieties of some crops ready to be transferred to the end-users. In this regard, one of the leaders at university level described:

> "*We come up with improved varieties of wheat, 'teff' and chickpea, and the community engagement is expected to multiply these varieties and disseminate to the end users as they are tested and found best for our agro-ecology*" (RLU2).

Regarding contributions to improve the teaching and learning problems of the colleges and the University, the project leaders and the co-investigators responded that there was no engagement to contribute to improvement because there were no scientific studies launched as there was a shortage of budgeting and the projects might not be in line with the research and development guidelines of the University. With regard to the contributions of the research and innovation projects to the local community, the community leaders at zone level admitted that there were no contributions other than need-based training as part of the community engagement function of Thgnu University.

In order to ensure the research and innovation projects contribute to addressing the problems of the local community, the University and the nation, the leaders should develop a culture of learning, creativity and adaptability in their research and innovation leadership practices. One of the leaders at university level commented on the challenges of adaptive leadership pertaining to stakeholder resistance and the solution of promoting these challenges as opportunities. The leader described:

> "*There are change resistant people even at top leadership level. When you bring something new, they resist. The work culture is not performing to the level of our performance. Therefore, those things sometimes could be a challenge but we need to take the challenges as opportunity, we try to convince and develop the culture*" (RLU1).

Leaders at college and project level and co-investigators concurred that a culture of learning was absent though very important. With reference to the University research practice moving from discipline-based basic research to interdisciplinary thematic applied mega research, the research leaders were asked if the move emerged from interactions within and outside the University engaging in research and innovation project activity. Research leader RLU1 pointed out that it was an internally initiated endeavour:

> "D*emand driven research is chosen because of the interactions we have with the stakeholders and we come up with such research strategy. So it is not because the government says so but we strongly believe and we even discuss with the whole staff whether we should stay where we are or move forward by take issues into consideration, and it is by the consensus of all academic staff we move into thematic research*"(RUL1).

It was clear that changing the research leadership practice to interdisciplinary mega research was mainly initiated by agreement amongst research leaders at university level and not because of intent to address burning needs from industry and the local community as determined by consultations with these stakeholders. Leaders at college and project level stated that interdisciplinary applied mega thematic research was introduced by the university level research and community engagement vice president's office, typically by the research and development directorate and did not emerge from the interactions within and outside the

University. One of the project leaders commented on the source of the change of the research leadership practice, experiences of the researchers and how real research problems should be managed. The project leader explained:

> *"It seems from top-down but it may not be a problem. We are third generation university and we may not even have plenty of professionals that are seniors. Most of them are bachelor holders that may not be expected to undertake advanced type of research. When the research problem is real, it should be managed by interdisciplinary research managers as it cannot be handled by single professional*" (PL1).

It was clear from the interviews that if the research leaders at different levels of governance intend to make researchers effective in their research and innovation project engagements, they should create enabling conditions and an enabling environment for research endeavour. In facilitating enabling conditions and an enabling environment, the research and project leaders should practice enabling leadership. The results of the qualitative data regarding enabling leadership at university, college and project level are presented next.

Enabling leadership at university, college and project level

The research leaders at Thgnu University should facilitate interactions among the stakeholders of the University and create favourable conditions for researchers to engage constructively in their research endeavours. One of the conditions is creating strong interrelationships among education, research, and innovation so that the postgraduate education can prepare competent human resources for the University, industry and the country. In this regard, research leader RLU1 questioned the competency of the first-generation universities in properly integrating the three pillars of knowledge, questioning the capabilities of second- and the third- generation universities to pursue such integration. RLU1 described that "*even in the first generation universities where senior researchers are there, the three pillars are not integrated well. Therefore, this is a big challenge for Ethiopian higher education institutions"* (RLU1).

To create interconnection among education, research and innovation, there should be a practical linkage with industry, the government, the University, and the local community.

Research leader RLU3 described the challenge to link industry and the University because of an absence of manufacturing industry in the local community:

> "*We do not have manufacturing industries in our town where our university established. What we have been started at the beginning of this year is that we are looking manufacturing industries at regional level to establish a forum with our university. This year, we planned together but we did not get time to work together. We signed agreement but practically we have not implemented the plan*" (RLU3).

In this regard, the University has to link itself to the local community so that the local community can engage in studying and the University can utilise indigenous knowledge and technology in a scientific way. Regarding liaising with the community, one of the leaders responded, "*That is the point we missed. I do not know how to bring the community to part of the linkage but next time I think it is wonderful idea and we need to incorporate the community in our linkage"* (RLU1). Community leaders at zone level responded that they did not have linkages to undertake collaborative research and innovation projects except need-based training, financial support, and providing some improved varieties of crops and vegetables. One of the community leaders commented on how the University is working with the community and the shortcomings of the research conducted by the University which relates to not being functional research to address real needs encountered in the community. The leader stated:

> "*Thgnu University has started providing improved varieties like potato, Enset and wheat to the community. The University has also been providing awareness training. However, we do not have collaborative research and innovation with the University. There are number of research done by the University so far but they are not problem solving. They are shelved as they did not have the ability to solve local problems*" (CL3).

To sustain linkages among the different stakeholders to have mutual benefits through collaborative leadership, there should be an established and functional innovation system of the University accommodating inputs from industry, the government, the researchers and the local community. In this regard, one of leaders at university level responded that they had made

the effort for such linkage though it was not well established and functional. The leader described:

> "*A system is established but the structure of the University is weak so we are trying to reengineering concerning the human resources. Now we are establishing incubation centres for encouraging innovative ideas related to technology. That is our good start but it should be strengthened*" (RLU1).

Establishing the innovation system of the University also creates enabling conditions to accommodate the differences among researchers and between the stakeholders in terms of human resources, funds, skills, and technology. In this regard, the leaders were asked about the conditions that they facilitated for the researchers to engage in research and innovation projects successfully. The leaders at university level responded that they tried to encourage the researchers to be committed to their duties and responsibilities and to recognise their moral obligations and duties and acknowledge them by writing appreciation letters stating that they are the ones that should contribute to the local community. The leaders also described that they invited senior researchers and professors from different universities to provide research skill training to the junior researchers in order for the junior researchers to have the knowledge with related passion to engage in research and to share their research experiences and publications so that the academic community would be inspired to engage in research activities. However, one of the leaders commented on the potential source of visiting professors but the constraining hesitance from the University to create enabling conditions for researchers. The leader described:

> "*We have lot of professors from these areas in other universities and abroad that are willing to help us but the University is not conducive because we do not have collaboration to bring these people. So far, very generous professors came to our university by their own expenses, and shared their expertise, success stories, and challenges*" (RLU2).

Managing the differences among researchers and between key stakeholders in terms of human resources, funds, skills, technology, and techniques is also the responsibility of leaders at college and project level. In this regard, the research leaders at college level responded that they facilitated different competency building training initiatives, however RLC2 admitted that

"*there are shortages in terms of facilitations because of finance, transportation, and favorable environment"* (RLC2). The project leaders should also facilitate enabling conditions for the co-investigators to be effective and productive in their research and innovation project engagement. In this regard, project leader PL1 confirmed co-investigators' inadequacy, namely that "*they did not have such experience"* (PL1). Co-investigator CI1 responded that "*there are no special conditions for the researchers facilitated by the principal investigators"*. In order to facilitate enabling conditions for the co-investigators, the project leaders should have personal qualities and competencies relating to being skilled at leadership and management of research projects, having good communication skills, and having a thorough knowledge and understanding of the research project. Co-investigator CI2 added additional crucial qualities of the project leaders, namely as pertaining to being "*punctual, cooperative, and open-minded"* (CI2).

In general, it was clear that there are efforts and shortcomings with regard to the leadership and management of the research and innovation policy and practice at Thgnu University. With individual interviewing and with the open-ended questions of the structured questionnaire, participants were requested to indicate the strengths and weaknesses of the research and innovation leadership and management policy and practice of the University. The results of their opinions on leadership strengths and weaknesses are discussed next.

Strengths and weaknesses of the research and innovation leadership and management practice at Thgnu University

The results of the qualitative data from the semi-structured individual interviews and from the open-ended questions of the structured questionnaire showed the main strengths and shortcomings at project, college, and university level. At project level, the main strengths related to facilitating research activity, team building, and resource management. At college level, strengths pertained to research leaders being focused on applied research and facilitating regular schedules for research proposals to be examined and approved by a committee. At university level, the main strengths pertained that there were good intentions to promote applied research to solve community problems and the research leaders tried to disseminate the research findings related to health and agriculture through radio and the annual research conferences of the University.

Participants identified shortcomings as pertaining to the problems and challenges they observed in the research and innovation leadership and management at project, college, and university level. At project level, the main challenge entailed the attitude of academics to conduct research because research was considered as a second duty, secondary to their main duty of tuition. Research problems were identified from internet searches and not from needs encountered by applicable stakeholders. At college level, the main weakness pertained to a lack of coordination, and weak research management and leadership. The departments were not focused on being aligned with the University's policy document with being focussed on community needs not a significant endeavour because of the absence of guidelines for community engagement. Budget constraints exacerbated inadequacy problems. At university level, the research leaders were acting as leaders without preparation to be research leaders so that they did not have the strategies, scientific knowledge, appropriate skills, good leadership, commitment, and honesty to lead the research and innovation projects of the University. The research leaders also did not have the expertise of research management, as they did not obtain the position through fair competition, but through mere seniority resulting in them not managing the research projects effectively as they lacked competence in coordination, monitoring and follow-up. There was no linkage with industry or any of the other possible stakeholders of the projects.

At project, college and university level, there was lack of exercising an interdisciplinary research approach, and there was limited community-based research. The researchers lacked the skill and commitment for engaging passionately in research conduct, as the majority of researchers were young and joined the University after gaining their Bachelor and Master's degree. The system to evaluate research proposals was not clear and appropriate as the proposals were not evaluated by professionals and were not based on the extent to which the intended research had problem-solving capacity relating to stakeholder needs. There was a shortage of proper budgeting for the projects especially for the projects where applied research had to be conducted. There was no standard template for writing research proposals and reports. There were problems in monitoring the progress and evaluating the outputs of the projects. The research outcomes were not applicable for solving community problems because of the low quality of research outputs, as the researchers focused on satisfying their personal agenda pertaining to publication for promotion. There were also weak controlling mechanisms to minimise copying research projects from different sources. There was no training on research undertaking and software application for researchers who lacked experience in these areas. A

research culture was not developed, and the academics were not motivated to conduct research because they were still young and inexperienced. Budgeting for research was inadequate because of fixed funds, and academics were not promoted based on consideration of their profound research performance. Industry did not provide opportunities for students' practical learning with internship programmes as mentors requested expensive fees, merely completed students' attendance register with students returning from the work place without having received proper practical training.

In addressing the shortcomings and improving the research and innovation management and leadership at Thgnu University, the participants were requested to offer suggestions. These suggestions are discussed next.

Suggestions from participants to improve the research and innovation leadership and management policy and practice at Thgnu University

The participants suggested certain actions for improvement of the research and innovation management and leadership at project, college, and university level. At project level, it was suggested that a project appraisal phase be applied. The staff should focus on doing action research, as they are not capable of doing grand research due to a lack of experience. At college level, it was suggested that the research project management including budget management should be delegated college level research leaders.

At project, college, and university level, it was proposed that the research problems should be focused on local problems, and the project beneficiaries and stakeholders should be active participants contributing with project identification. It was found beneficial to focus on and allocate the annual budget of the University to one thematic research project that has the potential to make a substantive contribution in addressing real problems rather than having many less meaningful research projects. Applicable facilities, appropriate funds, and a conducive research environment that motivates researchers to deep thinking are important. However, the researchers should take action in arranging such a conducive environment by developing grant proposals capacitating them to develop academically while obtaining finances for their research endeavour. Research leaders should encourage innovative researchers by allocating sufficient budgets, and awarding them based on the relevance, feasibility and efficiency of their research projects. As research projects differ in value, the budget allocation

should be flexible, and consider the weight and the expected contribution of the specific research project. There should be proper monitoring and continuous follow-up of the research projects as the quality of research output is critical, and there should be continuous training of different kinds of empowerment competency building for the researchers. The research leaders should control the budget against the project performance, and there should be mechanisms to implement the research outcomes constructively.

At university level, the participants suggested that there should be a dynamic and appropriate research policy and research guidelines. The research leaders should be optimistic, committed, responsible, proper communicators, exemplary, open-minded, and good examples serving as identification figures for solid research endeavour. The research leaders should have profound knowledge and skill of research and innovation leadership and management. The leadership positions at Thgnu University in particular and in most Ethiopian universities in general should be filled by means of procedures consisting of fair competition and appointment based on the right qualifications and the right competency and experience. The linkage between the university and industry and among all stakeholders should be strengthened. Community leaders suggested a common pursuit of all stakeholders working collaboratively with the research and innovation projects of the University to produce practical knowledge and the right technology to solve real problems of the local community. It was proposed that the problems of industry should be identified at country or region level, and a problem bank should be available at the universities for researchers to consider when deciding on research problems to be initiated. There should be a uniform governance structure for research and innovation activities for all universities in Ethiopia so that experiences can be shared optimally and functionally.

Comprehensively considered, from the results of the qualitative data analysis about the performance of the research and innovation leadership and management at Thgnu University, it was clear that there were competencies and inadequacies. To understand the research and innovation leadership and management at policy and practice level, quantitative data were also collected using the structured questionnaire distributed to participants and using document analysis pertaining to the five-year annual performance reports of the University. Research findings are presented next.

6.2.3 Findings of the quantitative data analysis

The total number of participants at Thgnu University approached to complete the structured questionnaire was 50 with 48 (96%) who have returned the completed questionnaire. Table 6.1 presents the demographic information of the participants who completed and returned the questionnaire.

Table 6.1: Demographic information on research participants at Thgnu University

Demographic information	**Categories**	**N**	**%**	**Demographic information**	**Categories**	**N**	**%**
Gender	Male	40	83.3	Experience in the specific position	1-3 years	30	62.5
	Female	8	16.7		4-6	11	22.9
	Total	48	100		7-10	2	4.2
Qualification	PhD	4	8.3		Above 10	0	0
	MA/MEd/MSc	44	91.7		Not indicated	5	10.4
	Total	48	100		Total	48	100
Academic ranks	Professor	0	0	Total years of work experience as academics	1-5 years	15	31.3
	Associate professor	0	0		6-10	28	58.3
	Assistant professor	5	10.4		11-15	0	0
	Lecturer	43	89.6		16-20	0	0
	Total	48	100		Above 20	0	0
Training related to responsibilities	Yes	7	14.6		Not indicated	5	10.4
	No	41	85.4		Total	48	100
	Total	48	100				

Keys: N= Number of participants

As shown in Table 6.1, the majority of the participants from Thgnu University were males (83.3%) with females representing a mere 16.7%. Among the participants, only 8.3% of them had doctoral degrees and 91.7% a master's degree qualification. With regard to academic rank, 89.6% of participants were lecturers and 10.4% were assistant professors. With regard to professional training to develop their leadership and research undertaking competencies, 85.4% of the participants did not get any training while 14.6% got training related to their responsibility. The research leaders, the project leaders, and the researchers can also develop their knowledge and skills from their day-to-day practical experience. However, the majority of the participants, 85.4% (62.5% & 22.9%) had one to six years' experience in their specific positions, 4.2% had between seven to ten years of experience in their specific positions while 10.4% did not indicate their experience, maybe feeling inferior having a limited amount of working experience. More than half of the participants (58.3%) had between six to ten years and nearly one third (31.3%) five years' work experience as academics while 10.4% did not

indicate their experiences, possibly feeling inferior perceiving that they were complete novices at academic work.

Related to the demographic data of the participants, the results of the quantitative data regarding administrative, adaptive, and enabling leadership at university, college and project levels at Thgnu University, and the contributions of the research and innovation projects at Thgnu University are presented next.

To describe the research and innovation leadership and management policy and practice at Thgnu University, the participants were requested to indicate their agreement or disagreement regarding the practice of administrative, adaptive, and enabling leadership at university, college, and project level at Thgnu University. The following are the findings of the analysis of the quantitative data regarding administrative leadership at university level.

Administrative leadership at university level

Table 6.2 provides the research findings based on the data collected using the items in Part I of the structured questionnaire about the participants' degree of agreement or disagreement regarding the practice of administrative leadership at university level (Appendix F).

Table 6.2: Agreement and disagreement of participants on matters pertaining to administrative leadership at university level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14	AdL15	AdL16
Participants having	Disagreement	1	N	5	5	4	3	1	0	6	6	9	14	4	5	7	14	11	10
			%	10.4	10.4	8.3	6.3	2.1	0	12.5	12.5	18.8	29.2	8.3	10.4	14.6	29.2	22.9	20.8
		2	N	5	7	8	9	7	9	17	21	24	24	24	16	16	19	17	22
			%	10.4	14.6	16.7	18.8	14.6	18.8	35.4	43.8	50.0	50.0	50.0	33.3	33.3	39.6	35.4	45.8
		3	N	10	8	14	9	15	14	15	12	13	8	16	16	16	13	17	15
			%	20.8	16.7	29.2	18.8	31.3	29.2	31.3	25.0	27.1	16.7	33.3	33.3	33.3	27.1	35.4	31.3
		Sub-total	**N**	**20**	**20**	**26**	**21**	**23**	**23**	**38**	**39**	**46**	**46**	**44**	**37**	**39**	**46**	**45**	**47**
			%	**41.6**	**41.7**	**54.2**	**43.9**	**48**	**48**	**79.2**	**81.3**	**95.9**	**95.9**	**91.6**	**77**	**81.2**	**95.9**	**93.7**	**97.9**
	Agreement	4	N	14	13	13	13	13	8	10	2	2	1	4	8	8	2	3	1
			%	29.2	27.1	27.1	27.1	27.1	16.7	20.8	4.2	4.2	2.1	8.3	16.7	16.7	4.2	6.3	2.1
		5	N	12	13	3	8	4	11	0	7	0	1	0	3	1	0	0	0
			%	25.0	27.1	6.3	16.7	8.3	22.9	0	14.6	0	2.1	0	6.3	2.1	0	0	0
		6	N	2	2	6	6	3	6	0	0	0	0	0	0	0	0	0	0
			%	4.2	4.2	12.5	12.5	6.3	12.5	0	0	0	0	0	0	0	0	0	0
		Sub-total	**N**	**28**	**28**	**22**	**27**	**20**	**25**	**10**	**9**	**2**	**2**	**4**	**11**	**9**	**2**	**3**	**1**
			%	**58.4**	**58.4**	**45.9**	**56.3**	**41.7**	**52.1**	**20.8**	**18.8**	**4.2**	**4.2**	**8.3**	**23**	**18.8**	**4.2**	**6.3**	**2.1**
	Not indicated		N	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0
			%	**0**	**0**	**0**	**0**	10.4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Total		N	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree and 6=strongly agree

AdL=Administrative Leadership

AdL1=The research policy of the university is developed in line with national STI and related higher education policies.

AdL2=The research policy of the university incorporates important elements from national, continental and international science, technology and innovation policies.

AdL3=The university research leaders are managing the policy in line with national priority areas.

AdL4=The research leaders are managing the research policy by developing research strategic plans.

AdL5=The research leaders of the university see the research policy as a finished document.

AdL6=The research leaders influence their followers by controlling their day-to-day activities using the structure of the university.

AdL7=The research leaders are good at developing the research competency of the academics.

AdL8=The research leaders are good at resource mobilization from different sources.

AdL9=The research leaders are effective in managing research projects.

AdL10=The research leaders are effective in managing innovation projects.

AdL11=The research leaders are good at quality control of the research activities

AdL12=The research leaders are effective in resolving conflicts

AdL13=The research leaders are effective in managing the performance of the researchers.

AdL14=The research leaders are good at commercialising the research project results.

AdL15=The leaders are effective in incorporating learning, creativity and adaptability while managing the research and innovation activities of the university.

AdL16=The research leaders are good at establishing networking and partnership with different organisations.

As administrative leaders, the research leaders of Thgnu University should facilitate the formulation and implementation of the research policy of the University in line with national, continental, and global research policies. As shown in Table 6.2, 58.4% of the participants (as opposed to 41.6%) did not think that the University research policy was developed to be aligned to the national research policy and 58.4% of participants (as opposed to 41.7%) denied University research policy to be developed to be aligned to continental and global research policies. To improve the research policy of the University, the leaders should not perceive the policy as a finished document, and 48% of the participants (as opposed to 41.7%) were satisfied that this was the approach followed at Thgnu University. The research leaders should develop the priority areas of the University to be aligned with the priority areas of the national research policy, but 45.9% participants (as opposed to 54.2%) agreed that the University priority areas are aligned to national specifications. To implement the priority areas of the research policy of the University, the research leaders should develop a research strategic plan which 56.3% participants (as opposed to 43.9%) were satisfied was happening at Thgnu University.

To achieve the research policy objectives of Thgnu University, the research leaders should be effective in managing the research and innovation projects though the vast majority of the participants (95.9%) (as opposed to 4.2%) questioned research leaders' capacity for effective management and leadership of innovative research projects. In managing the projects effectively, the leaders have to influence research conduct by facilitating rather than controlling the day-to-day activities of researchers using the research governance structure of the University as motivation measure. Only 48% of the participants (as opposed to 52.1%) believed in the research leaders' influence on the researchers by encouraging their daily engagement in the research and innovation projects through the University's research governance structure.

As skilled project managers, research leaders should be good at mobilising resources for the projects, developing the competency of the researchers, and managing the performance of the researchers by resolving conflict functionally and controlling the quality of the projects in a constant manner. In this regard, 81.3% of the participants (as opposed to 18.7%) did not believe research leaders to mobilise resources effectively, 79.2% (as opposed to 20.8%) questioned the

competency of research leaders to ensure the development of researchers, and 81.2% of participants (as opposed to 18.8%) were not satisfied with research leaders' ability to manage the research performance of the researchers adequately. Among the participants, 77% (as opposed to 23%) opined that research leaders were not skilled at conflict resolution and 91.6% (as opposed to 8.4%) distrusted research leaders' capacity to manage the quality of the research and innovation projects. The research leaders should be good at networking and arranging partnership with different organisations though 97.9% of the participants (as opposed to 2.1%) questioned research leaders' ability to establish workable networks and partnerships with relevant stakeholders at Thgnu University. Research leaders should commercialise the outcomes of the research projects. However, the vast majority of the participants (95.9%) (as opposed to 4.1%) opined that research leaders are not successful in commercializing research outcome endeavour. In improving the research and innovation leadership and management at Thgnu University, the research leaders should incorporate their continuous learning to engender creativity for being flexible in responding to research problems in a tailormade way through incorporating adaptive leadership into the formal research governance structure of the University. In this regard, 93.7% of the participants (as opposed to 6.3%) were not impressed that research leaders are able to incorporate their adaptive leadership approach into the formal research governance structure of the University. What follows are the findings of the quantitative data regarding adaptive leadership at university level.

Adaptive leadership at university level

Table 6.3 represents the research findings based on the data collected using the items in Part I of the structured questionnaire about the extent of agreement and disagreement of the participants regarding the practice of adaptive leadership at university level at Thgnu University (Appendix F).

Table 6.3: Agreement and disagreement of participants on matters pertaining to adaptive leadership at university level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdaL10	AdaL11	AdaL12	AdaL13	AdaL14	AdaL15	AdaL16	AdaL17	AdaL18	AdaL19	AdaL20
Participants having	Disagreement	1	N	7	5	3	3	3	5	10	7	4	1	3	6	4	3	7	10	4	9	5	11
			%	14.6	10.4	6.3	6.3	6.3	10.4	20.8	14.6	8.3	2.1	6.3	12.5	8.3	6.3	14.6	20.8	8.3	18.8	10.4	22.9
		2	N	24	9	16	16	20	25	26	23	27	27	20	16	18	19	19	18	16	16	17	24
			%	50.0	18.8	33.3	33.3	41.7	52.1	54.2	47.9	56.3	56.3	41.7	33.3	37.5	39.6	39.6	37.5	33.3	33.3	35.4	50.0
		3	N	8	24	14	11	9	13	8	11	12	17	21	21	18	21	18	14	17	20	20	7
			%	16.7	50.0	29.2	22.9	18.8	27.1	16.7	22.9	25.0	35.4	43.8	43.8	37.5	43.8	37.5	29.2	35.4	41.7	41.7	14.6
		Sub	N	**39**	**38**	**33**	**30**	**32**	**43**	**44**	**41**	**43**	**45**	**44**	**43**	**40**	**43**	**44**	**42**	**37**	**45**	**42**	**42**

			%	**81.3**	**79.2**	**68.8**	**62.5**	**66.8**	**89.6**	**91.7**	**85.4**	**89.6**	**93.8**	**91.8**	**89.6**	**83.3**	**89.7**	**91.7**	**87.5**	**77**	**93.8**	**87.5**	**87.5**
	Agreement	**4**	**N**	7	10	12	15	13	4	4	5	1	1	4	1	6	4	3	6	11	3	5	4
			%	14.6	20.8	25.0	31.3	27.1	8.3	8.3	10.4	2.1	2.1	8.3	2.1	12.5	8.3	6.3	12.5	22.9	6.3	10.4	8.3
		5	**N**	2	0	3	3	3	1	0	1	4	2	0	4	2	1	1	0	0	0	1	2
			%	4.2	0	6.3	6.3	6.3	2.1	0	2.1	8.3	4.2	0	8.3	4.2	2.1	2.1	0	0	0	2.1	4.2
		6	**N**	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	2.1	0	0	0	0	0	0	0	0	0	0	0	0
		Sub-	**N**	**9**	**10**	**15**	**18**	**16**	**5**	**4**	**9**	**5**	**3**	**4**	**5**	**8**	**5**	**4**	**6**	**11**	**3**	**6**	**6**
			%	**18.8**	**20.8**	**31.3**	**37.6**	**33.4**	**10.4**	**8.3**	**14.6**	**10.4**	**6.3**	**8.3**	**10.4**	**16.7**	**10.4**	**8.4**	**12.5**	**22.9**	**6.3**	**12.5**	**12.5**
	Total		**N**	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL=Adaptive leadership

AdaL1=The research leaders see the practice of research policy as learning by producing new knowledge through participation.

AdaL2=The leaders see the practice of research policy as producing new knowledge to solve real world problems through dynamic interaction.

AdaL3=The research leaders of the university see the research policy as continuous learning.

AdaL4=The research leaders see research leadership as a process.

AdaL5=The research leaders exercise research leadership as context specific.

AdaL6=The research leaders lead the research activities focusing on innovation by facilitating interaction outside the university.

AdaL7=There is collaborative leadership in the innovation system of the university.

AdaL8=The research leaders are good at setting direction.

AdaL9=The leaders are leading the research and innovation activities of the university in line with the needs of the local community.

AdaL10=The leaders are leading the research and innovation activities of the university in line with the needs of the nation.

AdaL11=The leaders are leading the research and innovation activities of the university to address their own internal teaching problems.

AdaL12=The leaders lead the research teams to find solutions to solve local problems.

AdaL13=The leaders are good at collecting information about the weaknesses of their policies and competencies from their stakeholders.

AdaL14=The leaders use the information they gathered to fill their gaps in line with the needs of the stakeholders.

AdaL15=The leaders accommodate emergent ideas into the university research structure to facilitate innovation.

AdaL16=The leaders lead the research and innovation activities of the university to develop new ideas and find innovative solutions to develop new products and services for the local context.

AdaL17=The research leaders emphasise leading basic research within a context of application.

AdaL18=The leaders prioritise applied research for real problem solving.

AdaL19=The leaders focus on action based on learning and creativity.

AdaL20=The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the university.

As adaptive leaders, the research leaders of Thgnu University should consider the research policy as on-going learning, as a practice to produce new knowledge through participation, and as a practice to produce new knowledge to address real world problems through dynamic interactions. As indicated in Table 6.3, 68.8% of the participants (as opposed to 31.3%) did not believe the research policy was managed to engender continuous learning, 81.3% of participants (as opposed to 18.8%) did not believe the research policy to be used to direct the production of new knowledge, and 79.2% (as opposed to 20.8%) questioned the production of relevant knowledge to solve real problems based on research policy intent. To implement the research policy of the University effectively, the research leaders should be competent at setting direction though 85.4% of the participants (as opposed to 14.6%) mistrusted research leadership ability for setting such direction. In implementing the research policy of the University, the research leaders should see research and innovation leadership as a process that is context specific and that should be approached collaboratively. Among the participants, 62.5% (as opposed to 37.6%) did not think leadership understood research conduct as a process, 66.8% (as opposed to 33.4%) questioned leadership's ability to arrange research conduct to be aligned to the specific context, and 91.7% of participants (as opposed to 8.3%) confirmed that no collaborative research endeavours were undertaken at Thgnu University.

The research leaders of Thgnu University should prioritise basic or applied research to achieve context specific outcomes. In this regard, 77% of the participants (as opposed to 22.9%) did not think that research leaders prioritse basic research for context specific application, and 93.8% (as opposed to 6.2%) did not agree that applied research endeavour contributes to the solving of real problems. To achieve the present goals of research and innovation of the University, the leaders should lead the research and innovation activities of the University to be aligned with the problems of the local community, the University, and the country. The majority of the participants (89.6%) (as opposed to 10.4%) questioned research leaders' leadership of research and innovation projects to be aligned to problems encountered in the local community, 91.8% (as opposed to 8.2%) did not see any outcomes of projects leading to the solving of the University's own problems, and 93.8% of participants (as opposed to 6.2%) were sure that research projects did not address national problems. To address the real problems of the local community, the University, and the country, the research leaders should focus on leading the research activities of the University that can be changed into innovation projects in collaboration with concerned beneficiaries and stakeholders. 89.6% of the participants (as opposed to 10.4%) questioned research leaders' capacity to promote research-based

innovation. Research leaders should also lead the research and innovation activities of the University to develop new ideas and innovative solutions to the local context. However, 87.5% of the participants (as opposed to 12.5%) were mistrusting leadership's ability to encourage the development of creative solutions to local problems.

With regard to improving the research and innovation practice of the University, the research leaders should be competent at facilitating dynamic interactions among key stakeholders of the University though 87.5% of the participants (as opposed to 12.5%) did not think research leaders were facilitating any interactions with stakeholders. Research leaders should also focus on actions based on continuous learning in order to engender creativity for innovative research outcomes though 87.5% of the participants (as opposed to 12.5%) questioned leadership's capacity for creative action taking in pursuit of improved performance.

Research leaders have to collect information and feedback on the practice of the research and innovation projects, use the information to address the limitations and accommodate emerging ideas to adjust the research and innovation leadership practices for improved outcomes. However, 83.3% of the participants (as opposed to 16.7%) did not think leadership was successful in collecting feedback to understand their leadership practice and the conducting of research better. 89.7% of participants (as opposed to 10.3%) questioned leadership capacity to use the feedback from research endeavour to address the shortcomings of the research and innovation leadership, and 91.7% (as opposed to 8.3%) did not think that research leadership practice were improved based on relevant ideas that emerged from the interaction within and outside the University. To make the research and innovation projects productive, the research leaders should create enabling conditions and an environment conducive to constructive productivity. In creating enabling conditions for the project leaders and researchers, the research leaders should use enabling leadership, and the findings of the quantitative data regarding enabling leadership at university level are provided next.

Enabling leadership at university level

Table 6.4 provides the research findings based on the data collected using the items in Part I of the structured questionnaire about the extent of agreement and disagreement of participants on the practice of enabling leadership at university level (Appendix F).

Table 6.4: Agreement and disagreement of participants on matters pertaining to enabling leadership at university level

Items				EnL1	EnL2	EnL3	EnL4	EnL5	EnL6	EnL7	EnL8	EnL9	EnL10	EnL11	EnL12	EnL13	EnL14	EnL15
Participants having	Disagreement	1	N	4	7	9	6	8	5	13	14	9	9	6	9	4	8	5
			%	8.3	14.6	18.8	12.5	16.7	10.4	27.1	29.2	18.8	18.8	12.5	18.8	8.3	16.7	10.4
		2	N	22	22	21	17	9	6	16	18	14	18	18	14	20	18	14
			%	45.8	45.8	43.8	35.4	18.8	12.5	33.3	37.5	29.2	37.5	37.5	29.2	41.7	37.5	29.2
		3	N	16	13	10	23	28	18	17	14	22	18	23	25	11	17	21
			%	33.3	27.1	20.8	47.9	58.3	37.5	35.4	29.2	45.8	37.5	47.9	52.1	22.9	35.4	43.8
		Sub-total	**N**	**42**	**42**	**40**	**46**	**45**	**29**	**46**	**46**	**45**	**45**	**47**	**48**	**35**	**43**	**40**
			%	**87.4**	**87.5**	**83.4**	**95.8**	**93.8**	**60.4**	**95.8**	**95.9**	**93.8**	**93.8**	**97.9**	**100.1**	**72.9**	**89.6**	**83.4**
	Agreement	4	N	5	6	7	1	3	18	2	2	2	2	1	0	12	5	4
			%	10.4	12.5	14.6	2.1	6.3	37.5	4.2	4.2	4.2	4.2	2.1	0	25.0	10.4	8.3
		5	N	1	0	1	1	0	0	0	0	1	1	0	0	1	0	3
			%	2.1	0	2.1	2.1	0	0	0	0	2.1	2.1	0	0	2.1	0	6.3
		6	N	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
			%	0	0	0	0	0	2.1	0	0	0	0	0	0	0	0	2.1
		Sub-total	**N**	**6**	**6**	**8**	**2**	**3**	**19**	**2**	**2**	**3**	**3**	**1**	**0**	**13**	**5**	**8**
			%	**12.5**	**12.5**	**16.7**	**4.2**	**6.3**	**39.6**	**4.2**	**4.2**	**6.3**	**6.3**	**2.1**	**0**	**27.1**	**10.4**	**16.7**
	Total		N	48	48	48	48	48	48	48	48	48	48	48	48	48	48	48
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

EnL=Enabling leadership

EnL1=The leaders inspire researchers to engage in research-based innovation.

EnL2=The leaders encourage the researchers to adopt technologies from foreign countries.

EnL3=The leaders are effective in building research teams having different skills with shared identity.

EnL4=The leaders interconnect research activities to facilitate the production, dissemination, and utilisation of new knowledge or technologies.

EnL5=The leaders promote interactive relationships among education, research, and innovation.

EnL6=There is an environment conducive to undertake research and innovation activities in the university.

EnL7=There are adequate funds for research undertakings in the university.

EnL8=There are adequate funds for innovation in the university.

EnL9=There is strong linkage between the university and industry for collaborative research and innovation.

EnL10=The leaders facilitate dynamic interaction between and among researchers from different disciplines.

EnL11=The leaders motivate the researchers to engage passionately in the research task by providing resources to come up with new and innovative results.

EnL12=The leaders put managerial pressure on the university research system to adjust and bring about the required change.

EnL13=The leaders are good at using the structure of the university to address challenges to research and innovation activities.

EnL14=The leaders are good at establishing functional networks across stakeholders that engage in research and innovation activities.

Enl15=There is functional innovation system that comprises researchers, the government, industry,

and the local community

As enabling leaders, the research leaders at university level have to inspire and encourage researchers and build effective research teams that have different skills but a shared identity so that they can produce relevant knowledge and develop the right technology to address local, institutional, and national problems. However, as shown in Table 5.30, 87.4% of the participants (as opposed to 12.5%) did not think research leaders were competent in inspiring researchers to engage in research based innovation, 87.5% of participants (as opposed to 2.5%) questioned research leaders' zest to encourage researchers to adapt foreign technology, and 83.4% of participants (as opposed to 16.7%) questioned leadership capacity to establish research teams that function productively. The leaders should also interconnect the research activities of the University to facilitate the production, dissemination, and application of new knowledge and technology though 95.8% of the participants (as opposed to 4.2%) mistrusted the ability of research leaders at university level to facilitate the production of new knowledge through the application of appropriate technology at Thgnu University.

To address the shortcomings regarding technology, human, material, and financial resources within and outside the Thgnu University, research leaders at university level should encourage the interrelation of tuition, research, and innovation though the vast majority of the participants (93.8%) (as opposed to 6.2%) opined that research leaders are not successful in integration tuition, research and innovation for community improvement. In facilitating the relationship among the three pillars of knowledge, the leaders have to establish a strong linkage between the University and industry for collaborative research and innovation though the vast majority of the participants (93.8%) (as opposed to 6.2%) did not believe that a solid foundation is created to ensure linkages between the University and industry. To translate the research and innovation goals of the University effectively, there should be a functional innovation system at the University that consists of the researchers, the government, industry and the local community though 83.4% of the participants (as opposed to 16.7%) denied any presence of a practical innovation system at the University. With regard to establishing functional networks with key stakeholders who engage in research and innovation activities, 89.6% of the participants (as opposed to 10.4%) did not believe any practical network is established with the stakeholders of research and innovation projects. The research leaders should also facilitate an environment that is conducive to research conduct and allocate an adequate budget for research and innovation projects at Thgnu University. 60.4% of the participants (as opposed to 39.6%) were not impressed with any efforts of creating an environment that is conducive for researchers to engage passionately in their research activities. The vast majority of the

participants (95.8%) (as opposed to 4.2%) were not satisfied with budgetary arrangements for research and innovation projects.

In countering the constraints relating to knowledge and skills development within and outside the University, the research leaders should facilitate interaction among researchers, and should motivate the researchers to engage zealously in the research projects and put managerial pressure on the University research system to adjust the leadership practice and infuse the required changes for improved practice. The vast majority of the participants (93.8%) (as opposed to 6.2%) distrusted research leader capacity to facilitate interaction among researchers from different disciplines; 97.9% of participants (as opposed to 2.1%) did not experience any motivation and encouragement from research management to provide new and innovative solutions to problems. All of the participants (100%) had misgivings about research leaders' competency to prompt energy to arrange for vital changes for improved performance by facilitating the required resources as and when needed. Research leaders should use the University research governance structure to address the challenges of research and innovation project leadership, though 72.9% of the participants (as opposed to 27.1%) were not sure of leadership responding to the challenges of project leadership by using the research governance structure of the University.

One of the main challenges of managing and leading research and innovation at higher education institutions pertains to allocating a sufficient budget for research project endeavour. To describe the practice of planning and utilising budgets for research and innovation projects at Thgnu University, the five-year annual performance reports of the University for the period 2012to 2017 are presented next. Table 6.5 compares the research findings based on the data collected for the five-year period 2012/13 to 2016/17 using a checklist approach about the budget share of the research and community engagement from the annual total budget of Thgnu University (Appendix H).

Table 6.5: Annual budget of Thgnu University and the budget share for research and community engagement

Academic Year	Annual budget planned in Ethiopian Birr	Annual budget for research and community engagement planned	Percentage of the research and community budget	Annual budget achieved	Annual budget share for research and community engagement achieved	Percentage of the research and community budget
2012/13	224,568,290	3,256,500	1.5	182,646,410.39	1,688,734.23	0.9

2013/14	320,491,648.10	7,035,767.07	2.1	274,114,504.70	4,466,481.58	1.6
2014 /15	440,107,500	14,649,402.65	3.3	426,473,775.32	11,161,444.26	2.6
2015/16	624,630,760	24,990,210	4.0	607,250,327.52	22,799,521.79	3.8
2016/17	890,173,031	38,118,967	4.3	890,172,439	30,417,517.05	3.4

Source: Thgnu University Annual Performance Reports (2012/13-2016/17)

As indicated in Table 6.5, the budget share for research and community engagement represents an increase from 1.5% to 4.3% for the five-year period 2012/13 to 2016/17. This increase pertains the planning of the budget share for research and community engagement by utilising the planned budget for research and community engagement from 0.9% to 3.8% in four consecutive years from 2012/13 to 2015/16 which was reduced again to 3.4% for 2016/17. From Table 6.5, it is clear that the budget share for research and community engagement did not reach its minimum share of 5% for budget allocation as set for higher education institutions in Ethiopia by the framework for higher education research and technology transfer document.

Competency of research leaders at university level to manage research and innovation – a critical interpretation

A critical interpretation of the research findings on administrative, adaptive, and enabling leadership at university level at Thgnu University regarding the research and innovation leadership and management of research leaders revealed that there were competency shortcomings with leadership and management of research and innovation at Thgnu University. In exercising administrative leadership, the research leaders of the University should be competent to manage the research and innovation projects of the University though the vast majority of the participants (95.9%) were not satisfied with the ability of research leaders to manage research projects effectively. The research leaders of the University should also be competent in leading the research and innovation projects as per the specific context and the real problems of the local community, the University, and the country to ensure change for the sake of improvement though more than 89.6% of the participants denied adaptive leadership competency of research leaders at university level at Thgnu University. In motivating and encouraging researchers to productivity in their research and innovation project engagement, the research leaders should create enabling conditions by motivating the researchers and facilitating the required resources though the vast majority of the participants (97.9%) were not satisfied with such actions taking place at Thgnu University.

In producing and utilising relevant knowledge and technology in higher education institutions, administrative, adaptive, and enabling leadership should also be exercised at college level with regard to research and innovation management and leadership. The findings of the quantitative data regarding administrative leadership at college level at Thgnu University are provided next.

Administrative leadership at college level

Table 6.6 shows the research findings based on the data collected using the items in Part II of the structured questionnaire about the degree of agreement and disagreement of participants regarding the practice of administrative leadership at college level at Thgnu University (Appendix F).

Table 6.6: Agreement and disagreement of participants on matters pertaining to administrative leadership at college level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13
Participants having	Disagreement	1	N	1	1	6	2	7	9	5	7	7	6	16	11	9
			%	2.1	2.1	12.5	4.2	14.6	18.8	10.4	14.6	14.6	12.5	33.3	22.9	18.8
		2	N	5	5	0	12	5	24	22	21	13	26	18	17	17
			%	10.4	10.4	0	25.0	10.4	50.0	45.8	43.8	27.1	54.2	37.5	35.4	35.4
		3	N	9	12	10	24	11	11	12	13	20	11	10	10	17
			%	18.8	25.0	20.8	50.0	22.9	22.9	25.0	27.1	41.7	22.9	20.8	20.8	35.4
		Sub-total	**N**	**15**	**18**	**16**	**38**	**23**	**44**	**39**	**41**	**40**	**43**	**44**	**45**	**43**
			%	**31.3**	**37.5**	**33.3**	**79.2**	**47.9**	**91.7**	**81.2**	**85.5**	**83.4**	**89.6**	**91.6**	**93.7**	**89.6**
	Agreement	4	N	19	17	17	6	21	4	6	6	5	4	4	3	2
			%	39.6	35.4	35.4	12.5	43.8	8.3	12.5	12.5	10.4	8.3	8.3	6.3	4.2
		5	N	9	8	12	3	4	0	3	1	2	1	0	0	3
			%	18.8	16.7	25.0	6.3	8.3	0	6.3	2.1	4.2	2.1	0	0	6.3
		6	N	5	5	3	1	0	0	0	0	1	0	0	0	0
			%	10.4	10.4	6.3	2.1	0	0	0	0	2.1	0	0	0	0
		Sub-total	**N**	**33**	**30**	**32**	**10**	**25**	**4**	**9**	**7**	**8**	**5**	**4**	**3**	**5**
			%	**68.8**	**62.5**	**66.7**	**20.9**	**52.1**	**8.3**	**18.8**	**14.6**	**16.7**	**10.4**	**8.3**	**6.3**	**10.5**
	Total		N	48	48	48	48	48	48	48	48	48	48	48	48	48
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The research leader (coordinator) of the college manages the college research activities in line with the university research policy.

AdL2=The research leader of the college manages the college innovation activities in line with the university research policy.

AdL3=The leader is good at communication with the researchers.

AdL4=The leader focuses on managing the schedules and budgets of the projects.

AdL5=The leader is good at delegating managerial responsibilities for improved performance.

AdL6=The research leader is good at research project management.

AdL7=The research leader is good at managing the performance of the researchers.

AdL8=The research leader is good at resources mobilization for the projects.

AdL9=The research leader is good at resolving conflict among researchers.

AdL10=The research leader is effective in managing the qualities of applicability outcomes of the research projects.

AdL11=The research leader is good at managing research-based innovation.

AdL12=The research leader is struggling in innovation project management.

AdL13=The leader is good at incorporating learning, creativity and adaptability while managing research and innovation activities of the college.

As administrative leaders, the research leaders at college level at Thgnu University should manage research and innovation activities to be aligned to the University's research policy. In this regard, 68.8% of the participants (as opposed to 31.3%) did not rate the research management competency of the colleges as effective, and 62.5% of participants (as opposed to 37.5%) opined that research leadership and management were not capacitated for innovation management capabilities of the colleges. To translate the research and innovation activities of the colleges into action, the research leaders should be good at research and innovation project management, but 91.7% of the participants (as opposed to 8.3%) questioned the adequacy of research project management and leadership, and 93.7% of participants (as opposed to 6.3%) did not think research management and leadership are able to engender innovation endeavour with research project activities.

As effective project managers, the research leaders should be good at communication, resource mobilisation, and conflict resolution. In this regard 66.7% of participants (as opposed to 33.3%) were impresses with research leaders' communication skills, 85.5% (as opposed to 14.6%) did not believe resources to be mobilized effectively and 83.4% of participants (as opposed to 16.7%) questioned the competency of the research management in resolving conflict functionally. The leaders should manage the research projects with regard to quality outcomes, ensuring enough budgeting and arranging realistic timeframes for product completion, and 79.2% of the participants (as opposed to 20.9%) did not evaluate research leaders' competency to ensure enough budgeting and realistic timeframes to be adequate. Most of the participants (89.6%) (as opposed to 10.4%) did not think research projects are managed in such a way warranting quality research outcomes with applicable use and 91.6% of the participants (as

oppose to 8.4%) did not believe that research leaders are able to ensure research-based innovation.

Research leaders should manage the progress of the research, and delegate managerial responsibilities for improved performance though the majority of the participants (81.2%) (as opposed to 18.8%) questioned research leaders' capacity to ensure improved performance with research endeavour and 52.1% of participants (as opposed to 47.9%) felt strongly that research management should be delegated for the sake of improved performance. To improve the research and innovation activities of the colleges at Thgnu University, the leaders should apply and incorporate their continuous learning engendering creativity and adaptability for improved outcomes by incorporating their adaptive leadership endeavour into the formal research governance structure of the colleges. 89.6% of the participants (as oppose to 10.4%) questioned research leadership at college's level capacity to respond to the challenges for improved performance using administrative leadership. The findings of the quantitative data regarding adaptive leadership at college level at Thgnu University are presented next.

Adaptive leadership at college level

Table 6.7 provides the research findings based on the data collected using the items in Part II of the structured questionnaire about the extent to which participants agree or not regarding the practice of adaptive leadership at college level at Thgnu University (Appendix F).

Table 6.7: Agreement and disagreement of participants on matters pertaining to adaptive leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
AdaL1	8	16.7	28	58.3	8	16.7	**44**	**91.7**	4	8.3	0	0	0	0	**4**	**8.3**	48	100
AdaL2	10	20.8	28	58.3	8	16.7	**46**	**95.8**	2	4.2	0	0	0	0	**2**	**4.2**	48	100
AdaL3	8	16.7	18	37.5	15	31.3	**41**	**85.5**	7	14.6	0	0	0	0	**7**	**14.6**	48	100
AdaL4	8	16.7	12	25.0	23	47.9	**43**	**89.6**	4	8.3	1	2.1	0	0	**5**	**10.4**	48	100
AdaL5	1	2.1	22	45.8	13	27.1	**36**	**75**	8	16.7	4	8.3	0	0	**12**	**25**	48	100
AdaL6	5	10.4	20	41.7	21	43.8	**46**	**95.9**	2	4.2	0	0	0	0	**2**	**4.2**	48	100
AdaL7	5	10.4	27	56.3	11	22.9	**43**	**89.6**	5	10.4	0	0	0	0	**5**	**10.4**	48	100

Keys:

AdaL1=The colleges put more value on areas of research applicable to the internal development of the college.

AdaL2=The leader is leading the researchers to research their own teaching to address the internal problems of the colleges.

AdaL3=The leader is leading the researchers to research and address the problems of the local communities.

AdaL4=The leader is leading the researchers to research and produce new knowledge for the socio-economic development of the country.

AdaL5=The research leader is struggling with innovation project leadership.

AdaL6=The leader focuses on action based learning and creativity.

AdaL7=The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the colleges.

As adaptive leaders, the research leaders at college level at Thgnu University should lead the research and innovation activities to be aligned to the specific context of the college, the local community, and the nation. As shown in Table 6.7, the vast majority of participants (91.7%) were of the opinion that leadership at college level is not able to manage the internal development of the colleges while only 8.3% of participants had faith in leadership's abilities. The vast majority of the participants (95.8%) (as opposed to 4.2%) did not believe leadership to have the capacity to align research endeavour with teaching problems encountered in the colleges, 85.5% of participants (as opposed to 14.5%) did not perceive leadership to align research endeavour with problems encountered in the local community, and 89.6% of participants (as opposed to 10.4%) did not think leadership to have the ability to contribute to

the socio-economic development of the country. To ensure the research and innovation activities of the colleges address internal problems, the problems of the local community and the nation, the leaders should be good at innovative project leadership. However, 75% of participants (as opposed to 25%) questioned this capability of research leadership at college level at Thgnu University.

In improving the research and innovation leadership at college level at the University, the leaders should practice the research and innovation leadership as an ongoing process so that they are able to gain improved knowledge on a constant basis in order to create improved knowledge and technology to adapt to the needs of the specific context. Consequently, the leaders should take action based on learning and creativity though the vast majority of the participants (95.9%) (as opposed to 4.1%) mistrusted research leadership's capability for such adaptation relating to taking action based on improved learning to prompt creativity. In facilitating the learning from the research and innovation leadership practice, the leaders should facilitate dynamic interactions among their key stakeholders though 89.6% of the participants (as opposed to 10.4%) had misgivings regarding the competency of research leaders at college level to arrange for collaboration opportunities. In order to facilitate interaction within and outside the colleges and creating enabling conditions, research leaders should use enabling leadership, and the findings of the quantitative data regarding enabling leadership at college level at Thgnu University are provided next.

Enabling leadership at college level

Table 6.8 depicts the research findings based on the data collected using the items in Part II of the structured questionnaire about the extent of agreement and disagreement of participants regarding the practice of enabling leadership at college level at Thgnu University (Appendix F).

Table 6.8: Agreement and disagreement of participants on matters pertaining to enabling leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	**N**	**%**	N	%	N	%	N	%	**N**	**%**	N	%
EnL1	4	8.3	17	35.4	19	39.6	**40**	**83.3**	7	14.6	1	2.1	0	0	**8**	**16.7**	40	100
EnL2	2	4.2	14	29.2	22	45.8	**38**	**79.2**	9	18.8	1	2.1	0	0	**10**	**20.9**	40	100
EnL3	10	20.8	9	18.8	23	47.9	**42**	**87.5**	4	8.3	2	4.2	0	0	**6**	**12.5**	40	100
EnL4	11	22.9	18	37.5	14	29.2	**43**	**89.6**	4	8.3	1	2.1	0	0	**5**	**10.4**	40	100
EnL5	2	4.2	14	29.2	24	50.0	**40**	**83.4**	5	10.4	2	4.2	1	2.1	**8**	**16.7**	40	100
EnL6	7	14.6	6	12.5	29	60.4	**42**	**87.5**	4	8.3	2	4.2	0	0	**6**	**12.5**	40	100
EnL7	3	6.3	16	33.3	24	50.0	**43**	**89.6**	5	10.4	0	0	0	0	**5**	**10.4**	40	100
EnL8	4	8.3	13	27.1	15	31.3	**32**	**66.7**	8	16.7	8	16.7	0	0	**16**	**33.4**	40	100

Keys:

EnL1=The research leaders motivate the researchers to undertake problem-solving research.

EnL2=The leader are good at team building has different skills.

EnL3=The leader are good at inspiring the researchers to engage in the research and innovation projects effectively.

EnL4=The research leaders encourage disciplined-based research to produce improved discipline –based knowledge.

EnL5=The research leaders encourage interdisciplinary research to solve real problems.

EnL6=The research leaders encourage collaborative research with external bodies that promote research-based innovation.

EnL7=The leaders are good at establishing functional networks across stakeholders that engage in research and innovation activities.

EnL8=The leaders are good at using the structure of the college to address challenges to research and innovation activities.

In creating enabling conditions for researchers, the research leaders at college level at Thgnu University should employ enabling leadership which pertains to research leaders motivating and inspiring researchers and building research teams with members having different skills but a shared identity. As is evident from Table 6.8, the majority of participants (87.5%) (as opposed to 12.5%) did not perceive the research leaders to act inspiringly encouraging researchers to engage in the research and innovation projects effectively, 79.2% of participants (as opposed to 20.9%) had misgivings about leadership arranging competent research teams, and 83.3% of participants (as opposed to 16.7%) did not think research leadership to motivate researchers

convincingly to engage in problem-solving research. The leaders should encourage the researchers to undertake discipline-based research to produce improved discipline-based knowledge, and interdisciplinary research to solve real problems and collaborative research to promote research-based innovation. In this regard, the majority of participants (89.6%) (as opposed to 10.4%) did not have faith in their research leaders to lead discipline-based research to produce improved knowledge, 83.4% of participants (as opposed to 16.7%) mistrusted research leaders to lead interdisciplinary research successfully to address real problems and 87.5% of participants (as opposed to 12.5%) were not positive about research leaders' ability to arrange for collaborative engagement in order to promote research-based innovation.

To counter the constraints relating to human, material, and financial resources, the research leaders should establish functional networks with their stakeholders to engage in research and innovation activities at the colleges at Thgnu University. However, the majority of the participants (89.6%) (as opposed to 10.4%) questioned the competencies of leadership at college level to arrange for constructive networks with the stakeholders of the research and innovation projects. The research leaders should use the research governance structure of the colleges to address challenges of research and innovation leadership though 66.7% of the participants (as opposed to 33.4%) were not positive about leadership responding to the challenges with research and innovation project endeavour using the research governance structure of the colleges at Thgnu University.

Competency of research leaders at college level to manage research and innovation – a critical interpretation

With regard to a critical interpretation of the research findings of administrative, adaptive, and enabling leadership regarding research and innovation management and leadership at college level at Thgnu University, it became clear that there were shortcomings with regard to leadership competency. As administrative leaders, the research leaders at college level at Thgnu University should be competent in research and innovation project management though more than 91% of the participants were not sure of leadership possessing competency pertaining to research and innovation project management at University level. In leading the research and innovation projects to be aligned to the problems of the local community, the University, and the country, more than 85% of the participants emphasised that the research leaders was not competent at adaptive leadership. In order to make the researchers effective in

their research undertakings and applying the research outcomes functionally to solve real problems, the research leaders at university level at Thgnu University should be competent in motivating, encouraging, and inspiring the researchers to undertake different kinds of research for different purposes. In this regard, more than 80% of the participants were of the opinion that the leaders were not competent in leading discipline-based research to produce improved knowledge, to undertake interdisciplinary research to solve real problems, or collaborative research to promote research based innovation at Thgnu University.

Administrative, adaptive, and enabling leadership should also be exercised at project level so that the research and innovation project leaders can use the three leadership functions to manage and lead the research and innovation projects effectively. The findings of the quantitative data regarding the practice of administrative leadership at project level are provided next.

Administrative leadership at project level

Table 6.9 provides the research findings based on the data collected using the items in Part III of the structured questionnaire about the extent of disagreement and agreement of participants regarding administrative leadership at project level (Appendix F).

Table 6.9: Agreement and disagreement of participants on matters pertaining to administrative leadership at project level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14
Participants having	Disagreement	1	N	24	7	10	7	7	8	9	4	5	8	14	8	9	20
			%	50.0	14.6	20.8	14.6	14.6	16.7	18.8	8.3	10.4	16.7	29.2	16.7	18.8	41.7
		2	N	14	20	28	23	24	29	22	21	10	24	27	14	10	16
			%	29.2	41.7	58.3	47.9	50.0	60.4	45.8	43.8	20.8	50.0	56.3	29.2	20.8	33.3
		3	N	7	13	10	16	7	11	16	16	23	12	6	17	29	9
			%	14.6	27.1	20.8	33.3	14.6	22.9	33.3	33.3	47.9	25.0	12.5	35.4	60.4	18.8
		Stub-total	**N**	**45**	**40**	**48**	**46**	**38**	**48**	**47**	**41**	**38**	**44**	**47**	**39**	**48**	**45**
			%	**93.8**	**83.4**	**99.9**	**95.8**	**79.2**	**100**	**97.9**	**85.4**	**79.1**	**91.7**	**98**	**81.3**	**100**	**93.8**
	Agreement	4	N	3	7	0	2	5	0	1	3	7	4	1	4	0	3
			%	6.3	14.6	0	4.2	10.4	0	2.1	6.3	14.6	8.3	2.1	8.3	0	6.3
		5	N	0	1	0	0	1	0	0	4	2	0	0	4	0	0
			%	0	2.1	0	0	2.1	0	0	8.3	4.2	0	0	8.3	0	0
		6	N	0	0	0	0	4	0	0	0	1	0	0	1	0	0
			%	0	0	0	0	8.3	0	0	0	2.1	0	0	2.1	0	0
		Stub-	**N**	**3**	**8**	**0**	**2**	**10**	**0**	**1**	**7**	**10**	**4**	**1**	**9**	**0**	**3**

			%	**6.3**	**16.7**	**0**	**4.2**	**20.8**	**0**	**2.1**	**14.6**	**20.9**	**8.3**	**2.1**	**18.7**	**0**	**6.3**
	Total		N	48	48	48	48	48	48	48	48	48	48	48	48	48	48
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The project leader (principal investigator) sets realistic and functional objective(s) for a project in collaboration with the project stakeholders.

AdL2=The project leader is good at communication.

AdL3=The project leader is effective in research project management.

AdL4=The project leader is good at managing resources.

AdL5=The project leader is struggling to manage the quality of the research project in terms of producing new and relevant knowledge.

AdL6=The project leader is effective in innovation project management.

AdL7=The project leader is a good problem solver.

AdL8=The project leader manages project progress effectively.

AdL9=The project leader manages the success of the project in terms of time and budget.

AdL10=The project leader manages his or her team effectively.

AdL11=There is effective risk-assessment in the research and innovation projects.

AdL12=The project leader is good at conflict resolution.

AdL13=The project leader is effective in obtaining research grants.

AdL14=The project leader is good at incorporating learning, creativity and adaptability while managing research or innovation project.

As administrative leaders, the project leaders should be good at setting realistic and functional objectives for their research and innovation projects in collaboration with the beneficiaries and key stakeholders of the projects. However, 93.8% of the participants (as opposed to 6.2%) questioned the competency of the project leaders in planning practical objectives for the projects. To set realistic and functional objectives for the projects, the leaders should be skilled at research and innovation project management though all the participants (99.9% & 100%) had misgivings about the competencies of the project leaders to manage research and to manage innovation effectively. In managing the research projects, the project leaders should secure financial resources by obtaining research grants though all the participants (100%) mistrusted project leaders' competency to arrange for sufficient research grants. The project leaders should manage the resources for the research projects, project progress, and the research team of each research project effectively. However, 95.8% of the participants (as opposed to 4.2%) questioned project leaders' ability to arrange project resources adequately, 85.4% (as opposed to 14.6%) did not think project leaders are skilled at managing the progress of the projects, and 91.7% of participants (as opposed to 6.3%) were not satisfied with project leaders' management of the research teams. The project leaders should manage the research projects in terms of

budget and timeframe, but 79.1% of participants (as opposed to 20.9%) questioned project leaders' ability to manage research projects successfully with regard to budgets for the projects and timeframes for projects' progress and completion.

Regarding managing possible project risks, 98% of the participants (as opposed to 2%) did not think project leaders were skilled to manage project risk factors pertaining to an adequate basis for the research project to progress according to planned schedule effectively. As an effective project manager, the project leaders should be good at communication, problem solving, and conflict resolution. Most of the participants (83.4%) (as opposed to 16.7%) did not believe project leaders had effective communication skills, 97.9% of participants (as opposed to 2.1%) questioned project leaders' ability to solve problems arising from the research projects constructively, and 81.3% of participants (as opposed to 18.7%) had misgivings about project leaders' capacity to resolve possible conflict among team members functionally. The project leaders should manage the quality of the research outcomes but 79.2% of the participants (as opposed to 20.8%) did not think this kind of management was taking place, namely ensuring consistent quality of the research project undertakings and the functional application of research outcomes within practice. To improve the management of the research and innovation projects, the project leaders should incorporate their continuous learning to prompt creativity for adaption with future conduct but 93.8% of the participants (as opposed to 6.2%) questioned the competency of the project leaders in practising research and innovation leadership as a process by exercising adaptive leadership. In order to describe the practice of adaptive leadership at project level, the findings based on data quantitatively collected are provided next.

Adaptive leadership at project level

Table 6.10 provides the research findings based on the data collected using the items in Part III of the structured questionnaire about the extent of agreement and disagreement of participants regarding the practice of adaptive leadership at project level at Thgnu University (Appendix F).

Table 6.10: Agreement and disagreement of participants on matters pertaining to adaptive leadership at project level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdaL10	AdaL11
Participants having	Disagreement	1	N	19	8	9	11	4	15	6	4	6	9	8
			%	39.6	16.7	18.8	22.9	8.3	31.3	12.5	8.3	12.5	18.8	16.7
		2	N	15	23	25	27	29	10	25	8	23	28	20
			%	31.3	47.9	52.1	56.3	60.4	20.8	52.1	16.7	47.9	58.3	41.7
		3	N	13	15	12	10	13	22	13	32	16	6	13
			%	27.1	31.3	25.0	20.8	27.1	45.8	27.1	66.7	33.3	12.5	27.1
		Sub-total	N	**47**	**46**	**46**	**48**	**46**	**47**	**44**	**44**	**45**	**43**	**41**
			%	**98**	**95.9**	**95.9**	**100**	**95.8**	**97.9**	**91.7**	**91.7**	**93.7**	**89.6**	**85.5**
	Agreement	4	N	1	2	2	0	2	1	4	4	3	4	6
			%	2.1	4.2	4.2	0	4.2	2.1	8.3	8.3	6.3	8.3	12.5
		5	N	0	0	0	0	0	0	0	0	0	1	1
			%	0	0	0	0	0	0	0	0	0	2.1	2.1
		6	N	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0
		Stub-total	N	**1**	**2**	**2**	**0**	**2**	**1**	**4**	**4**	**3**	**5**	**7**
			%	**2.1**	**4.2**	**4.2**	**0**	**4.2**	**2.1**	**8.3**	**8.3**	**6.3**	**10.4**	**14.6**
	Total		N	48	48	48	48	48	48	48	48	48	48	48
			%	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL1=The project leader is effective in research project leadership.

AdaL2=The project leader is effective in leading innovation projects to develop unique products and services for commercialization.

AdaL3=The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the local communities.

AdaL4=The project leader is effective in leading innovation projects to develop unique product and service to solve the problem of the country.

AdaL5=The project leader assigns difficult tasks and facilitates collaboration.

AdaL6=The project leader facilitates teamwork, and creates room for interaction and exchange of ideas.

AdaL7=The project leader builds research teams based on the competencies of the researchers.

AdaL8=The project leader focuses on action based on learning and creativity.

AdaL9=The project leader leads researchers to produce new knowledge to address the challenges of the industry.

AdaL10=The project leader leads researchers to produce new knowledge to address the challenges of the local community.

AdaL11=The project leader leads researchers to produce new knowledge to address the challenges of the university itself.

Functioning as adaptive leaders, the project leaders should be effective in leading the research and innovation projects at Thgnu University to be aligned to the specific context and real problems encountered in the specific context. Therefore, the project leaders should lead the

researchers to produce new knowledge to address the challenges encountered by industry, the local community, and the University. Among the participants, 93.7% (as opposed to 6.3%) did not think project leaders' research leadership competency was adequate to respond to challenges of industry, 89.6% of participants (as opposed to 10.4%) questioned research leadership's capacity to address the problems of the local community, and 85.5% of participants (as opposed to 14.5%) did not believe project leaders are able to arrange for research outcomes to solve the University's own problems.

Research project leaders are also innovation project leaders; they should therefore engender innovation with research conduct. Among the participants, 98% (as opposed to 2%) did not have faith in leadership's competencies to encourage innovative research endeavour in order to develop new products and services for constructive use by consumers, 95.9% of participants (as opposed to 4.1%) questioned leadership's competency to motivate the development of new products and services to solve problems of the local community. All the participants (100%) questioned the innovation project leadership's competency in developing unique products and services to address national problems. To achieve the research and innovation objectives effectively, the project leaders should establish research teams based on the competencies of each member of the research team, they should facilitate teamwork, and assign difficult tasks that necessitate collaborative efforts. The vast majority of the participants (91.7%) (as opposed to 8.3%) did not think project leaders were able to establish research teams constructively, 97.9% of participants (as opposed to 2.1%) did not believe project leaders encourage teamwork endeavour passionately, and 95.8% of participants (as opposed to 4.2%) had misgivings on project leaders' capacity to manage challenging research tasks that require functional collaboration.

In improving the research and innovation leadership of the projects at Thgnu University, the project leaders should take actions based on continuous learning engendering creativity for adaption with research conduct in pursuit of sustained improvement. 97.1% of participants (as opposed to 2.9%) were not sure that project leaders are able to ensure the pursuit of such research conduct. In order to create enabling conditions and an environment conducive to constructive research conduct, the project leaders should apply enabling leadership, and the findings of the quantitative data regarding enabling leadership at project level at Thgnu University are provided next.

Enabling leadership at project level

Table 6.11 reveals the research findings based on the data collected using the items in Part III of the structured questionnaire about the agreement and disagreement of participants on the practice of enabling leadership at project level at Thgnu University (Appendix F).

Table 6.11: Agreement and disagreement of participants on matters pertaining to enabling leadership at project level

Items	Disagreement								Agreement								Total	
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
EnL1	9	18.8	12	25.0	22	45.8	**43**	**89.6**	5	10.4	0	0	0	0	**5**	**10.4**	48	100
EnL2	9	18.8	12	25.0	24	50.0	**45**	**93.8**	3	6.3	0	0	0	0	**3**	**6.3**	48	100
EnL3	12	25.0	20	41.7	13	27.1	**45**	**93.8**	3	6.3	0	0	0	0	**3**	**6.3**	48	100
EnL4	8	16.7	29	60.4	8	16.7	**45**	**93.8**	3	6.3	0	0	0	0	**3**	**6.3**	48	100
EnL5	17	35.4	10	20.8	20	41.7	**47**	**97.9**	1	2.1	0	0	0	0	**1**	**2.1**	48	100
EnL6	11	22.9	12	25.0	14	29.2	**37**	**77.1**	11	22.9	0	0	0	0	**11**	**22.9**	48	100
EnL7	17	35.4	16	33.3	15	31.3	**48**	**100**	0	0	0	0	0	0	**0**	**0**	48	100
EnL8	11	22.9	9	18.8	21	43.8	**41**	**85.5**	6	12.5	1	2.1	0	0	**7**	**14.6**	48	100

Keys:

EnL1=The project leader is good at motivating his/her research team.

EnL2=The project leader is able to promote good quality research and innovation.

EnL3=The project leader encourages creative researchers.

EnL4=The project leader is effective in using ICT for research and innovation management.

EnL5=The project leader has the quality of a broker to create linkage between teaching, research, and innovation.

EnL6=The project leader is very good at team building.

EnL7=The project leader injects tension into his/her research team to come up with innovative ideas.

EnL8=The project leader is good at using the structure of the college to address challenges to research and innovation activities.

As enabling leaders, the project leaders should motivate their research teams and encourage creativity among researchers so that they can engage in their research and innovation projects innovatively. As can be seen from Table 6.11, 89.6% of the participants (as opposed to 10.4%)

questioned project leaders' competency to inspire their research teams to exceptional research conduct, and 93.8% of participants (as opposed to 6.2%) were not satisfied with project leaders' zest for encouraging researchers to be innovative in their research endeavours. The project leader should build good research teams, promote quality research and innovation, and use information technology applicably in managing research and innovation activities. Among the participants, 77.1% (as opposed to 22.9%) questioned the competency of the project leaders in establishing effective research teams. The vast majority of participants (93.8%) (as opposed to 6.2%) were not sure about project leaders' capacity to manage the quality of the research undertakings outstandingly in order to be applied as research outcomes to address real problems effectively. 93.8% of participants (as opposed to 6.2%) did not think project leaders use information technology adequately to manage the research and innovation projects successfully.

The project leaders should have broker qualities in order to arrange conditions to link tuition, research, and innovation practically but most participants (97.9%) (as opposed to 2.1%) judged the ability of project leaders to arrange such linkage as inadequate. When problems need urgent innovative solutions, the project leaders should guide and motivate the researchers to provide new and innovative ideas though all of the participants (100%) questioned project leaders' competency to prompt creativity to address complex problems that require innovative solutions. In addressing the challenges of the research and innovation leadership at project level at Thgnu University, the project leaders have to use the research governance structure of the colleges but 85.5% of the participants (as opposed to 14.6%) questioned project leaders' ability to respond to research-related challenges drawing from administrative leadership competencies at Thgnu University.

Competency of research leaders at project level to manage research and innovation - a critical interpretation

With a critical analysis of the research findings on administrative, adaptive, and enabling leadership at project level relating to the management of research and innovation projects at Thgnu University, it was clear that the project leaders encountered shortcomings in managing the research and innovation projects as reported by 99.9% of the participants. In leading the research and innovation projects to be aligned to the real problems of the local community, the University, and industry, more than 85% of the participants indicated that the project leaders

were not competent at adaptive leadership to prompt such problem solution at project level at Thgnu University. To encourage the researchers to engage in their research and innovation projects keenly, the project leaders should motivate their research teams and encourage creative researchers though more than 89% of the participants were of the opinion that leadership at project level did not have the capacity to engender such keen engagement in their team members at Thgnu University.

Comprehensively considered, the research leaders at university, college and project level at Thgnu University should manage and lead the research and innovation projects to contribute to new and relevant knowledge, adapt or develop the right technology, and develop competent human capital to address the problems of the local community, the University, industry and the country at large. In this regard, the findings of the quantitative data regarding the contributions of the research and innovation projects to address real problems, knowledge and technology shortcomings, and to develop competent human capital at Thgnu University are presented next.

The contributions of the research and innovation projects of Thgnu University

Table 6.12 provides the research findings based on the data collected using the items in Part IV of the structured questionnaire about participants' perceptions on the degree of significance of research and innovation project contributions to societal development at Thgnu University (Appendix F).

Table 6.12: Contributions of research and innovation projects at Thgnu University

Items				Ct1	Ct2	Ct3	Ct4	Ct5	Ct6	Ct7	Ct8	Ct9	Ct 10	Ct 11	Ct 12	Ct 13
The contributions of the projects were	insignificant	1	N	6	8	0	3	13	19	17	14	13	14	12	0	14
			%	12.5	16.7	0	6.3	27.1	39.6	35.4	29.2	27.1	29.2	25.0	0	29.2
		2	N	32	26	40	31	20	20	22	31	9	6	5	18	4
			%	66.7	54.2	83.3	64.6	41.7	41.7	45.8	64.6	18.8	12.5	10.4	37.5	8.3
		3	N	6	13	7	14	15	9	9	3	21	14	20	23	17
			%	12.5	27.1	14.6	29.2	31.3	18.8	18.8	6.3	43.8	29.2	41.7	47.9	35.4
		Sub-total	N	**44**	**47**	**47**	**48**	**48**	**48**	**48**	**48**	**43**	**34**	**37**	**41**	**35**
			%	**91.7**	**98**	**97.9**	**100**	**100**	**100**	**100**	**100**	**89.7**	**70.9**	**77.1**	**85.4**	**72.9**
	significant	4	N	3	1	1	0	0	0	0	0	5	14	11	7	13
			%	6.3	2.1	2.1	0	0	0	0	0	10.4	29.2	22.9	14.6	27.1
		5	N	1	0	0	0	0	0	0	0	0	0	0	0	0
			%	2.1	0	0	0	0	0	0	0	0	0	0	0	0

		6	**N**	0	0	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0	0	0
		Sub-total	**N**	**4**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**5**	**14**	**11**	**7**	**13**
			%	**8.4**	**2.1**	**2.1**	**0**	**0**	**0**	**0**	**0**	**10.4**	**29.2**	**22.9**	**14.6**	**27.1**
	Total		**N**	48	48	48	48	48	48	48	48	48	48	48	48	48
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

1=no contribution, 2=very low contribution, 3=low contribution, 4=average contribution, 5=high contribution or 6= very high contribution

Ct=Contribution

Ct1=To what extent do you feel that the research projects you have engaged in so far have contributed to address the problems of the local community?

Ct2=To what extent do you feel that the innovation projects you have engaged in so far have contributed to solve the problems of the local community?

Ct3=To what extent do you feel that the research projects you have engaged in so far have contributed to address the university's own internal problems?

Ct4=To what extent do you feel that the innovation projects you have engaged in so far have contributed to address the university's own internal problems?

Ct5=To what extent do you feel that the research projects you have engaged in have contributed to fill the knowledge or technology needs of the country?

Ct6=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the technological advancement of the country?

Ct7=To what extent do you feel that the research projects you have engaged in so far have contributed to the knowledge –based economy of the country?

Ct8=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the knowledge-based economy of the country?

Ct9=To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the university?

Ct10=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the university?

Ct11=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the industry?

Ct12=To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the nation at large?

Ct13=To what extent do you feel that the innovation projects of your team have contributed to the human capital development of the nation at large?

As discussed in paragraph 1.2.3, the research and innovation goals of higher education institutions are not simply aimed at producing knowledge for the sake of knowledge production alone but extend to application of this improved knowledge for societal development. In this regard, the major goals of the research and innovation projects of Thgnu University are to address the problems of the local community, the University, industry and the nation by developing competent human capital, and producing and applying relevant knowledge and technology to engender development of a knowledge-based society. One of the aims of this study was to examine the extent of significance of the contributions of research and innovation goals of higher education institutions to address local, institutional and national problems. In

this regard, and with reference to Thgnu University as depicted in Table 6.12, the participants were requested to indicate the significance of the contributions of the research and innovation projects to address the problems of the local community and the University. The vast majority of the participants (91.7%) believed that the contributions of the research projects to solve local problems were insignificant while only 8.3% of participants believed the contributions to be significant. While 97.9% of the participants also indicated that the contributions of the research projects to address the University's own problems were insignificant, 2.1% of them indicated that the contributions were significant. While 98% of the participants indicated that the contributions of the innovation projects to solve the problems of the local community were insignificant, 2% of them showed that the contributions were significant; all the participants (100%) indicated that the contributions of the innovation projects to address the problems of the University were insignificant.

All the participants (100%) indicated that the contributions of the research and innovation projects to address knowledge and technology shortcomings of the country, to advance technology, and to become a source for a knowledge-based economy of the country were insignificant. The majority of the participants (89.7%) indicated that the contributions of the research projects for the human capital development of the University were insignificant while 10.3% indicated that the contributions were significant. While 85.4% of the participants indicated that the contributions of the research projects were insignificant for the human capital development of the country, 14.6% of them showed that the contributions were significant. With regard to the contributions of the innovation projects to the human capital development of the University, 70.9% of the participants indicated that the contributions were not successful in ensuring adequate numbers of skilled employees for University use while 29.2% of participants believed that the research projects were performing well in delivering adequately skilled manpower for University use. While 77.1% of the participants indicated that the contributions of the innovation projects to the human capital development of industry were insignificant, 22.9% held the opinion that the research projects delivered satisfactory numbers of appropriate skilled manpower for industry use. While 72.9% of the participants indicated that the contributions of the innovation projects to the human capital development of the country were inadequate, 27.1% believed that the research projects are successfully contributing to sufficient, correctly skilled manpower for the nation at large.

Thgnu University is expected to contribute in terms of disseminating scientific knowledge through publications, producing competent human capital in research and innovation at postgraduate level, and completing research projects and transferring the outcomes to the local community and industry by establishing practical collaborations and partnerships. In this regard, the five-year annual performance reports s for the period 2012/13 to 2016/17 were considered for all four selected research sites. However, there was no data available from the reports of Thgnu University relating to the indicators included in the checklist as depicted in Appendix H.

In order to understand the performance of leadership and management of research and innovation policy and practice at Thgnu University comprehensively, the research findings on research leadership and management at university, college and project level at Thgnu University are discussed next.

6.2.4 An integrated interpretation of the results from the data qualitatively and quantitatively collected

The research leaders of Thgnu University have to use administrative leadership to manage the research policy formulation and implementation to be aligned to the national higher education research and technology transfer framework, and the national STI policy. The results of the documents analysis indicated that Thgnu University did not have a research and innovation policy. Rather it had research and development guidelines that had no vision, mission and objectives formulations. In contrast, the results of the qualitative data from the semi-structured individual interviewing revealed that two of the leaders acknowledged that the guidelines of the University were developed in line with national research policies. Whereas one of the leaders disclosed that even first-generation universities were not translating national policies into their research policy, third-generation universities like Thgnu University would also fail with this translation. The results of the quantitative data depicted that more than half of the participants (58.4%) (as opposed to 41.6%) agreed that the formulation of the University research policy is aligned to the national research policies. The results from the document analysis showed that some of the thematic areas of Thgnu University like natural resource management, human capital development, and science and technology were similar to the policy directions of the national STI policy. With regard to priority area development, 45.9% of the participants (as opposed to 54.2%) were satisfied that the development of the priority

areas for research at the University was aligned to national priority area identification. The results of the qualitative data showed that there was no research strategic plan but there was a University strategic plan for the three functions of higher education as a whole which 56.3% of participants confirmed as genuinely existing.

To translate the thematic areas of the University into practice, the research leaders at university level should be skilled at research and innovation project management. However, more than 93% of the participants questioned the research and innovation project management competency of the research leaders at Thgnu University. The results of the qualitative data revealed that the leaders had shortcomings in research and innovation project management relating to the fact that project leaders should be good at research and innovation project management. In this regard, the results of the quantitative data indicated that all of the participants (99.9%) questioned this competency of project leaders. The results of the qualitative data also revealed that the project leaders had shortcomings in research and innovation project management, as there was poor research proposal selection with unclear criteria. The proposals were evaluated by people who were not professionals in their field. The leaders focused on funding, not on monitoring and evaluating the outcomes of the projects.

As leaders skilled in adaptive leadership, the research leaders of Thgnu University should lead the research and innovation projects relating to the real problems of the local community, the University, industry and the country. However, the results of the quantitative data indicated that more than 89% of the participants questioned the adaptive leadership competency of the research leaders at the University. The results of the qualitative data showed that the research and innovation projects were not aligned to the real problems of the local community, the University, industry and the country. The qualitative data from the community leaders indicated that there were real and specific problems related to agriculture, education, and health that were not addressed by the research and innovation projects of Thgnu University. As adaptive leaders, the research leaders at college level should focus on specific problems of colleges, the local community, and the country, and produce practical knowledge and develop the right technology to address real problems encountered within the specific context. However, the results of the quantitative data indicated that more than 85% of the participants had misgivings about the adaptive leadership competency of the research leaders at college level at Thgnu University.

The results of the qualitative data revealed that the research leaders did not have any research and innovation projects implemented to address the colleges own tuition problems. However, research projects tried to address some of the problems of the local community related to education and health by providing need-based training and trying to transfer some improved varieties of some crops and vegetables to address problems related to agriculture through adaptation. The project leaders should lead their project teams to focus on the real problems of the local community, the University, industry and the country. However, the results of the qualitative data revealed that the research projects were developed based on inadequacies identified with a literature study carried out on the internet and not as identified by considering real problems from the local contexts as supported by a thorough literature review based on sources consulted from an inner circle of authors. The results of the quantitative data also depicted that the project leaders were not effective in leading the research and innovation projects to solve real problems of the local community, the University, and the country as indicated by more than 85% of the participants.

In improving the research and innovation leadership and management of the University, the research leaders at university level should take action based on continuous learning to prompt creativity for the production of improved knowledge but 87.5% of the participants did not believe research leaders were engaged in such conduct. The results of the qualitative data also showed that a culture of learning, creativity, and adaptability was not developed as there were employees who were resistant to change including executive leaders. For this reason, a research culture was not developed well yet which was exacerbated by the fact that the researchers and the University were still very young. To adjust the research and innovation practices of the University, the leaders should accommodate emerging ideas from their interaction within and outside the University but 91.7% of the participants did not perceive research leaders competent to incorporating emerging ideas into the research and innovation leadership of the University.

The University's research leadership practice has been changed from small-scale basic research to interdisciplinary applied mega thematic research, but the move was motivated by the demand from stakeholders and government and was not initiated by the University itself as revealed by the results of the qualitative data. However, the results of the qualitative data acknowledged that the vice president for research and community engagement at Thgnu University introduced the move from small scale discipline-based research to interdisciplinary research based on

mega thematic research projects as encouraged by government's research and development directorate. In order to improve the research and innovation leadership of the colleges, the research leaders at college level at Thgnu University should facilitate dynamic interactions among stakeholders so that meaningful ideas might emerge to improve the research and innovation practices of the colleges. However, most of the participants (89.6%) were skeptical about the existence of a culture of accommodating emerging ideas as prompted by the capacity of the colleges' research and innovation leadership.

As skilled enabling leaders, the research leaders of Thgnu University should create enabling conditions for the researchers. In this regard, the leaders should facilitate interactions among the key stakeholders of the research and innovation projects of the University by establishing a functional innovation system but 83.4% of the participants questioned the presence of a practical innovation system at the University. The results from the qualitative data showed that there was an underdeveloped structure for innovation that should be strengthened. The leaders at college level should have functional networks with the stakeholders who engage in the research and innovation projects of the colleges though the majority of the participants (89.6%) did not believe that practical networks existed which was confirmed by the results of the qualitative data, namely that the research leaders did not establish networks with the stakeholders. One of the key conditions for quality research and innovation project implementation and application of the outcomes for societal improvement is the allocation of sufficient budgeting. However, the results of the qualitative data revealed that there were financial constraints at Thgnu University. The results of the quantitative data disclosed that most of the participants (95.8%) were skeptical about the existence of adequate budgeting for the research and innovation projects at Thgnu University.

Comprehensively considered, the main goal of the research and innovation leadership and management at Thgnu University is to contribute with relevant knowledge, appropriate technology, and competent human capital to address the real problems of the local community, the University, industry and the country in order to consistently move to a knowledge-based dispensation. In this regard, the results of the quantitative data showed that the contributions of the research and innovation projects for the local community and the University in terms of addressing knowledge and technology inadequacies and to become a source for prompting the development of a knowledge-based economy for the country, were not successfully achieved as opined by more than 90% of the participants. There were also no convincing contributions

from the research projects for the human capital development of the University, industry and the country as indicated by more than 72% of participants in Table 6.12.

6.3 RESEARCH AND INNOVATION LEADERSHIP AND MANAGEMENT AT THGNSTU UNIVERSITY

6.3.1 Profile of the research site as a third-generation science and technology university in Ethiopia

Thgnstu University is one of the third-generation science and technology universities in Ethiopia. Established in 2011, the University has one functional campus, five colleges, ten schools and 22 departments, and offers 21 undergraduate, 13 masters and 8 PhD programmes. Performing the three functions of teaching and learning, research and community engagement, the University strives to become the best university at national level, competent in Africa and internationally renowned by 2025 (Thgnstu University, 2018:2).

To understand the performance of the research and innovation leadership and management of Thgnstu University at policy and practice level, both qualitative and quantitative data were collected using document analysis, semi-structured individual interviewing and a structured questionnaire. The results of the qualitative and the quantitative data are analysed separately and integrated at the end. What follows are the results arising from the qualitative data.

6.3.2 Results of the qualitative data analysis

In the following sub-paragraph, the results of the qualitative data from the document analysis, from the semi-structured individual interviewing, and from the open-ended questions in the structured questionnaire that are incorporated with the data from the individual interviewing are presented consecutively. The results from the document analysis are presented first.

6.3.2.1 Results from document analysis

The results from the document analysis are presented comparing the vision, mission, objectives, and priority areas of the national STI policy and the higher education research and technology transfer framework with the vision, mission, objectives, and research and

technology transfer policy of Thgnstu University. The research and innovation leadership and management aims expressed in the national policy documents and the University research and technology transfer policy document are also compared.

From the analysis of the three policy documents, namely the national STI policy, the framework for higher education research and technology transfer and Thgnstu University research and technology transfer policy, it was found that the vision of the national STI policy focused on establishing a system for foreign technology transfer and developing competency to select and transfer effective foreign technology. The vision of the framework for higher education research and technology transfer emphasised developing excellence with regard to the research and technology transfer of the universities to address community and national development problems. With regard to the vision of Thgnstu University, it was found that Thgnstu University had a research and technology transfer policy with a vision of "*becoming a lead player with continental repute in all its fields of science and technology and an internationally recognised and respected hub of Science and Technology with strong national commitment and significant continental impact by 2021*" (Thgnstu University 2013:1). Comparing the visions of the three policy documents, it was found that the vision of the national STI policy focuses on foreign technology transfer, the vision of the national framework for higher education research and technology transfer policy emphasises research and technology transfer, and the vision of the Thgnstu University research and technology transfer focuses on science and technology. However, the University cannot achieve its vision without excellence in research, as research is a basis for advancement in science and technology, especially with regard to research practice at higher education institutions (par 2.9).

Comparing the three policy documents, it was found that the mission of the national STI policy was developing a national framework and competency to transfer effective foreign technology for the manufacturing and service providing enterprises. The mission of the research and technology framework for higher education was to develop the competency of the universities to address the development problems of the country using the best research and technology outcomes for transfer purposes. Compared to the national documents, it was found that the mission of Thgnstu University was "*becoming a leading force in higher education in Ethiopia to be an agent of change and development, a catalyst for progress in science and technology focusing on innovative research and education*" (Thgnstu University 2013:1). The results of the documents analysis revealed that the mission of the framework for higher education

research and technology transfer emphasised solving the development problems of the country through research and technology transfer. The mission of Thgnstu University focused on advanced research and education to become an agent of development and advancement in science and technology. It was found that the mission of the STI policy was too specifically focused on manufacturing and service-providing enterprises so that it was not developed in line with the complex development needs and problems of the country as stated in the mission of the framework document.

With regard to the objectives of the three policy documents, it was found that some of the objectives of the national STI policy focused on promoting research and technology transfer including indigenous knowledge and technologies. The objectives of the framework for higher education research and technology transfer emphasised conducting research and transferring technology by developing the competency of the academic staff. The objectives also connect the management of research and technology transfer by integrating teaching, research and technology transfer, by establishing and strengthening linkages, and by facilitating the required resources. The objectives of the University research and technology transfer policy, however, focused on establishing a framework for research; describing the setting for the management of research and technology transfers, community and consultancy service; and strengthening the linkage with industry. It was found that the objectives of the policy document of Thgnstu University did not consider research relating to indigenous knowledge and technology development like that of the objectives of the STI policy but the framework for higher education research and technology transfer document stipulated that universities should be custodians of indigenous knowledge and technology. It was also found that the objectives of the framework for higher education research and technology transfer document were comprehensive with regard to connecting research and technology transfer management within and outside the universities.

With an analysis of the priority areas of the three policy documents, it was found that the research and technology transfer policy document of Thgnstu University did not point out any research priority areas. However, it stipulated that the core thematic areas for research would be defined in line with the priority areas of the country and the customers of the university. It was also found that the framework for higher education research and technology transfer document did not have priority areas, but that the national STI policy had priority areas relating

to technology transfer, research conduct, human resource development, and environmental protection and development.

From the analysis of the three policy documents relating to research and innovation leadership and management, it was found that the national STI policy focused on financial management whereas the framework for the higher education research and technology transfer document emphasised result-based professional research management and scientific leadership. It was found that Thgnstu University's research and technology transfer policy emphasised research leadership in creating an environment that was conducive for cooperation and encouragement of academic researchers to develop research skills and to share ideas freely. The University policy also focused on research management, especially in facilitating internal and external funding for the research activities of the University (Thgnstu University 2013:3). The results show that the University policy document does not discuss innovation leadership and management, and the national STI policy does not discuss research and innovation leadership and management except for financial management.

In order to understand the formulation and implementation of the research and technology transfer policy of the University as per the two national policy documents, the research leaders at university, college and project level and the researchers were interviewed regarding the research and innovation leadership and management policy and practice at Thgnstu University. The results of the data collected with individual interviewing are presented next.

6.3.2.2 Results from the semi-structured individual interviews

At Thgnstu University, 14 participants were interviewed, and the participants were research leaders, project leaders, researchers, community leaders at zone level and industry managers around the university. To ensure confidentiality of the presentation in which excerpts from the verbatim responses of participants are included, the participants are distinguished by the labels RLU1 to RLU3 for research leaders at university level, RLC1 to RLC2 for research leaders at college level, PL1 to PL2 for project leaders, CI1 to CI2 for co-investigators, CL1 to CL3 for community leaders, and IM1 to IM2 for industry managers. The results from the analysed data collected via individual interviewing at Thgnstu University are presented next under the themes, namely administrative, adaptive, and enabling leadership.

Administrative leadership at university, college, and project level

The research leaders of Thgnstu University should facilitate the development and implementation of the research and technology transfer policy of the University in line with the national higher education research and technology transfer framework and the national STI policy. In this regard, the leaders responded that the University policy was developed in line with the STI policy as confirmed by one of the leaders, namely that "*the technologies to be transferred are in line with national policies"* (RLU3). The research leaders at college level should also manage the research and innovation activities of the colleges in line with the University research and technology transfer policy. Research leaders RLC1 and RLC2 described that they carry out their research management responsibilities to be aligned to the University policy. Based on the research and technology transfer policy of the University, the research leaders should also develop strategic plans for the research and technology transfer activities of the University in collaboration with their stakeholders so that all can have a shared vision and goals. The research leaders were asked if the University had a research strategic plan. The research leaders at all levels of management answered that the University did not have a research strategic plan; rather it had a strategic plan for the three functions of university endeavour as a whole.

The research leaders should also develop the priority areas of the research and technology transfer policy of the University to be aligned to the priority areas of the national STI policy. In this regard, one of the leaders responded that the University's priority areas are indeed aligned to national demand in that "*our priority areas are the priority areas of the country, and they are determined by government and we are given the task to do"* (RLU2). Research leader RLU3 listed the priority areas of the University but they were not included in the Thgnstu University policy document. RLU3 listed their priory areas as follows: "*Our priority areas focus on industries, and they are agro-processing, chemicals, minerals exploration and extraction, use of energy, nano-technology, and artificial intelligence"* (RLU3). According to RLU1, the focus of the priority areas of the University included industry needs and the needs of the local community and the way the priority areas are determined. RLU1 explained:

> "*The motto of the university is 'university for industry' so the problems of the industry are the subjects of our research. Our research and technology transfer activities focus on industry and as the same time, we serve our communities,*

> *especially in strengthening students in science and technology areas in a number of schools. The stakeholders usually participate in identifying the research priority areas of the university having meeting to get research problems for our research*" (RLU1).

The leaders at college level should manage the research and innovation activities of the colleges by determining their own priority areas from the University priority areas in line with the expected research and innovation activities of the colleges. Research leader RLC1 reported that the priority areas of the University were the priority areas of the colleges, whereas research leader RLU2 quantified these areas, namely "*we have around five thematic areas that were taken from the university thematic areas like sustainable water resource development, quality construction technology, energy, and structures"* (RLC2). However, the research and technology transfer policy document of the University did not have listed priority areas at all. The project leaders should select appropriate research and innovation themes in line with the colleges and the University priority areas. In this regard, it was found that the project leaders chose research themes based on their personal observations. Project leader PL2 responded, "*I choose in line with so many environmental issues, problem of human and animal health as the industries discharge their waste into the rivers"* (PL2). Project leader PL1 commented on the trend to focus research endeavour on areas relating to improved health through organic food:

> "*Currently I know that there is huge interest for people towards attaining health by taking appropriate and organic food. In this regard, the industry zone is growing in the world now so that there is huge demand. I thought that food has much health importance in Ethiopia, but they are not well screened and documented. This made me to work in this area*" (PL1).

However, the project leaders did not justify that they selected their research focus based on the thematic areas of their colleges and the University or the problems identified in consultation with industry and the local community.

As skilled administrative leaders who translate the research and technology transfer objectives of the University into action, the leaders should manage the research and innovation projects commencing from the phase of project idea identification to the phase of implementation of the research project and ending with the final phase of reaching constructive research

outcomes. The research leaders at university and college level at Thgnstu University explained that they had different research grants. For the internal grants, there were calls for proposals, and the proposals were evaluated and approved at college and university level by assessing if the proposals were aligned to the priority areas of the country in solving local problems. For external grants by industries, the research problems were identified by industry and it was managed by the University. For the grant from the Ministry of Science and Technology (MoST), the Ministry managed calls for and selection of the proposals on a competitive basis. After successful proposals were approved and agreements were signed, the researchers utilised the money and the research leaders monitored the technical and financial progress of the research projects. When the projects are completed, the researchers submit their final reports to the concerned bodies. The results show that the actions of project identification and project development were not considered seriously. Rather the research leaders focused on evaluating and selecting the research projects as developed by researchers themselves.

Based on the research projects identified by the University, by industry and by the Ministry of Science and Technology (MoST), the project leaders should choose research members to establish applicable research teams. In this regard, project leader PL1 proclaimed his preference for students as team members because "*as the department members were busy in other research projects, I preferred to work with students and I found working with students very good"* (PL1). According to project leader PL2 his selection of team members was directed by the kind of research to be conducted:

> "*It is the proposal that guide me to choose the team members that can contribute. I look for special people by collecting their CV to see their skill and the contributions. Then I recruit to be my research team and I share my project idea"* (PL2).

From the interviews, it was clear that the phase of research proposal development is the responsibility of the project leader. Co-investigators described that research teams were built based on subject disciplines and personal relationship. Co-investigator CI1 stated, "*The team was built based on our disciplines that the principal investigator and the co-investigators have the same background. We just come together and developed the proposal"* (CI1). Co-investigator CI2 described that a "*research team is usually build based on personal relationship and proximity"* (CI2).

While implementing the research and innovation projects, the research leaders at university level should manage the progress of the projects. In this regard, the leaders at university and college levels at Thgnstu University stated that they usually managed the progress of the projects by requesting periodic reports and presentation of parts of the projects completed. In this regard, research leader RLC1 disclosed the shortcomings regarding managing the progress of the projects. RLC1 described, "***I** can tell you that there is no follow-up as we are very busy in different activities"* (RLC1). Like the leaders at university and college levels at Thgnstu University, the project leaders requested progress reports from their team members, whereas one of the project leaders requested a progress report followed by discussing the report with the co-investigators. The leader explained, "*We discuss formally their progresses and challenges they face as I have a meeting with my research team"* (PL2).

In order to implement the research and innovation projects effectively, the leaders should manage the human and material resources properly. In this regard, the leaders at university, college, and project level at Thgnstu University explained that the materials and finance resources are managed centrally at university level but the main challenge they are facing is the lengthy and tedious purchasing process resulting in not utilising the funds properly. In this regard, co-investigator CI1 commented on the challenge of managing the finances in a repetitive manner. CI1 described:

> "*Finance management is not easy specially to withdraw and utilise money is a serious problem. On the first phase, only maximum 30,000 Birr is allowed, and phase by phase, you do the same thing repeatedly so that this is a problem*" (CI1).

The amount of 30, 000 Birr is the total research project budget for the first, the second, and the third-generation general universities which is a small amount of money to withdraw in one phase from the total research project budget at Thgnstu University.

Apart from material and financial resources, research managers should also manage the quality of the research projects, and the quality of the research performance of each member of the research team. According to the leaders at university, college and project level, and the co-investigators, the performances of the researchers were evaluated at the department level having evaluation criteria about teaching, research, and technology transfer and community engagement. Research leader RLU2 described that "*the staff are evaluated only for their*

teaching duties, and the staff do research based on their interest" (RLU2). With reference to the absence of formal performance evaluation criteria for researchers at project level as should be arranged by leaders at university level, project leader PL2 described:

> "*I look at the tasks they completed and inform them that some did well, others did well but others were very late. I will give feedback for each member to do so in such a way. Otherwise, I do not formally evaluate their performance like what we do at department level*" (PL2).

The leaders should also manage the quality of the process and outcome of the research and innovation projects. In this regard, one of the leaders at college level at Thgnstu University responded, "*I know the criteria and how to evaluate the quality but it is centralised, and I could not do it at college level"* (RLC1). Research leader RLC2 mentioned the assistance of external reviewers to ascertain the quality of conduct:

> "*We have tried to achieve the quality of the research by having external reviewers, but it is not as such seriously considered. Most of the time in our college, we invite guests especially PhD academic researchers so that they check the quality, especially, the write-up, the objectives, the literature review and the like based on guidelines*" (RLC2).

The main role players in managing the quality of the research undertakings and the extent of innovation endeavour with the research projects are the project leaders and the co-investigators. In this regard, one of the project leaders listed the steps to be followed to maintain quality with a research project. The project leader described:

> "*The first step is to get some product. The second is to get oral response on how they use and see the product. The third step is to evaluate the product scientifically, and then we evaluate in laboratory when we get the result. The fourth step is substantiating, giving evidence*" (PL1).

With regard to quality control, the project leaders and the co-investigators described that they manage the research process to maintain quality. Project leader PL2 listed the way quality is managed through the research process. PL2 stated,

> "*I use the activities that I designed, the expected outcomes I set in my proposal, and manage the whole process of the research as much as possible include the laboratory to result in quality output"* (PL2).

To manage the quality of the research process and the outcomes of the research and innovation projects, the research leaders should have criteria to evaluate the success with project implementation. However, the leaders at university, college and project level at Thgnstu University responded that they did not have criteria to determine success with implementing the projects though they are expected to have criteria to determine success with regard to project budgeting, research performance according to timeframes, and the relevance of the project to the direct beneficiaries. In this regard one of the project leaders stated the success criteria were "*meeting the expected outcome of the project with the budget and the schedule I set"* (PL2). In order to implement the research and innovation projects effectively, the project leaders should be good at managing conflict in their teams. The project leaders and co-investigators described that there was no serious conflict amongst their team members. However, co-investigator CI1 commented that "*if conflicts are arisen, the principal investigators will resolve using the different conflict resolving techniques*" (CI1) relating to discussion, teamwork, impartiality and negotiation.

As research managers are also responsible to ensure innovation endeavour with research conduct, the research leaders are expected to manage the research project undertaking and the extent of practical application of the research outcomes. In this regard, one of the leaders at university level at Thgnstu University focused on both the sources for research conduct and the possibilities of transfer of knowledge and technology. The leader described:

> "*The sources for technology transfer can be from abroad, from the industries with adaptation or modification. The academic staff, the students and external stakeholders develop technologies. The other is knowledge developed from the research outcomes of the university. Therefore, technology as knowledge will be selected, developed and transferred*" (RLU3).

One of the leaders at college level commented on the shortcomings with research conduct that related to the functionality and applicability of research outcomes at both college and university level at Thgnstu University. The leader explained:

> "*Honestly speaking, we all lack this fundamental issue. There are outcomes of the research projects and how to implement them is the drawback at least for this university. In our college, we do agree that but there are no any mechanisms, and there are no established guidelines for following and monitoring these activities. If the outcomes are not used in such a way, they will be shelved. Still we recommend our staff at least to publish the outcomes into reputable journals*" (RLC1).

To ensure the research and innovation projects are productive insofar as contributing to the advancement of beneficiary and stakeholder functioning, the research and innovation managers of Thgnstu University should be skilled at research and innovation leadership. In leading the research and innovation projects with cognizance of the specific contexts of the University, the local community, industry, and the country in order to address real problems, the research leaders at different levels of management at Thgnstu University should use adaptive leadership. The results of the qualitative data on the practice of adaptive leadership with research and innovation activities at Thgnstu University are discussed next.

Adaptive leadership at university, college, and project level

As adaptive leaders, the research leaders of Thgnstu University should lead the research and innovation projects to be aligned to the specific internal and external contexts. Consequently, the research leaders at different levels of governance should encourage researchers to focus on real problems of the local community, the University, industry and the country. In this regard, one of the leaders at university level explained the demand on them to focus on problems nationally encountered:

> "*We are Science and Technology University so that we are expected to address all major problem of the country. We work in any area but we focus on problem solving research because one of our major sponsors is Ministry of Science and Technology that requires the research projects to solve national problems*" (RLU1).

Research leader RLC1 commented on the shortcomings of the researchers in terms of identifying real problems to represent convincing research projects and to anticipate the significance of research outcomes to improve societal functioning in the face of not being acknowledged for research endeavour. The leader explained:

> "*The fundamental problem of our researchers is identifying real problem, and the entire awareness and understanding we have for research that research could bring change and change the life of the society. Still the problems is no incentives for the academic researchers so that they said 'why do I suffer for nothing?' Rather, they look for additional credit hours to teach in their free time in other universities*" (RLC1).

With regard to focusing on specific and real problems within and outside the University, the project leaders and the co-investigators explained that they focused on personal experience and observation so that they reviewed reports, articles and other sources and developed proposals and presented them at seminars so that interested researchers could join for a joint effort in research proposal development. One of the project leaders explained his way of developing a research proposal as "*I review reports, articles and other evidences, and based on the secondary data and my observation in the environment, I develop my research proposal and undertake the research with my research team*" (PL2). Co-investigator CI1 admitted a lack of focus on local problems, namely, "*we do not focus on specific real problems of the local community around the University"* (CI1). In this regard, and with reference to community leaders at sub-city level (equivalent to a zone in the big cities), there were serious real problems related to waste management, unemployment, and small-scale enterprises.

One of the community leaders described the problems relating to unemployment and a lack of comprehensive resources they faced. The community leader stated that "*there are many unemployed youths, and when we organise as small scale enterprises, they do not have the competency of finance, machineries, and working places. The machinery and financial supports and follow-up are not enough so that the enterprises are not successful"* (CL2). With regard to the problems of industry, industry managers around the University stated that there were problems related to the lack of a skilled workforce, and a lack of producing meaningful products. In this regard, one of industry managers explained that, "*there are two major*

problems. The first one is that we are not able to get trained work force in steel industry from the universities. The second one is we are not productive and profitable of our products" (IM2).

Regarding the teaching-learning problems of the University, the research leaders, the project leaders, and the co-investigators responded that there were no designated research projects focusing on addressing the tuition problems of the University. In this regard, one of the co-investigators commented on the shortcomings of conducting research in order to improve the tuition of the colleges and the University. Co-investigator CI1 described, *"We have not done research on our teaching problems. I do not have the exposure even in the form of seminar and workshop that action-based research was presented in our University"* (CI1).

In order to address the real problems of the local community, the University, industry and the country, the researchers should produce new and relevant knowledge, and adapt or develop the right technology. To produce relevant knowledge and the right kind of technology to address specific real problems, the research leaders should encourage and lead different types of research undertakings. The research leaders at Thgnstu University were asked about the type of research they focused on to achieve the goals and objectives of the research and innovation projects of the University. The research leaders at university and college level stated that they have chosen applied research but that there was room for basic research also. In this regard, one of the leaders at university level explained:

> "*We undertake research projects that are problem solving, basic research, and strategic research that can contribute for the next problem solving. But we prefer to conduct applied mega research that should have impact on product development, technology and knowledge transfer*" (RLU1).

Research leader RLU3 described the focus of research at Thgnstu University as applied research to benefit industry development in that "a*s a science and technology university, our university was established to do applied research to support the industries especially the manufacturing industries in the country. So, our focus is applied research*" (RLU3).

Unlike the responses of the leaders at university and college level at Thgnstu University, project leader PL2 confirmed his focus on basic or applied research according to his own choice, namely *"I have been doing discipline-based basic and applied research based on my personal*

interest and experience. I did not have interdisciplinary and collaborative research as we do not have such research culture" (PL2). Concurring with the experience of PL2 regarding undertaking discipline-based basic or applied research, project leader PL1 explained the recent trend in research practice at Thgnstu University to move from basic research to an applied interdisciplinary focus. PL1 described that "*since the last two years, we have started doing interdisciplinary mega research"* (PL1). One of the co-investigators contradicted the responses of the leaders at project, college and university level about specific research focus, and commented on the weakness of research endeavour in terms of being motivated merely by promotion possibilities. Co-investigator CI2 explained:

> "*It is very difficult to categorise our research either basic or applied as we simply do and participate in research for our promotion or to get some money. Otherwise, our goal is not to produce theoretical or practical knowledge to solve real problems*" (CI2).

The research leaders at different levels of governance should employ adaptive leadership to contribute to new and relevant knowledge and technology. In this regard, the research leaders were asked about the contributions of the research and innovation projects at Thgnstu University to new and improved knowledge. The research leaders answered that they were still at the early stage of research engagement and were still establishing the foundation for research and innovation endeavour at the University. In this regard, one of the leaders commented, "*As this is new university, it is not fair to expect a lot because developing and running a project takes some years. There are research projects in the pipeline that will be used soon"* (RLU1). Similarly, research leader RLU3 confirmed that research endeavour is still to be launched properly in that:

> "*The contributions are not visible as far as we are young. We tried to develop the culture of innovation and technology transfer, especially establishing the technology transfer system. We are working in waste treatment with leather industries. We do have many started projects and efforts to contribute but we need to strengthen these*" (RLU3).

Co-investigators also responded that the projects were not contributing to internal and national solutions yet, as the research projects were still in progress and were not completed yet. Co-

investigator CI2 commented on the shortcomings with their research projects pertaining to lacking a focus with proper research problem identification and research project development to respond to societal needs. CI2 described, "*Our projects may not have practical contributions to address the problems of the local community, the University, industry and our country, as we did not seriously design the projects to have such outcomes"* (CI2). However, one of the project leaders described his contributions to potentially more effective fertilising. The project leader PL2 stated:

> "*My research is on environmental biotechnology, and I found waste mediating plants. I developed bioorganic fertilizer and liquid fertilizer. I have tested them and found that bio-fertilizer is very effective. Still it is not produced to the market to be used by the local community, as there is the issue of patent*" (PL2).

The community leaders and the industry managers around the University reported that there were no significant practical contributions from the research and innovation projects of Thgnstu University yet. There was one research project carried out on small-scale, but the research findings of the project were not implemented as training of the beneficiaries for proper implementation still needs to be carried out in collaboration with consultation attempts to determine how implementation should proceed. In general and with regard to the contributions of the research and innovation projects to address the internal problems of the University, the research leaders responded that they did not have any contributions except improving the quality of roads by using red ash and consulting on building the infrastructure of the University using the expertise of the academic researchers.

As leadership is a process, the research leaders of Thgnstu University should develop a research culture of continuous learning to engender creativity for the development of meaningful knowledge and skill through a process of being adaptable for improved performance based on improved leadership skill. The research leaders at university and college level at Thgnstu University stated that continuous learning to prompt creativity for adaptability to improved know-how were not strongly settled at the University yet. The project leaders and the co-investigators should take actions based on continuous learning prompting creativity to be adapted to their research and innovation projects. Project leader PL2 reflected on the continuous learning from their research undertakings relating to learning from stakeholders while conducting research to be implemented with future research endeavour. The leader

explained that "*research is learning. As experienced researcher, it helps me to guide my students, and I have learnt a lot from the farmers, from my students and other stakeholders"* (PL2). Project leader PL1 critically commented on a culture of lack of vibrant pursuit of research endeavour for improved performance by both research leaders at university and by industry. The leader explained:

> "*In science and technology areas, research projects from the industries should enter researchers into competition and pressure. The problem is there is no such competition in Ethiopia. 'I have such quality shortcomings, I need research; I have output gap, I need research', No industry asks us. Research and development is not part of the industries. In university, it is said as usual, accommodating, adapting and the like but there is little debate and dealing in these areas*" (PL1).

Revealing the inadequacies of the research undertaking practice, co-investigator CI2 also commented on the lack of creativity and adaptability of the researchers. CI2 stated:

> "*There is informal learning with the research team, and learning by doing from the research projects. However, the issues of creativity and adaptability are always said but we are not practically creative and adaptive in almost all the research and innovation activities*" (CI2).

One of the characteristics of adaptive leadership is facilitating interactions with the beneficiaries and stakeholders of the research and innovation projects so that the leaders should accommodate emerging ideas from dynamic interactions with all stakeholders (par 2.10.2.2). The research leaders were asked if there was room to accommodate emerging ideas resulting from the dynamic interactions within and outside the University by those engaged in the research and innovation projects. In this regard, research leader RLU3 replied, *"There is room but so far we do not have ideas emerged from our interactions"* (RLU3). As said, the University research practice has been changed from a discipline-based approach to interdisciplinary thematic mega research. The leaders were asked whether the move from discipline-based basic research to interdisciplinary thematic mega research had emerged from their own interactions or were they directed by officials. Research leader RLU1 answered that it depended on the merit of the research, namely "*we can say in both ways, from top to bottom, and from bottom to top based on the merits of mega research"* (RUL1). Similarly, research leader RLU3

described the reasons for and the importance of the change to interdisciplinary research as relating to solving community-based industry problems and in so doing achieving the main mission of the University namely to respond with research outcomes for the sake of internal and external betterment. RLU3 described:

> "*We were doing discipline-based research based on the interest of the researchers but before last year, we have started doing interdisciplinary thematic mega research for two reasons. One is it is national direction and the other is our understanding and learning from the experiences of senior universities that there are so many discipline-based research but they are still shelved. So, if we have the plan to solve problems of industries, we should do interdisciplinary mega researches so that the outcomes will be used*" (RLU3).

Research leaders at college level opined that the move from basic to applied research emerged from interactions in the research and innovation endeavour of the University. In this regard, the project leaders and the co-investigators responded that there was room to incorporate emerging ideas but the move from discipline-based into interdisciplinary thematic mega research was not the ideas of Thgnstu University but the ideas of the research directorate of government. Co-investigator CI2 explained as follows: "*It is the vice president for research and technology transfer office introduces and orients the academic staff about interdisciplinary thematic mega research"* (CI2).

In leading the research and innovation projects according to the specific context to produce relevant knowledge and develop the right technology to address real problems of the local community, the University, industry and the country, the research leaders should use enabling leadership to create enabling conditions and an enabling environment for researchers to engage optimally in research conduct. In this regard, the results of the qualitative data about the practice of enabling leadership at Thgnstu University are presented next.

Enabling leadership at university, college and project level

In exercising enabling leadership, the research leaders at different levels of management at Thgnstu University should create and facilitate enabling conditions for the researchers to engage in research and innovation projects effectively. Among the enabling conditions, one is

creating a strong interrelationship between tuition, research and innovation to prepare competent researchers and human capital for the University, industry and the society at large. In this regard, the research leaders at Thgnstu University were asked how they arrange an interrelationship between the three pillars of knowledge, namely education, research and innovation. One of the leaders explained that "*students are attached to most of the research projects so this really is helping in improving the quality of education"* (RLU1). Research leader RLU2 also stated that "*we have eight centres of excellence that the students take courses, and when they do research, they go to the centres. Therefore, research is already connected to the learning and teaching activities of the university"* (RLU2). Research leader RLU3 explained that his responsibility sufficed with research conduct and the managing and leading of this research conduct. The leader explained:

> "*I manage the relationship between research and innovation. I am trying to choose knowledge produced from research and transfer to the users. I am trying to identify knowledge and technology gaps of industries and share to the researchers to study. It is good if the research outcomes and technologies are used in our education, but this is the responsibility of the academic leaders*" (RLU3).

In order to facilitate an interrelationship between tuition, research and innovation effectively, the research leaders should create meaningful linkages with government, industry, the University and the local community. In this regard, research leaders RLU1 and RLU3 explained their efforts in terms of creating interconnections, and the shortcomings they encountered pertaining to a lack of collaboration intent. The leaders explained:

> "*We are active members of the cluster of university-industry linkage of the university. Our students and teachers go to industries for internship and externship, and we exploit senior experts of industries to teach our students*" (RLU1).

> "*The university is leading the university-industry forum, and we have discussion on the different issues, especially in their problems that we can work together periodically but we cannot say it is very effective. The local community and the government are not part of the linkage. There is no collaborative leadership so far as it is the university that is leading the forum*" (RLU3).

Regarding linkages and collaborative leadership with different stakeholders, the community leaders at sub-city level reported that there was no linkage with the University to engender collaborative research and inspire innovative research projects to address societal needs. The problems to arrange solid collaboration pertained to a lack of competency at the University to inspire such collaboration and because University students were not interested in industry-related employment. In this regard, one of the industry managers close to the University explained that:

> "*We did not work with Thgnstu University to address our problems, as it does not have the competency of having experts that can give practical training on how to operate machines for our new employees. But sometimes, we have meeting for what they call university and industry linkage and usually the staff of the university come here for getting practical experience and their students for internship for some months though the students do not have interest to work practical activities. Most of them come just to fulfil the formality*" (IM1).

To arrange effective linkages with stakeholders through collaborative leadership, there should be an established and functional innovation system at the University pursuing improved knowledge for successful application to improve societal functioning. The research leaders at university and college level at Thgnstu University acknowledged that such a system was established but that the innovation system was not properly functioning. In this regard, research leader RLU3 responded that *"we have university-industry linkage forum that is led by the University, but we cannot say it is functional innovation system"* (RLU3).

As enabling leaders, the research leaders should also manage the differences among researchers and between key stakeholders of the research and innovation projects in terms of human and material resources, funds, skills, technology, and techniques. In so doing, the leaders should facilitate enabling conditions for the researchers to engage optimally in research conduct. Research leaders were asked about the conditions that were facilitated for the researchers and project leaders to engage optimally with research conduct in their research and innovation projects. The leaders at university and college level at Thgnstu University stated that there were no specific conditions that were facilitated for enhanced research conduct except teaching load reduction, staff promotion opportunities and a staff externship programme arranged with different industries. However, research leader RLU3 commented on the special privilege

provided to the University to employ competent academics from local and international institutions to address the human resource shortages of the University. The leader stated, "*We do not have except that our university has special provision from the government to hire highly skilled professionals from abroad and from diaspora"* (RLU3). One of the research leaders at college level at Thgnstu University pointed to the inadequacies prevailing with both research managers and researchers to engage passionately in vibrant research conduct. The leaders explained, "*We lack organising learning environments but these are not the reasons for not doing research. The university management lacks something and we also lack something to do research"* (RLC1).

The project leaders should facilitate enabling conditions and environments for the co-investigators to engage optimally in their research activities. In this regard, the project leaders and the co-investigators responded that there were no enabling conditions except teaching load reduction for the project leaders, learning from one another, attending some seminars, some training and workshops related to research methodology and technology transfer facilitated by the colleges or the University. To facilitate conditions and environments that are conducive for inspired research conduct for co-investigators, the project leaders should have personal qualities relating to encouraging good quality research and competencies related to managing and providing leadership for proper research conduct. In this regard, the project leaders and the co-investigators concurred that the project leaders should be well equipped with appropriate knowledge and skills relating to research and innovation project management and leadership.

The project leaders should be good at project management including coordination, sharing ideas, managing time and money, and marketing the results of the research projects. They should also have the experience, knowledge, skills, attitudes and ethics required for profound research conduct and they should have had successful achievements with their own research undertakings. The project leaders should be committed, honest and being able to constructive interaction, and they should possess eloquent communication and presentation skills and solid writing skills. Research leaders should also have charisma to attract funding and arranging functional networks with different research organisations and research professionals.

It was clear from the interviews with participants that there were efforts and shortcomings in exercising administrative, adaptive and enabling leadership with research and innovation endeavour at Thgnstu University. In addition to semi-structured individual interviewing, the

participants who completed the structured questionnaire were requested to indicate the main strengths and weaknesses of the research and innovation leadership and management at Thgnstu University. The results are presented next.

Strengths and weaknesses with research and innovation leadership and management practice at Thgnstu University

The participants indicated the main strengths and weaknesses of the research and innovation leadership and management at project, college, and university level at Thgnstu University. At project level, the main strengths were that the project leaders tried to manage and lead the projects when there were a number of challenges and problems related to a lack of experienced researchers, finance, and procurement. At college level, the main strengths were that the leaders tried to encourage staff to undertake interdisciplinary thematic mega research. At university level, the main strengths were that the research leaders encouraged researchers to undertake interdisciplinary thematic mega research so that the research leaders announced calls for proposals on time and tried to facilitate internal and external research grants. Eight centres of excellence for research and innovation were established, on-going purchasing of laboratory facilities occurred and the allocation of realistic budgets for research projects ensured that there was a good basis for research activities to be carried out in terms of infrastructure albeit with a lack of pursuing innovation endeavour.

Participants indicated the main weaknesses observed with the research and innovation leadership and management at project, college and university level. At project level, the project leaders lacked project management skills and a thorough knowledge of the content of the University policy, strategies, and structures. The project leaders were not able to manage the research process optimally because the academic staffs were involved with huge teaching loads that jeopardised thorough engagement with research activities resulting in a lack of adequate research outcomes. Most of the academics were expatriates who might stay for two years only complicating the preparing of experienced staff for permanent research engagement at the University. At college level, the main weakness related to research leaders having limited knowledge about research conduct in order to motivate and direct research activities of the college based on thorough coordination of all research activities. The research leaders were therefore not capacitated to encourage staff to innovative research conduct resulting in strong connections regarding research endeavour between colleges and industry.

Research leaders were not competent enough to propose possible research problems based on assessing needs from the local community and other stakeholders. The colleges were not capacitated to invite guests who could provide research and innovation training for the academic staff. At university level, the major weakness related to inadequate leadership knowledge and skill to manage research and innovation endeavour to be aligned to community needs. There were leadership problems such as a lack of self-confidence, poor decision-making ability, and lack of skill to organise research conduct properly. The research leaders did not grant enough time to evaluate proposals so that problems were not determined thoroughly, there was no clear follow up on the progress of the research projects, and resource management was centralised at university level.

The level of motivation for staff was inadequate because staffs were not inspired to research conduct to the extent, which government and the community anticipated, as there were limited incentives to encourage research conduct and to distinguish between ordinary and outstanding research conduct. Leadership's research competency, the prevalence of a research culture, and the commitment of academic staff to conduct research were insignificant as all parties lacked experience, knowledge, and skills, especially with regard to utilising applicable and available technology appropriately. There was a weak linkage with industry, and collaboration with the local community and industry was too limited for proper research conduct. A research project budget for internal grants could not be allowed above 500, 000 Birr. With regard to infrastructure, there were limited laboratory facilities and laboratory equipment and the existing apparatus were imported from first world countries as tailormade installation was challenging.

At project, college and university level at Thgnstu University, one of the main weaknesses was the lack of competency to identify relevant research problems, especially with regard to scientific technological research which resulted in researchers following a fast track approach to develop research proposal, to present these proposals in a time limit of 15 minutes, and to receive comments within 24 hours after proposal presentation. Budgeting for proposed research projects occurred without thorough evaluation of the relevancy of research problems, without determining whether research teams were capacitated for the research conduct, and whether the research projects were initiated and supported by beneficiaries. The government purchase system was exposed to a lengthy bidding system, and the financial services and logistics

facilities of the University were tedious and subject to extreme bureaucratic measures. The research done by the staff was not disseminated to the beneficiaries and the contributions transpiring in research outcomes were substandard.

In order to improve the weaknesses observed with regard to research and innovation leadership and management at Thgnstu University, participants were requested to provide suggestions to be considered at project, college, and university level.

Suggestions by participants to improve the research and innovation leadership and management practice at Thgnstu University

The participants were asked to make suggestions regarding effective research and innovation leadership and management policy and practice at Thgnstu University. At project level, it was proposed that problem identification needs repeated discussion and debate, and the project leaders need to be trained to manage the research projects properly. Research undertakings should be practiced on a daily basis and not as a part-time or extra activity. The University should provide enough time for researchers for their research activities, there should be continuous feedback on the progress of the research projects at seminars, and there should be continuous follow-up and evaluation of the projects. Research teams should be capacitated and committed, and research projects should be practically focused on problem-solving related to societal development. At college level, participants suggested that the perception of researchers and research managers be changed in that they should consider research as one of their main responsibilities. The research leadership and management should be decentralised, and the research leaders should be provided with constant training on research and innovation leadership and management. Research leaders should adhere to the criteria of being skilled at research and innovation conduct and be employed based on merit and not on political affiliation and personal relationship with research and innovation leaders and managers at university level.

At university level, it was proposed that the University should work in close relation with the local community and industry, and research problems should emanate from the local community and industry. The research leaders and managers should be proactive to create demand, and research conduct should commence only after a relevant research problem is clearly identified and beneficiaries of the research clearly established. Researchers and research

leaders should be evaluated on clearly quantifiable outputs. There should be mechanisms to motivate researchers in terms of incentives and encouragement that should be based on what researchers have accomplished with their research outputs. Industry managers around the University suggested that the University address workforce needs of industry by including practical training in their courses to produce skilled graduates for industries. The University should also contribute to improved productivity at industry by incorporating more advanced technology training in their courses. The University should develop the research competency of academics to produce new ideas and develop new technology to improve the quality and productivity of different factories so that industry can benefit from the research and technology outcomes of the University. In this regard better exposure with regard to University services can be arranged with regular exhibitions, forums and symposiums. Community leaders wished for the University to be alerted to community needs through genuine interest and collaboration endeavour accompanied by a willingness and initiatives for collaboration in support of community needs and a solving of societal problems through relevant research and innovation projects steered by vibrant research and innovation leadership and management.

In order to arrive at a broader and deeper understanding of the performance of research and innovation leadership and management at Thgnstu University, quantitative data were collected which are discussed next.

6.3.3 Findings of the quantitative data analysis

The participants who were approached at Thgnstu University to complete the structured questionnaire were 68 in number and of the 68 participants 65 (95.6%) returned their completed questionnaires. Table 6.13 represents the demographic information of the participants who returned the completed questionnaire.

Table 6.13: Demographic information of participants at Thgnstu University

Demographic information	Categories	N	%	Demographic information	Categories	N	%
Gender	Male	55	84.6	Experience in their specific position	1-3 years	30	46.2
	Female	10	15.4		4-6	23	35.4
	Total	65	100		7-10	12	18.5
Qualification	PhD	14	21.5		Above 10	0	0
	MA/MEd/MSc	51	78.5				
	Total	65	100		Total	65	100
Academic ranks	Professor	2	3.1	Total	1-5 years	22	33.8

	Associate professor	4	6.2	years of work experience as academic	6-10	30	46.2
	Assistant professor	6	9.2		11-15	10	15.4
	Lecturer	53	81.5		16-20	0	0
	Total	65	100		Above 20	3	4.6
Training related to responsibilities	Yes	14	21.5				
	No	51	78.5		Total	65	100
	Total	65	100				

As shown in Table 6.13, the majority of participants at Thgnstu University were males (84.6%) with only 15.4% being females. Among the participants, 21.5% had doctoral degrees and 78.5% a master's degree. With regard to academic ranks, most of the participants (81.5%) were lecturers, with 9.2% being assistant professors, 6.2% associate professors and 3.1% professors. Irrespective of their qualifications and ranks, the leaders and the researchers should get ongoing training in line with their responsibilities, and 78.5% of the participants did not get any training while 21.5% underwent training relating to their specific responsibility. With regard to the experience they had in their specific position, more than 80% of the participants had between one to six years working experience with 18.5% having between seven to ten years' experience in their specific position. Nearly half of the participants (46.2%) had between six to ten years total work experience, one-third (33.8%) had between one to five years total work experience, 15.4% between 11 to 15 years, and 4.6% of participants above 20 years total work experiences as academics.

The participants who completed the structured questionnaire were approached to indicate their extent of agreement and disagreement regarding the practice of administrative, adaptive, and enabling leadership relating to research and innovation management and leadership at Thgnstu University. Their perceptions are discussed in the following paragraphs.

Administrative leadership at university level

Table 6.14 represents the research findings based on the data collected using the items in Part I of the structured questionnaire about the extent of the participants' agreement and disagreement regarding the practice of administrative leadership at university level at Thgnstu University (Appendix F).

Table 6.14: Agreement and disagreement of participants on matters pertaining to administrative leadership at university level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14	AdL15	AdL16
Participants having	Disagreement	1	N	6	4	13	18	4	4	16	14	13	27	27	16	15	12	8	3
			%	9.2	6.2	20.0	27.7	6.2	6.2	24.6	21.5	20.0	41.5	41.5	24.6	23.1	18.5	12.3	4.6
		2	N	9	5	13	4	14	7	21	30	30	18	26	18	21	38	13	36
			%	13.8	7.7	20.0	6.2	21.5	10.8	32.3	46.2	46.2	27.7	40.0	27.7	32.3	58.5	20.0	55.4
		3	N	6	5	3	12	22	27	22	18	16	13	5	27	23	7	37	14
			%	9.2	7.7	4.6	18.5	33.8	41.5	33.8	27.7	24.6	20.0	7.7	41.5	35.4	10.8	56.9	21.5
		Sub-total	N	**21**	**14**	**29**	**34**	**40**	**38**	**59**	**62**	**59**	**58**	**58**	**61**	**59**	**57**	**58**	**53**
			%	**32.2**	**21.6**	**44.6**	**52.4**	**61.5**	**58.5**	**90.7**	**95.4**	**90.8**	**89.2**	**89.2**	**93.8**	**90.8**	**87.8**	**89.2**	**81.5**
	Agreement	4	N	13	34	24	28	10	13	5	3	5	6	3	1	5	6	3	6
			%	20.0	52.3	36.9	43.1	15.4	20.0	7.7	4.6	7.7	9.2	4.6	1.5	7.7	9.2	4.6	9.2
		5	N	31	11	12	3	1	4	1	0	1	1	4	3	1	2	4	6
			%	47.7	16.9	18.5	4.6	1.5	6.2	1.5	0	1.5	1.5	6.2	4.6	1.5	3.1	6.2	9.2
		6	N	0	6	0	0	10	10	0	0	0	0	0	0	0	0	0	0
			%	0	9.2	0	0	15.4	15.4	0	0	0	0	0	0	0	0	0	0
		Sub-total	N	**44**	**51**	**36**	**31**	**21**	**27**	**6**	**3**	**6**	**7**	**7**	**4**	**6**	**8**	**7**	**12**
			%	**67.7**	**78.4**	**55.4**	**47.7**	**32.3**	**41.6**	**9.2**	**4.6**	**9.2**	**10.7**	**10.8**	**6.1**	**9.2**	**12.3**	**10.8**	**18.4**
		Not indicated	N	**0**	**0**	**0**	**0**	4	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
			%	**0**	**0**	**0**	**0**	6.2	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
	Total		N	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5= agree and 6=strongly agree

AdL=Administrative Leadership

AdL1=The research policy of the university is developed in line with national STI and related higher education policies.

AdL2=The research policy of the university incorporates important elements from national, continental and international science, technology and innovation policies.

AdL3=The university research leaders are managing the policy in line with national priority areas.

AdL4=The research leaders are managing the research policy by developing research strategic plans.

AdL5=The research leaders of the university see the research policy as a finished document.

AdL6=The research leaders influence their followers by controlling their day-to-day activities using the structure of the university.

AdL7=The research leaders are good at developing the research competency of the academics.

AdL8=The research leaders are good at resource mobilization from different sources.

AdL9=The research leaders are effective in managing research projects.

AdL10=The research leaders are effective in managing innovation projects.

AdL11=The research leaders are good at quality control of the research activities

AdL12=The research leaders are effective in resolving conflicts

AdL13=The research leaders are effective in managing the performance of the researchers.

AdL14=The research leaders are good at in commercialising the research project results.

AdL15=The leaders are effective in incorporating learning, creativity and adaptability while the managing research and innovation activities of the university.

AdL16=The research leaders are good at establishing networking and partnership with different organisations.

As administrative leaders, the research leaders of Thgnstu University should manage the formulation and implementation of the research and technology transfer policy of the University in line with the national STI policy, and the framework for higher education research and technology transfer by incorporating important elements from continental and global research policies. 67.7% of participants (as opposed to 32.3%) believed the formulation of the University research policy to be aligned with the two national policies. 78.4% of the participants (as opposed to 21.6%) were satisfied that the development of the research policy of the University related to continental and global research policies. The research leaders at university level should not see the research and technology transfer policy of the University as a finished document but 61.5% of the participants were of the opinion that the research and technology transfer policy of the University is treated as a final document while 32.3% participants believed the policy to be changing as directed by demands for change and 6.2% of participants refraining from any judgement. The research and technology transfer policy of the University should have priority areas in line with the priority areas of the two national policy documents and 55.4% of the participants (as opposed to 44.6%) were satisfied that priority areas were aligned to national directions. To translate the research and technology transfer policy objectives of the University into practice, the research leaders of the University should develop research strategic plans and 47.7% of the participants (as opposed to 52.4%) believed these strategic plans to be intact and operational.

In implementing the priority areas of the research and technology transfer policy of Thgnstu University, the research leaders should be effective in managing the research and innovation projects but the clear majority of the participants (95.4%) (as opposed to 4.6%) were skeptical about the competency of the research leaders to manage the projects. The majority of the participants (90.8%) (as opposed to 9.2%) had also misgivings about leadership's ability to manage research projects innovatively. To implement the research and innovation projects effectively, the research leaders have to influence their followers by facilitating, not by controlling, their day-to-day activities, and 58.5% of the participants (as opposed to 41.6%)

believed that the research leaders at university level are rather controlling than facilitating the implementation of research project initiatives.

In order to manage the research projects effectively, the leaders should be good at resource mobilisation, developing the competency of the researchers, managing researcher performance, resolving conflict, and controlling the quality of outcomes of the research and innovation projects. In this regard, 95.4% of the participants (as opposed to 4.6%) did not think leadership was competent in mobilising resources for the research projects, 90.7% (as opposed to 9.3%) questioned research leaders' zest for developing the capacity of the researchers, and 90.8% of participants (as opposed to 9.2%) were skeptical about the way in which research leaders lead and manage quality research outcomes. The majority of the participants (93.8%) (as opposed to 6.2%) did not think research leaders were successful with resolving conflict among team members in a functional way, and 89.2% of participants (as opposed to 10.8%) mistrusted leadership's competency to ensure good quality research conduct engendering innovative outcomes. In order to counter the constraints of the human, material and financial resources, the leaders have to be good at networking and establishing partnerships with applicable stakeholders but 81.5% of the participants (as opposed to 18.4%) were skeptical about the capacity of research leaders to establish partnerships and networks for the effective implementation and functioning of the research projects. Apart from managing the research process, research leaders are also responsible for ensuring the commercialisation of the research outcomes for societal benefit. However, 87.8% of the participants (as opposed to 12.3%) did not have confidence in leadership's marketing abilities of the results of the research projects.

By improving research and innovation management at Thgnstu University, the research leaders should incorporate continuous and consistent learning to engender creativity and flexibility in adapting improved leadership and management endeavour into the formal research governance structure of the University for improved research performance. In this regard, 89.2% of the participants (as opposed to 10.8%) doubted leadership's zest for continuous learning in pursuit of improved excellence with research endeavour. Adaptive leadership needs to be incorporated into the administrative leadership of the research and innovation projects. To understand leaders at university level's ability to practice adaptive leadership at Thgnstu University, the findings of the quantitative data are presented next.

Adaptive leadership at university level

Table 6.15 provides the research findings based on the data collected using the items in Part I of the structured questionnaire about participants' perception of the practice of adaptive leadership at university level at Thgnstu University (Appendix F).

Table 6.15: Agreement and disagreement of participants on matters pertaining to adaptive leadership at university level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdL10	AdL11	AdL12	AdL13	AdL14	AdL15	AdL16	AdL17	AdL18	AdL19	AdL20
Participants having	Disagreement	1	N	10	6	4	3	1	6	1	16	17	0	1	0	8	0	13	2	12	8	8	4
			%	15.4	9.2	6.2	4.6	1.5	9.2	1.5	24.6	26.2	0	1.5	0	12.3	0	20.0	3.1	18.5	12.3	12.3	6.2
		2	N	22	13	31	20	23	27	27	16	19	31	21	21	28	29	8	26	24	12	6	15
			%	33.8	20.0	47.7	30.8	35.4	41.5	41.5	24.6	29.2	47.7	32.3	32.3	43.1	44.6	12.3	40.0	36.9	18.5	9.2	23.1
		3	N	19	31	16	14	20	24	22	19	9	11	32	27	20	31	32	22	17	19	34	38
			%	29.2	47.7	24.6	21.5	30.8	36.9	33.8	29.2	13.8	16.9	49.2	41.5	30.8	47.7	49.2	33.8	26.2	29.2	52.3	58.5
		Sub-total	N	**51**	**50**	**51**	**37**	**44**	**57**	**50**	**51**	**45**	**42**	**54**	**48**	**56**	**60**	**53**	**50**	**53**	**39**	**48**	**57**
			%	**78.4**	**76.9**	**78.5**	**56.9**	**67.7**	**87.6**	**76.8**	**78.4**	**69.2**	**64.6**	**83**	**73.8**	**86.2**	**92.3**	**81.5**	**76.9**	**81.6**	**60**	**73.8**	**87.8**
	Agreement	4	N	10	9	8	21	14	2	8	8	7	17	5	10	2	2	8	8	5	24	5	6
			%	15.4	13.8	12.3	32.3	21.5	3.1	12.3	12.3	10.8	26.2	7.7	15.4	3.1	3.1	12.3	12.3	7.7	36.9	7.7	9.2
		5	N	4	6	2	1	5	2	1	4	7	0	0	5	7	3	4	3	1	0	6	2
			%	6.2	9.2	3.1	1.5	7.7	3.1	1.5	6.2	10.8	0	0	7.7	10.8	4.6	6.2	4.6	1.5	0	9.2	3.1
		6	N	0	0	4	6	2	4	6	2	6	6	6	2	0	0	0	4	6	2	0	0
			%	0	0	6.2	9.2	3.1	6.2	9.2	3.1	9.2	9.2	9.2	3.1	0	0	0	6.2	9.2	3.1	0	0
		Sub-total	N	**14**	**15**	**14**	**28**	**21**	**8**	**15**	**14**	**20**	**23**	**11**	**17**	**9**	**5**	**12**	**15**	**12**	**26**	**11**	**8**
			%	**21.6**	**23**	**15.4**	**33.8**	**29.2**	**6.2**	**13.8**	**18.5**	**30.8**	**35.4**	**16.9**	**23.1**	**13.9**	**7.7**	**18.5**	**16.9**	**18.4**	**40**	**16.9**	**12.3**
	Not indicated		N	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	6	**0**
			%	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	9.2	**0**
	Total		N	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL=Adaptive leadership

AdaL1=The research leaders see the practice of research policy as learning by producing new knowledge through participation.

AdaL2=The leaders see the practice of research policy as producing new knowledge to solve real world problems through dynamic interaction.

AdaL3=The research leaders of the university see the research policy as continuous learning.

AdaL4=The research leaders see research leadership as a process.

AdaL5=The research leaders exercise research leadership as context specific.

AdaL6=The research leaders lead the research activities focusing on innovation by facilitating interaction outside the university.

AdaL7=There is collaborative leadership in the innovation system of the university.

AdaL8=The research leaders are good at setting direction.

AdaL9=The leaders are leading the research and innovation activities of the university in line with the needs of the local community.

AdaL10=The leaders are leading the research and innovation activities of the university in line with the needs of the nation.

AdaL11=The leaders are leading the research and innovation activities of the university to address their own internal teaching problems.

AdaL12=The leaders lead the research teams to find solutions to solve local problems.

AdaL13=The leaders are good at collecting information about the weaknesses of their policies and competencies from their stakeholders.

AdaL14=The leaders use the information they gathered to fill their gaps in line with the needs of the stakeholders.

AdaL15=The leaders accommodate emergent ideas into the university research structure to facilitate innovation.

AdaL16=The leaders lead the research and innovation activities of the university to develop new ideas and find innovative solutions to develop new products and services for the local context.

AdaL17=The research leaders emphasise leading basic research in a context of application.

AdaL18=The leaders prioritise applied research for real problem solving.

AdaL19=The leaders focus on action based on learning and creativity.

AdaL20=The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the university.

As adaptive leaders, the research leaders at university level should approach the research and technology transfer policy of Thgnstu University as an on-going learning document prone to adaption as changes for the sake of betterment demand refinement. 78.5% of the participants (as opposed to 15.4%) were skeptical about leadership's understanding of the University's research policy as a dynamic document. The leaders should perceive research policy implementation as a continuous learning process whereby new knowledge is produced to address real problems identified through dynamic interaction with stakeholders. In this regard, more than three quarters of the participants (78.4%) (as opposed to 21.6%) had misgivings about leadership's perception of research policy implementation aimed at improved knowledge to benefit stakeholders. 76.9% of participants (as opposed to 23%) questioned leadership's capacity to arrange for the production of improved knowledge to address real problems.

The research leaders should be knowledgeable in order to be able to set the direction for research policy implementation but 78.4% of the participants (as opposed to 18.5%) questioned leadership's capacity for setting effective strategies for successful research conduct. While implementing the research policy of the University, the research leaders should approach their research and innovation leadership as a process that is context specific and that is best achieved with collaboration with stakeholders. As shown in Table 6.15, 56.9% of the participants (as

opposed to 33.8%) were skeptical about leadership's understanding of research management and research conduct as a process, 67.7% (as opposed to 29.2%) about leadership's perception of research to be focused on the specific context and 76.8% (as opposed to 13.8%) about leadership's capacity to ensure collaboration arrangements for improved research outcomes characterised by innovation qualities.

The research leaders should prioritise basic or applied research to be aligned to the specific knowledge and technology they intend to produce. The majority of the participants (81.6%) (as opposed to 18.4%) questioned leadership's conduct of prioritising basic research applicably for the sake of gaining improved knowledge, and 60% of participants (as opposed to 40%) did not think applied research is prioritized to solve context specific problems. To achieve the present goals of research and innovation of the University, the leaders should lead the research and innovation projects of the University to be aligned to the real problems of the local community, the University, and the country at large. However, 69.2% of the participants (as opposed to 30.8%) were skeptical about research and innovation leadership's success rate in aligning research projects with the actual problems of the local community, 83% (as opposed to 16.9%) about leadership's ability to align research endeavour with a solving of the University's own practical problems, and 64.6% (as opposed to 35.4%) about leadership's capacity to manage research endeavour for the benefit of the country. Nearly three quarters of the participants (73.8%) (as opposed to 23.1%) questioned leadership's encouragement of research teams to solve local problems.

The research leaders should also lead the research and innovation activities of the University to develop new ideas and innovative solutions for the local context's demands. However, 76.9% of the participants (as opposed to 23.1%) had misgivings about the competency of the research and innovation leadership at Thgnstu University to inspire innovative solutions for burning community issues. To address the real problems of the local community, industry, the University, and the nation, the research leaders should focus on leading the research projects of the University to represent research projects that are characterised by innovative endeavour strengthened by collaboration with concerned beneficiaries and stakeholders. In this regard, 87.6% of the participants (as opposed to 12.4%) questioned the competency of the research leadership to arrange for innovative research endeavour strengthened by collaboration for constructive research outcomes.

With regard to improving the research policy and the actual practice of the University, the research leaders should be competent at facilitating dynamic interactions among key stakeholders of the research and innovation projects but 87.8% of the participants (as opposed to 12.3%) were skeptical on leadership's ability to ensure collaborative endeavours between the University and the stakeholders of the research projects. The leaders should pursue continuous learning engendering creativity for constructive research outcomes but 73.8% of the participants (as opposed to 16.9% and with 9.2% not giving their opinion on this matter) were skeptical about leaders' capacity for creative endeavour prompting original solutions to address research problems in a constructive way. The leaders should collect information and feedback and use the feedback information to counter shortcomings and accommodate emerging ideas for improved performance. However, 86.2% of the participants (as opposed to 13.8%) were skeptical about leadership's zest for collecting and considering feedback for improved research endeavour with 92.3% of participants (as opposed to 7.6%) being sure that leadership are not focused on addressing shortcomings observed with research conduct, and 81.5% (as opposed to 19.5%) questioning leaders' pursuit of incorporating emerging ideas for proactive research conduct at Thgnstu University.

To lead the research and innovation projects of the University to be aligned to specific contexts to produce relevant knowledge and the right technology to solve real problems, the research leaders at university level should apply enabling leadership so that research leaders at different levels of management can create enabling conditions for researchers to engage productively with their research responsibilities. The findings of the quantitative data regarding enabling leadership at university level at Thgnstu University are provided next.

Enabling leadership at university level

Table 6.16 provides the research findings based on the data collected as per the items in Part I of the structured questionnaire about participant perception on the practice of enabling leadership at university level at Thgnstu University (Appendix F).

Table 6.16: Agreement and disagreement of participants on matters pertaining to enabling leadership at university level

Items				EnL1	EnL2	EnL3	EnL4	EnL5	EnL6	EnL7	EnL8	EnL9	EnL10	EnL11	EnL12	EnL13	EnL14	EnL15
Participants having	Disagreement	1	N	9	11	5	11	8	6	6	6	11	14	15	23	11	10	7
			%	13.8	16.9	7.7	16.9	12.3	9.2	9.2	9.2	16.9	21.5	23.1	35.4	16.9	15.4	10.8
		2	N	15	15	35	26	42	21	9	24	27	18	25	27	11	35	28
			%	23.1	23.1	53.8	40.0	64.6	32.3	13.8	36.9	41.5	27.7	38.5	41.5	16.9	53.8	43.1
		3	N	23	20	14	22	14	24	23	18	21	26	19	14	38	19	13
			%	35.4	30.8	21.5	33.8	21.5	36.9	35.4	27.7	32.3	40.0	29.2	21.5	58.5	29.2	20.0
		Sub-total	N	**47**	**46**	**54**	**59**	**64**	**51**	**38**	**48**	**59**	**58**	**59**	**64**	**60**	**64**	**48**
			%	**72.3**	**70.8**	**83**	**90.7**	**98.4**	**78.4**	**58.4**	**73.8**	**90.7**	**89.2**	**90.8**	**98.4**	**92.3**	**98.4**	**73.9**
	Agreement	4	N	18	6	10	6	1	9	19	9	6	6	6	1	5	1	17
			%	27.7	9.2	15.4	9.2	1.5	13.8	29.2	13.8	9.2	9.2	9.2	1.5	7.7	1.5	26.2
		5	N	0	13	1	0	0	5	8	8	0	1	0	0	0	0	0
			%	0	20.0	1.5	0	0	7.7	12.3	12.3	0	1.5	0	0	0	0	0
		6	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Sub-total	N	**18**	**19**	**11**	**6**	**1**	**14**	**27**	**17**	**6**	**7**	**6**	**1**	**5**	**1**	**17**
			%	**27.7**	**29.2**	**16.9**	**9.2**	**1.5**	**21.5**	**41.5**	**26.1**	**9.2**	**10.7**	**9.2**	**1.5**	**7.7**	**1.5**	**26.2**
	Total		N	65	65	65	65	65	65	65	65	65	65	65	65	65	65	65
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

EnL=Enabling leadership

EnL1=The leaders inspire researchers to engage in research-based innovation.

EnL2=The leaders encourage the researchers to adopt technologies from foreign countries.

EnL3=The leaders are effective in building research teams having different skills with shared identity.

EnL4=The leaders interconnect research activities to facilitate the production, dissemination, and utilisation of new knowledge or technologies.

EnL5=The leaders promote interactive relationships among education, research, and innovation.

EnL6=There is an environment conducive to undertake research and innovation activities in the university.

EnL7=There is adequate fund for research undertaking in the university.

EnL8=There is adequate fund for innovation in the university.

EnL9=There is strong linkage between the university and industry for collaborative research and innovation.

EnL10=The leaders facilitate dynamic interaction between and among researchers from different disciplines.

EnL11=The leaders motivate the researchers to engage passionately in the research task by providing resources to come up with new and innovative results.

EnL12=The leaders put managerial pressure on the university research system to adjust and about the required change.

EnL13=The leaders are good at using the structure of the university to address challenges to research and innovation activities.

EnL14=The leaders are good at establishing functional networks across stakeholders that engage in research and innovation activities.

Enl15=There is functional innovation system that comprises researchers, the government, industry and the local community

As enabling leaders, the research leaders of Thgnstu University have to inspire and encourage researchers to improved performance and build effective research teams that have different skills but a shared identity. However, as Table 6.16 indicates, 72.3% of the participants (as opposed to 27.7%) were not satisfied with leadership's motivation attempts to inspire researchers to innovative research outcomes, 70.8% (as opposed to 29.2%) did not believe research leaders to encourage researchers to adopt and adapt foreign technology for contextual application, and 83% (as opposed to 16.9%) questioned research leaders' actions of establishing effective research teams to achieve a common goal. The leaders should also interconnect research activities at the University to facilitate the production, dissemination, and application of relevant knowledge and technology for improved internal performance but most of the participants (90.7%) (as opposed to 9.3%) were not impressed with the potential of leadership to ensure the production and application of improved knowledge with research endeavour.

In order to counter the constraints of knowledge, skills, and technology capacity within and outside the University, the research leaders have to link education, research, and innovation although 98.4% of the participants (as opposed to 1.6%) questioned the success of such linking endeavours. The research leaders should establish strong linkages between the University and industry for collaborative research and innovation projects directed by mutual benefit but 90.7% of the participants (as opposed to 9.3%) did not think such linkages were established. To achieve the research and innovation goals of the University effectively, there should be a functional innovation system at the University but 73.9% of the participants (as opposed to 26.2%) were skeptical about the presence of a practical innovation system at the University. Regarding establishing functional networks with key stakeholders who engage in research and innovation activities, 98.4% of the participants (as opposed to 1.6%) questioned the existence of such networks.

The research leaders at university level should facilitate functional interaction among researchers, motivate researchers to engage in research and innovation projects single-mindedly, and exert constant managerial pressure on the University's research system for sustained research performance. Most of the participants (89.2%) (as opposed to 10.8%) did not believe profound interaction among researchers existed, 90.8% of participants (as opposed to 9.2%) were not satisfied with leadership's motivation endeavours to ensure researchers are passionately engaged with their research conduct. Most of the participants (98.4%) (as opposed

to 1.6%) had misgivings about leadership's capacity to exert managerial pressure on the University research system to ensure adequate research resources for sustained and constructive research conduct.

In using enabling leadership, the research leaders should facilitate the development of an environment that is conducive for researchers to engage optimally with their research conduct. 78.4% of participants (as opposed to 21.5%) were not sure that leadership had such intent. One of the key enabling conditions for profound research conduct is the allocation of a realistic budget to ensure research actions can process uninterruptedly. Regarding the adequacy of the budget, 58.4% of the participants (as opposed to 41.5%) did not believe enough money was available for proper research endeavour, and 73.8% the participants (as opposed to 26.1%) were skeptical about budgeting focused on innovative research outcomes at Thgnstu University. To address the challenges relating to the leadership and management of research and innovation projects, the research leaders should use the University research governance structure to establish and sustain research conduct but most of the participants (92.3%) (as opposed to 7.7%) questioned research leadership's capacity for applying the University's research governance structure optimally to ensure satisfactory research engagement at Thgnstu University.

Responding to research challenges, research leaders should apply administrative (management) leadership with regard to proper budgeting. In order to describe the practice and challenges of proper budgeting for the research and innovation activities at Thgnstu University, the annual performance reports for the five-year period 2012/2013-2016/2017 of Thgnstu University were considered. The findings are presented with reference to Table 6.17 depicting the data collected using a checklist with indicators on the planning and utilising of the budget share for research and community engagement as percentage of the annual comprehensive budget for Thgnstu University (Appendix H).

Table 6.17: Annual budget and the budget share for research and community engagement at Thgnstu University for the five-year period 2012/13-2016/17.

Academic Year	Annual budget planned in Ethiopian Birr	Annual budget share for research, technology transfer and community	Percentage of the research, technology transfer and community	Annual budget achieved	Annual budget share for research , technology transfer and community	Percentage of the research, technology transfer and community

		engagement planned	planned budget		engagement achieved	budget performed
2012/13	NA	NA	N/A	NA	NA	N/A
2013/14	444,504,802.28	17,083,374.95	3.8	379,999,101.58	3,431,497.31	0.9
2014 /15	580,275,674.16	6,861,070.00	1.2	561,953,022.28	8,692,407.60	1.6
2015/16	852,349,539.90	5,225,412.69	0.6	848,558,391.36	4,872,945.76	0.6
2016/17	1,124,455,450.00	13,678,990.00	1.2	861,814,322.44	4,826,905.86	0.6

Source: Thgnstu University Annual Performance Reports (2012/13 -2016/17)

As indicated in Table 6.17, the budget share for research, technology transfer and community engagement depict a decrease from 3.8% to 1.2% and an increase in the utilisation of the budget from 0.9% to 1.6% for the period 2012/13 -2014/15. The planned budget share increased from 0.6% to 1.6%, and the utilization rate remained the same, namely 0.6% for the period 2015/16 to 2016/17. The framework for higher education research and technology transfer document suggests that universities should allocate at least 5% from their total annual budget for the research activities of the university.

Competency of research leaders at university level to manage research and innovation - a critical interpretation

A close interpretation of the research findings on administrative, adaptive, and enabling leadership with the research and innovation leadership and management actions at Thgnstu University indicated that there were competency shortcomings. In using administrative leadership in the research and innovation activities of the University, the research leaders should be competent at research and innovation project management although more than 90% of the participants were of the opinion that there were competency shortcomings in the research and innovation project leadership and management at Thgnstu University. As competent adaptive leaders, the research leaders of the University should lead the research and innovation projects to be aligned to the specific and real problems of the local community, the University, industry and the country though more than two-thirds of the participants (64%) perceived the leaders to have shortcomings in adaptive leadership. In order to make the research and innovation projects productive, the research leaders should motivate the researchers to engage in the projects keenly. However, 90.8% of the participants believed the research leaders of the University were not competent in motivating the researchers to produce innovative ideas and

creative solutions for complex problems that require unique solutions through exercising enabling leadership.

Administrative, adaptive, and enabling leadership should also be exercised with the research and innovation leadership and management at college level. The findings of the quantitative data regarding administrative leadership at college level follows.

Administrative leadership at college level

Table 6.18 presents the research findings based on the data collected in line with the items in Part II of the structured questionnaire about participant opinion on administrative leadership at college level at Thgnstu University (Appendix F).

Table 6.18: Agreement and disagreement of participants on matters pertaining to administrative leadership at college level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13
Participants having	Disagreement		N	2	14	17	4	3	23	23	16	16	8	23	4	24
			%	3.1	21.5	26.2	6.2	4.6	35.4	35.4	24.6	24.6	12.3	35.4	6.2	36.9
		2	N	19	17	16	32	17	22	17	19	19	29	17	24	18
			%	29.2	26.2	24.6	49.2	26.2	33.8	26.2	29.2	29.2	44.6	26.2	36.9	27.7
		3	N	10	25	20	18	12	11	18	30	23	28	19	37	17
			%	15.4	38.5	30.8	27.7	18.5	16.9	27.7	46.2	35.4	43.1	29.2	56.9	26.2
		Sub-total	**N**	**31**	**56**	**53**	**54**	**32**	**56**	**58**	**65**	**58**	**65**	**59**	**65**	**59**
			%	**47.7**	**86.2**	**81.6**	**83.1**	**49.3**	**86.1**	**89.3**	**100**	**89.2**	**100**	**90.8**	**100**	**90.8**
	Agreement	4	N	16	9	11	1	32	9	7	0	6	0	6	0	6
			%	24.6	13.8	16.9	1.5	49.2	13.8	10.8	0	9.2	0	9.2	0	9.2
		5	N	18	0	1	10	1	0	0	0	1	0	0	0	0
			%	27.7	0	1.5	15.4	1.5	0	0	0	1.5	0	0	0	0
		6	N	0	0	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0	0	0
		Sub-total	**N**	**34**	**9**	**12**	**11**	**33**	**9**	**7**	**0**	**7**	**0**	**6**	**0**	**6**
			%	**52.3**	**13.8**	**18.4**	**16.9**	**50.7**	**13.8**	**10.8**	**0**	**10.7**	**0**	**9.2**	**0**	**9.2**
	Total		N	65	65	65	65	65	65	65	65	65	65	65	65	65
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The research leader (coordinator) of the college manages the college research activities in line with the university research policy.

AdL2=The research leader of the college manages the college innovation activities in line with the university research policy.

AdL3=The leader is good at communication with the researchers.

AdL4=The leader focuses on managing the schedules and budgets of the projects.

AdL5=The leader is good at delegating managerial responsibilities for improved performance.

AdL6=The research leader is good at research project management.

AdL7=The research leader is good at managing performance of the research.

AdL8=The research leader is good at resources mobilization for the projects.

AdL9=The research leader is good at resolving conflict among researchers.

AdL10=The research leader is effective in managing the qualities of applicability outcomes of the research projects.

AdL11=The research leader is good at managing research-based innovation.

AdL12=The research leader is struggling in innovation project management.

AdL13=The leader is good at incorporating learning, creativity and adaptability while managing research and innovation activities of the college.

In using administrative leadership, the research leaders at college level should manage the research and innovation activities of the colleges to be aligned to the University research and technology transfer policy. Among the participants 52.3% (as opposed to 47.7%) rated research leadership to be competent in managing research activities effectively aligned to University specifications but 86.2% of participants (as opposed to 13.8%) were skeptical about leadership competency to ensure innovation with research leadership and management at college level at Thgnstu University. To translate the research and innovation activities of the colleges into practice, the leaders should be skilled at research and innovation project management although 86.1% of the participants (as opposed to 13.9%) had misgivings about research leaders' management abilities and 100% of the participants had no trust in research leaders' competency to ensure innovation with research conduct.

As research project managers, the leaders should be skilled at clear communication, effective resource mobilization, and successful conflict resolution. Also, 81.6% of the participants (as opposed to 19.4%) were not impressed with research leaders' communication skills, 100% denied any adequate mobilization of required resources for effective research conduct, and 89.2% (as opposed to 10.8%) were skeptical about leaders' capacity to resolve conflict erupting in research teams functionally. The leaders should manage the research projects in terms of quality outcomes, proper budgeting and realistic timeframes but most participants (83.1%) (as opposed to 16.9%) questioned research leaders' successes with proper budgeting and realistic timeframes for research project completion. All the participants (100%) had agreement on the fact that the leaders were not effective in managing the quality of utilisation of research outcomes for societal development. Also, 90.8% of participants were of the opinion that research leaders at college level are not able to manage research endeavours innovatively while

only 9.2% judged research leaders as able to be innovative managers. The leaders should manage the performance of the researchers, and delegate managerial responsibilities for empowerment and improved performance purposes, but 89.3% of the participants (as opposed to 10.7%) did not think that leadership was managing the performance of researchers optimally. 50.7% of participants (as opposed to 49.3%) acknowledged research leaders' actions of delegating authority for the sake of empowerment and improved performance for researchers.

In order to improve the research and innovation activities of the colleges, research leaders should incorporate continuous learning that engenders creativity and eventual adaptability by practicing adaptive leadership to be incorporated into the formal research governance structure of the colleges, but 90.8% of the participants (as opposed to 9.2%) were skeptical of research leaders' capacity to ensure such incorporation of adaptive leadership into the formal research governance structure at college level. To describe the practice of adaptive leadership at college level at Thgnstu University, the findings of the quantitative data are provided next.

Adaptive leadership at college level

Table 6.19 provides the research findings based on the data collected as per the items in Part II of the structured questionnaire about participant perception of the practice of adaptive leadership at college level at Thgnstu University (Appendix F).

Table 6.19: Agreement and disagreement of participants on matters pertaining to adaptive leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	**N**	**%**	N	%	N	%	N	%	**N**	**%**	N	%
AdaL1	9	13.8	25	38.5	22	33.8	**56**	**86.1**	9	13.8	0	0	0	0	**9**	**13.8**	65	100
AdaL2	21	32.3	22	33.8	19	29.2	**62**	**95.3**	3	4.6	0	0	0	0	**3**	**4.6**	65	100
AdaL3	18	27.7	19	29.2	19	29.2	**56**	**86.1**	9	13.8	0	0	0	0	**9**	**13.8**	65	100
AdaL4	16	24.6	18	27.7	14	21.5	**48**	**73.8**	17	26.2	0	0	0	0	**17**	**26.2**	65	100
AdaL5	3	4.6	34	52.3	19	29.2	**56**	**86.1**	0	0	5	7.7	4	6.2	**9**	**13.9**	65	100
AdaL6	15	23.1	17	26.2	24	36.9	**56**	**86.2**	9	13.8	0	0	0	0	**9**	**13.8**	65	100

AdaL7	13	20.0	23	35.4	28	43.1	**64**	**98.5**	0	0	1	1.5	0	0	**1**	**1.5**	65	100

Keys:

AdaL1=The college puts more value on areas of research applicable to the internal development of the college.

AdaL2=The leader is leading the researchers to research their own teaching to address the internal problems of the college.

AdaL3=The leader is leading the researchers to research and address the problems of the local communities.

AdaL4=The leader is leading the researchers to research and produce new knowledge for the socio-economic development of the country.

AdaL5=The research leader is struggling in innovation project leadership.

AdaL6=The leader focuses on action based on learning and creativity.

AdaL7=The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the college.

In exercising adaptive leadership, the research leaders at college level at Thgnstu University should lead the research and innovation activities to be applicable to the specific context of the college, the local community, industry, and the nation. As shown in Table 6.19, the majority of the participants (86.1%) (as opposed to 13.8%) did not believe leadership is aimed at research outcomes addressing internal problems. Most of the participants (95.3%) (as opposed to 4.6%) questioned research and innovation leadership actions to align the teaching problems of the colleges with research conduct in pursuit of solutions for improved practice. The majority of the participants (86.1%) (as opposed to 13.8%) had doubts about leaders' management of research conduct to address the problems of the local community, and 73.8% (as opposed to 26.2%) denied alignment of research endeavour with the solving of country wide problems for the sake of the socio-economic development of the nation.

In order to ensure the research and innovation projects of the colleges contribute to addressing internal problems, the problems of the local community, industry, and the nation, research leaders should be competent at innovation project leadership but 86.1% of the participants (as opposed to 13.9%) were skeptical about any innovation endeavour with research conduct to address the problems of stakeholders. In order to contribute to the required change and improvement in the specific context, research leaders should base their actions on continuous learning to prompt creative solutions but 86.2% of the participants (as opposed to 13.8%) questioned such zest for creative actions forthcoming from research leaders. The research leaders should facilitate dynamic interactions among researchers and key stakeholders for constructive research outcomes but 98.5% of the participants (as opposed to 1.5%) questioned

leadership capacity to arrange for such constructive collaboration with stakeholders. To engage the researchers and project leaders of research and innovation projects constructively in research conduct, the research leaders of the colleges at Thgnstu University should create enabling conditions exercising enabling leadership. The findings of the quantitative data regarding the practice of enabling leadership at college level at Thgnstu University are provided next.

Enabling leadership at college level

Table 6.20 depicts the research findings based on the data collected using the items in Part II of the structured questionnaire about participant opinion on the practice of enabling leadership at college level at Thgnsu University (Appendix F).

Table 6.20: Agreement and disagreement of participants on matters pertaining to enabling leadership at college level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	**N**	**%**	N	%	N	%	N	%	**N**	**%**	N	%
EnL1	20	30.8	24	36.9	12	18.5	**56**	**86.2**	9	13.8	0	0	0	0	**9**	**13.8**	65	100
EnL2	11	16.9	11	16.9	27	41.5	**49**	**75.3**	5	7.7	11	16.9	0	0	**16**	**24.6**	65	100
EnL3	9	13.8	26	40.0	29	44.6	**64**	**98.4**	1	1.5	0	0	0	0	**1**	**1.5**	65	100
EnL4	17	26.2	23	35.4	19	29.2	**59**	**90.8**	6	9.2	0	0	0	0	**6**	**9.2**	65	100
EnL5	9	13.8	28	43.1	22	33.8	**59**	**90.7**	6	9.2	0	0	0	0	**6**	**9.2**	65	100
EnL6	12	18.5	13	20.0	20	30.8	**45**	**69.3**	20	30.8	0	0	0	0	**20**	**30.8**	65	100
EnL7	6	9.2	19	29.2	31	47.7	**56**	**86.1**	9	13.8	0	0	0	0	**9**	**13.8**	65	100
EnL8	8	12.3	11	16.9	32	49.2	**51**	**78.4**	14	21.5	0	0	0	0	**14**	**21.5**	65	100

Keys:

EnL1=The research leader motivates the researchers to undertake problem-solving research.

EnL2=The leader is good at team building having different skills.

EnL3=The leader is good at inspiring and motivating researchers.

EnL4=The research leader encourages disciplined-based research to produce improved discipline –based knowledge.

EnL5=The research leader encourages interdisciplinary research to solve real problems.

EnL6=The research leader encourages collaborative research with external bodies that promote research-based innovation.

EnL7=The leader is good at establishing functional networks across stakeholders who engage in research and innovation activities.

EnL8=The leader is good at using the structure of the college to address challenges to research and innovation activities.

In order to create enabling conditions for the researchers and project leaders, the research leaders at college level should employ enabling leadership to motivate and inspire researchers, and to build effective research teams having different skills but a shared identity. As indicated in Table 6.20, 86.2% of the participants (as opposed to 13.8%) were not satisfied with research leaders' efforts of motivating researchers to conduct problem-solving research, 98.4% of participants (as opposed to 1.6%) did not encounter leaders to inspire creative research conduct and 75.3% of participants (as opposed to 24.6%) questioned research leaders' ability to develop skilled research teams having a sense of belonging, aspiring for common goal realization. The research leaders should encourage researchers to diversify by undertaking different kinds of research for different purposes. Most of the participants (90.8%) (as opposed to 9.2%) questioned leaders' encouragement of the researchers to undertake discipline-based research to produce constructively improved knowledge.

The clear majority of participants (90.7%) (as opposed to 9.3%) did not encounter leadership encouraging researchers to undertake interdisciplinary research to solve real problems, and 69.3% of participants (as opposed to 30.8%) did not think leaders encourage researchers to conduct collaborative research for an improved final product in terms of innovative research outcomes. To counter the constraints related to human, material, and financial resources at college level, the research leaders should establish functional networks with stakeholders but most of the participants (86.1%) (as opposed to 13.8%) questioned leaders' competency to create constructive networks for their research teams in pursuit of improved research outcomes. In addressing the challenges pertaining to the research and innovation leadership of the colleges, the research leaders should utilise the research governance structure of the colleges effectively but 78.4% of the participants (as opposed to 21.5%) were skeptical about the competency of the research leaders to respond to the research challenges utilising administrative leadership at college level at Thgnstu University.

Competency of research leaders at college level to manage research and innovation - a critical interpretation

From a critical analysis of the research findings about administrative, adaptive, and enabling leadership with research and innovation management and leadership at college level at Thgnstu University, it was clear that there were research leadership competency shortcomings. As skilled administrative leaders, the research leaders at college level should be competent in research and innovation project management but 86% of the participants believed research leaders at college level did not have adequate competencies in project management and all of the participants perceived research leaders at college level not to be effective in managing research projects innovatively.

As competent adaptive leaders, the research leaders should be capable of leading the research projects to be aligned to the specific context to address internal problems relating to college functioning and external problems relating to industry, the local community and nation development. However, more than 73% of the participants indicated that the leaders had competency shortcomings in adaptive leadership at college level. In order to ensure researchers are productive in their research and innovation project involvement addressing context specific problems by producing relevant knowledge and the right kind of technology, research leaders should encourage researchers to conduct discipline-based research for improved knowledge. Research leaders should encourage researchers to become involved in interdisciplinary research to address real problems practically and collaboratively for an improved product based on refined innovation. However, more than two-thirds of the participants (69.3%) opined that research leaders were not competent in enabling leadership relating to encouraging discipline-based research by means of interdisciplinary collaborative effort in pursuit of innovative outcomes at college level at Thgnstu University.

With regard to research and innovation management and leadership at Thgnstu University, administrative leadership, adaptive leadership, and enabling leadership should be practiced at project level. The findings of the quantitative data regarding administrative leadership at project level are discussed next.

Administrative leadership at project level

Table 6.21 depicts the research findings based on the data collected using the items in Part III of the structured questionnaire to determine the perceptions of participants about the

competencies of research leaders at project level to act as administrative leaders of their research projects at Thgnstu University (Appendix F).

Table 6.21 Agreement and disagreement of participants on matters pertaining to administrative leadership at project level

Items				AdL1	AdL2	AdL3	AdL4	AdL5	AdL6	AdL7	AdL8	AdL9	AdL10	AdL11	AdL12	AdL13	AdL14
Participants having	Disagreement	1	N	30	25	21	20	17	27	6	25	19	14	15	20	18	8
			%	46.2	38.5	32.3	30.8	26.2	41.5	9.2	38.5	29.2	21.5	23.1	30.8	27.7	12.3
		2	N	23	20	25	24	36	27	49	18	26	30	28	9	30	35
			%	35.4	30.8	38.5	36.9	55.4	41.5	75.4	27.7	40.0	46.2	43.1	13.8	46.2	53.8
		3	N	1	12	17	17	9	11	10	22	20	11	22	29	17	22
			%	1.5	18.5	26.2	26.2	13.8	16.9	15.4	33.8	30.8	16.9	33.8	44.6	26.2	33.8
		Stub-t	N	**54**	**57**	**63**	**61**	**62**	**65**	**65**	**65**	**65**	**55**	**65**	**58**	**65**	**65**
			%	**83.1**	**87.8**	**97**	**93.9**	**95.4**	**99.9**	**100**	**100**	**100**	**84.6**	**100**	**89.2**	**100.1**	**99.9**
	Agreement	4	N	11	8	2	4	3	0	0	0	0	10	0	7	0	0
			%	16.9	12.3	3.1	6.2	4.6	0	0	0	0	15.4	0	10.8	0	0
		5	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		6	N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
		Stub-t	N	**11**	**8**	**2**	**4**	**3**	**0**	**0**	**0**	**0**	**10**	**0**	**7**	**0**	**0**
			%	**16.9**	**12.3**	**3.1**	**6.2**	**4.6**	**0**	**0**	**0**	**0**	**15.4**	**0**	**10.8**	**0**	**0**
	Total		N	65	65	65	65	65	65	65	65	65	65	65	65	65	65
			%	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdL1=The project leader (principal investigator) sets realistic and functional objective(s) to a project in collaboration with the project stakeholders.

AdL2=The project leader is good at communication.

AdL3=The project leader is effective in research project management.

AdL4=The project leader is good at managing resources.

AdL5=The project leader is struggling in managing the quality of the research project in terms of producing new and relevant knowledge.

AdL6=The project leader is effective in innovation project management.

AdL7=The project leader is a good problem solver.

AdL8=The project leader manages project progress effectively.

AdL9=The project leader manages the success of the project in terms of time and budget.

AdL10=The project leader manages his or her team effectively.

AdL11=There is effective risk-assessment in the research and innovation projects.

AdL12=The project leader is good at conflict resolution.

AdL13=The project leader is effective in obtaining research grants.

AdL14=The project leader is good at incorporating learning, creativity and adaptability while managing research or innovation projects.

In applying administrative leadership, the project leaders should be skilled at setting realistic and functional objectives for research and innovation projects in collaboration with beneficiaries and key stakeholders. In this regard, 83.1% of the participants (as opposed to 16.9%) questioned the competency of the project leaders in planning practical objectives for their research projects. To set realistic and functional objectives for the research projects, research leaders should be competent at research and innovation project management but most of the participants (93.9%) (as opposed to 6.1%) had misgivings about the ability of research leaders to set realistic and functional research objectives in pursuit of innovative solutions to determined problems. 99.9% of participants questioned research leaders' capacity at project level to prompt innovative actions with research conduct at Thgnstu University.

As competent project managers, the project leaders should manage the project resources, project progress, and the effective functioning of research teams but 93.9% of the participants (as opposed to 6.1%) were skeptical about project leaders' ability to arrange for adequate resources, all the participants (100%) questioned research leaders ability to manage project progress effectively and 84.6% (as opposed to 15.4%) questioned the successful management of research team functioning. All the participants (100%) questioned research leaders' competency to obtain research grants convincingly. The project leaders should manage the quality of the research projects to produce new and relevant knowledge but 95.4% of the participants (as opposed to 4.6%) did not think new knowledge resulting in practice application by consumers is occurring. The project leaders should be competent communicators, effective problem solvers, and masters of conflict resolution but 87.8% of participants (as opposed to 12.2%) questioned research leaders' communication skills, all the participants (100%) questioned leaders' problem-solving skills and 89.2% of participants (as opposed to 10.8%) questioned research leaders' ability to solve erupting conflict functionally.

In order to implement the research projects effectively, the research leaders at project level should manage the projects successfully with regard to proper budgeting and realistic timeframes for project completion but 100% of the participants were skeptical about leaders' performance to ensure adequate budgeting and completing research projects according to realistically productive timelines. With regard to managing possible risks that affect project progress negatively, 100% of the participants questioned leaders' competency to counter possible risks by assessing the possibility of risk factors in order to develop countering measures. Pursuing administrative leadership at project level, the project leaders should

incorporate consistent learning to prompt creativity and adaptability relying on their adaptive leadership capacity to be incorporated into the formal governance structure of the colleges. Almost all of the participants (99.9%) were skeptical about research leaders' competency to integrate adaptive leadership with administrative leadership for improved performance. In describing the practice of adaptive leadership at project level at Thgnstu University, the findings of the quantitative data regarding adaptive leadership at project level are presented next.

Adaptive leadership at project level

Table 6.22 provides the research findings based on the data collected relating to the items in Part III of the structured questionnaire about participant perception of the practice of adaptive leadership at project level at Thgnstu University (Appendix F).

Table 6.22: Agreement and disagreement of participants on matters pertaining to adaptive leadership at project level

Items				AdaL1	AdaL2	AdaL3	AdaL4	AdaL5	AdaL6	AdaL7	AdaL8	AdaL9	AdaL10	AdaL11
Participants having	Disagreement	1	N	12	28	25	11	14	32	4	25	36	27	26
			%	18.5	43.1	38.5	16.9	21.5	49.2	6.2	38.5	55.4	41.5	40.0
		2	N	33	10	15	37	30	15	26	24	11	27	12
			%	50.8	15.4	23.1	56.9	46.2	23.1	40.0	36.9	16.9	41.5	18.5
		3	N	14	27	25	17	15	12	14	10	18	5	21
			%	21.5	41.5	38.5	26.2	23.1	18.5	21.5	15.4	27.7	7.7	32.3
		Sub-total	N	**59**	**65**	**65**	**65**	**59**	**59**	**44**	**59**	**65**	**59**	**59**
			%	**90.8**	**100**	**100.1**	**100**	**90.8**	**90.8**	**67.7**	**90.8**	**100**	**90.7**	**90.8**
	Agreement	4	N	6	0	0	0	6	0	6	0	0	6	6
			%	9.2	0	0	0	9.2	0	9.2	0	0	9.2	9.2
		5	N	0	0	0	0	0	6	15	6	0	0	0
			%	0	0	0	0	0	9.2	23.1	9.2	0	0	0
		6	N	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0
		Sub-total	N	**6**	**0**	**0**	**0**	**6**	**6**	**21**	**6**	**0**	**6**	**6**
			%	**9.2**	**0**	**0**	**0**	**9.2**	**9.2**	**32.3**	**9.2**	**0**	**9.2**	**9.2**
	Total		N	65	65	65	65	65	65	65	65	65	65	65
			%	100	100	100	100	100	100	100	100	100	100	100

Keys:

AdaL1=The project leader is effective in research project leadership.

AdaL2=The project leader is effective in leading innovation projects to develop unique products and services for commercialization.

AdaL3=The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the local communities.

AdaL4=The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the country.

AdaL5=The project leader assigns difficult tasks and facilitates collaboration.

AdaL6=The project leader facilitates teamwork, and creates room for interaction and exchange of ideas.

AdaL7=The project leader builds research teams based on the competencies of the researchers.

AdaL8=The project leader focuses on action based on learning and creativity.

AdaL9=The project leader leads researchers to produce new knowledge to address the challenges of industry.

AdaL10=The project leader leads researchers to produce new knowledge to address the challenges of the local community.

AdaL11=The project leader leads researchers to produce new knowledge to address the challenges of the university itself.

As competent adaptive leaders, the project leaders should be effective in leading research and innovation projects to be aligned to specific purposes with the outcomes of the projects. In this regard, most of the participants (90.8%) (as opposed to 9.2%) questioned the effectiveness of the project leadership in promoting the results of the research projects for specific purposes, and all of the participants (100%) questioned the effectiveness of the projects leadership in ensuring that research endeavour is focused on solving local and national problems. To achieve the objectives of the research and innovation projects, the project leaders should build research teams based on their competencies, facilitate teamwork successfully, assign challenging and meaningful tasks and facilitate collaboration. Two thirds of the participants (67.7%) (as opposed to 32.3%) were skeptical about the competency of the project leaders in establishing competent research teams, and 90.8% (as opposed to 9.2%) questioned the ability of project leaders to facilitate teamwork successfully and assigning meaningful tasks that require collaborative efforts.

As research is the basis for innovation, the project leaders should lead the researchers to produce new knowledge in an innovative way to address the challenges of industry, the local community, and the University. All the participants (100%) questioned leadership's competency to manage research conduct to be aligned to the challenges of industry, 90.7% (as opposed to 9.3%) doubted research project leadership ensuring alignment with the problems of the local community, and 90.8% (as opposed to 9.2%) doubted management to ensure a focus on the University's own problems. To improve the research and innovation project leadership

at project level at Thgnstu University, the project leaders should take actions based on consistent learning to engender creativity for innovative research conduct but 90.8% of participants (as opposed to 9.2%) did not think that project leaders are able to encourage creative actions resulting in improved research conduct. By incorporating consistent learning to prompt creativity for integration with the formal governance research structure of the colleges, the project leaders should apply enabling leadership. The findings of the quantitative data regarding the practice of enabling leadership at project level at Thgnstu University are provided next.

Enabling leadership at project level

Table 6.23 presents the research findings based on the data collected using the items in Part III of the structured questionnaire about participant opinion of the practice of enabling leadership at project level at Thgnstu University (Appendix F).

Table 6.23: Agreement and disagreement of participants on matters pertaining to enabling leadership at project level

Items	Participants having																Total	
	Disagreement								Agreement									
	1		2		3		Sub-total		4		5		6		Sub-total			
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
EnL1	6	9.2	39	60.0	19	29.2	**64**	**98.4**	1	1.5	0	0	0	0	**1**	**1.5**	65	100
EnL2	36	55.4	10	15.4	3	4.6	**49**	**75.4**	16	24.6	0	0	0	0	**16**	**24.6**	65	100
EnL3	12	18.5	25	38.5	11	16.9	**48**	**73.9**	17	26.2	0	0	0	0	**17**	**26.2**	65	100
EnL4	28	43.1	19	29.2	12	18.5	**59**	**90.8**	6	9.2	0	0	0	0	**6**	**9.2**	65	100
EnL5	6	9.2	37	56.9	16	24.6	**59**	**90.7**	6	9.2	0	0	0	0	**6**	**9.2**	65	100
EnL6	20	30.8	15	23.1	23	35.4	**58**	**89.3**	7	10.8	0	0	0	0	**7**	**10.8**	65	100
EnL7	22	33.8	23	35.4	7	10.8	**52**	**80**	13	20.0	0	0	0	0	**13**	**20**	65	100
EnL8	22	33.8	13	20.0	13	20.0	**48**	**73.8**	16	24.6	1	1.5	0	0	**17**	**26.1**	65	100

Keys:

EnL1=The project leader is good at motivating his/her research team.

EnL2=The project leader is able to promote good quality research and innovation.

EnL3=The project leader encourages creative researchers.

EnL4=The project leader is effective in using ICT for research and innovation management.

EnL5=The project leader has the quality of a broker to create linkage between teaching, research, and innovation.

EnL6=The project leader is very good in team building.

EnL7=The project leader injects tension into his/her research team to come up with innovative ideas.

EnL8=The project leader is good at using the structure of the college to address challenges to research and innovation activities.

In exercising enabling leadership, the project leaders should create enabling conditions for research conduct and an environment conducive to inspiring research engagement to motivate and encourage researchers to sustained focus with their research activities. As evident from Table 6.23, almost all the participants (98.4%) (as opposed to 1.6%) denied leadership competency to motivate research teams for sustained performance, and 73.9% of participants (as opposed to 26.2%) questioned leadership's zest for encouraging research team members to be creative with their research endeavour pursuing innovative research outcomes. The project leader should be competent at team building, promoting quality research and innovation efforts, and encourage the application of information technology applicably with research and innovation activities but 89.3% of the participants (as opposed to 10.7%) questioned research leaders' competency to build successful research teams. Three quarters of the participants (75.4%) (as opposed to 24.6%) were skeptical about research leaders' ability to promote good quality research conduct, and 90.8% (as opposed to 9.2%) doubted research leadership's competency to utilise information technology applicably in managing the research and innovation projects for improved performance. The project leaders should have broker qualities to arrange for the interrelationship between tuition, research, and innovation transpiring in practically improved performance but 90.7% of participants (as opposed to 9.3%) did not believe that research leaders had such qualities to ensure a profound interrelationship between tuition, research and innovation for improved performance internally.

With problems that need innovative solutions, the project leaders should motivate researchers to engage zealously in the research projects to produce new and innovative ideas by ensuring that conducive conditions prevail for thorough research conduct. Most of the participants (80%) (as opposed to 20%) questioned research leaders' capacity to exercise enabling leadership relating to ensuring an environment convincingly conducive to research endeavour. To address the challenges with the leadership and management of research and innovation projects, the project leaders have to utilise the governance structure of the colleges convincingly but 73.8% of the participants (as opposed to 26.1%) were not satisfied with leadership's responses to the

challenges associated with research conduct by utilisling the administrative leadership of the colleges at Thgnstu University.

Competency of research leaders at project level to manage research and innovation - a critical interpretation

From a critical interpretation of the research findings on administrative, adaptive and enabling leadership with regard to research and innovation project management and leadership at project level at Thgnstu University, it was clear that there were competency shortcomings. The project leaders should be competent in managing the research and innovation projects to ensure convincing outcomes but more than 93% of participants agreed that the project leaders were not competent in project identification, project development, project implementation, and consistent monitoring and evaluation of the research and innovation projects to ensure good quality research outcomes. As competent adaptive leaders, the project leaders should be competent in leading the research and innovation projects to be aligned to the real and specific problems of industry, the local community, and the University. However, more than 90% of the participants believed that the project leaders had competency shortcomings in adaptive leadership. As skilled enabling leaders, the project leaders should motivate the researchers to be involved in the research projects in order to produce innovative ideas for the solving of context specific problems that require unique, creative and specific solutions but 80% of the participants were of the opinion that the project leaders were not competent in this kind of enabling leadership at project level at Thgnstu University.

As current research and innovation goals are not merely aimed at producing knowledge for the sake of knowledge only but also for functional application in pursuit of societal development, one of the aims of this study was to examine the significance of research contributions aligned to research and innovation goals to address the problems of the local community, the University, industry and the country. In this regard, the contributions of the research and innovation projects of Thgnstu University to societal development are presented next.

The contributions of the research and innovation projects at Thgnstu University

Table 6.24 provides the research findings on the data collected using the questions in Part IV of the structured questionnaire about the significance of contributions of the research and innovation projects at Thgnstu University (Appendix F).

Table 6.24: The contributions of the research and innovation projects of Thgnstu University

Items				Ct1	Ct2	Ct3	Ct4	Ct5	Ct6	Ct7	Ct8	Ct9	Ct	Ct	Ct	Ct
The contributions of the projects were	insignificant	1	N	25	27	11	9	11	26	21	23	21	14	13	8	4
			%	38.5	41.5	16.9	13.8	16.9	40.0	32.3	35.4	32.3	21.5	20.0	12.3	6.2
		2	N	13	7	14	27	17	17	8	18	15	10	16	11	21
			%	20.0	10.8	21.5	41.5	26.2	26.2	12.3	27.7	23.1	15.4	24.6	16.9	32.3
		3	N	16	21	34	18	24	8	32	23	24	35	18	11	23
			%	24.6	32.3	52.3	27.7	36.9	12.3	49.2	35.4	36.9	53.8	27.7	16.9	35.4
		Sub-total	N	**54**	**55**	**59**	**54**	**52**	**51**	**61**	**64**	**60**	**59**	**47**	**30**	**48**
			%	**83.1**	**84.6**	**90.7**	**83**	**80**	**78.5**	**93.8**	**98.5**	**92.3**	**90.7**	**72.3**	**46.1**	**73.9**
	significant	4	N	11	10	6	11	13	13	4	1	5	2	18	18	17
			%	16.9	15.4	9.2	16.9	20.0	20.0	6.2	1.5	7.7	3.1	27.7	27.7	26.2
		5	N	0	0	0	0	0	1	0	0	0	4	0	17	0
			%	0	0	0	0	0	1.5	0	0	0	6.2	0	26.2	0
		6	N	0	0	0	0	0	0	0	0	0	0	0	0	0
			%	0	0	0	0	0	0	0	0	0	0	0	0	0
		Sub-total	N	**11**	**10**	**6**	**11**	**13**	**14**	**4**	**1**	**5**	**6**	**18**	**35**	**17**
			%	**16.9**	**15.4**	**9.2**	**16.9**	**20**	**21.5**	**6.2**	**1.5**	**7.7**	**9.3**	**27.7**	**53.9**	**26.2**
	Total		N	65	65	65	65	65	65	65	65	65	65	65	65	65
			%	100	100	100	100	100	100	100	100	100	100	100	100	100

Keys:

1=no contribution, 2=very low contribution, 3=low contribution, 4=average contribution, 5=high contribution or 6=very high contribution

Ct=Contribution

Ct1=To what extent do you feel that the research projects you have engaged in so far have contributed to address the problems of the local community?

Ct2=To what extent do you feel that the innovation projects you have engaged in so far have contributed to solve the problems of the local community?

Ct3=To what extent do you feel that the research projects you have engaged in so far have contributed to address the university's own internal problems?

Ct4=To what extent do you feel that the innovation projects you have engaged in so far have contributed to address the university's own internal problems?

Ct5=To what extent do you feel that the research projects you have engaged in have contributed to fill the knowledge or technology needs of the country?

Ct6=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the technological advancement of the country?

Ct7=To what extent do you feel that the research projects you have engaged in so far have contributed to the knowledge –based economy of the country?

Ct8=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the knowledge-based economy of the country?

Ct9=To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the university?
Ct10=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the university?
Ct11=To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the industry?
Ct12= To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the nation at large?
Ct13= To what extent do you feel that the innovation projects of your team have contributed to the human capital development of the nation at large?

The research and innovation projects should be led to contribute relevant knowledge and technology to address the problems of the local community and the University's own problems. While most of the participants (83.1%) indicated that the contributions of the research projects to solve the problems of the local community were insignificant and only 16.9% regarded them as significant, most participants (90.7%) indicated that the contributions of the research projects to solve the University's own problems were insignificant while 9.3% claimed the contributions to be significant. Most of the participants (84.6%) opined that the contributions of the innovation projects to solve the problems of the local community were insignificant and 15.4% said the contributions were significant. Most participants (83%) indicated that the contributions of the innovation projects to solve the University's own problems were insignificant while the minority (16.9%) of participants indicated the contributions to be significant.

The research and innovation projects should contribute by addressing knowledge and technology inadequacies of the country, and to become sources prompting the development of a knowledge-based dispensation. Among the participants, 80% believed the contributions of the research projects not to be positive in addressing the shortcomings of relevant knowledge and technology for the country while 20% regarded the contributions as significant. 93.8% of participants opined that the contributions of the research projects to act as sources prompting the development of a knowledge-based society were insignificant while 6.2% of participants were satisfied with research conduct contributions to enhance a knowledge-based dispensation. With regard to the contributions of the research and innovation projects to address the knowledge and technology shortcomings internally and externally encountered, more than three quarters of the participants (78.5%) indicated that the contributions were insignificant while 21.5% of participants were satisfied with the contributions to address either internal or external demands.

The research and innovation projects should contribute to competent human capital for employment at University, at industry and in other occupations nationwide. 92.3% of participants were not convinced of the contributions of the research projects for employment at the University while 7.7% of participants experienced the training at university level as satisfactorily for constructive employment at university. Regarding the contributions of the research projects to arrange for adequate human capital development for the country, 46.1% of the participants were skeptical about these contributions with 53.9% of participants rating the contributions as successful. The contributions of the research and innovation projects to solve industry-related problems were encountered as insignificant by 72.3% of the participants with only 27.7% of participants believing that university graduated labour force members are well prepared for industry employment.

To examine the selected research sites' performances with regard to contributions of their research and innovation projects culminating into meaningful research outcomes by means of a checklist approach including indicators based on the research sites' annual performance reports for the period 2012/13-2016/17 (Appendix H), no data was available for Thgnstu University. It was, therefore, not possible to assess, based on the indicators included in the checklist (Appendix H) what Thgnstu University's performance was regarding the number of research projects completed, the number of new technology developments and transfers applied, the number of articles published in peer-reviewed journals, and the number of master's and doctoral students graduated. It was orally conveyed, however, that the number of research outputs appearing in the vernacular language and distributed to the local communities represented three articles (reports) for the 2015/16 academic year and two articles (reports) for the 2016/17 academic year.

In order to understand the performance of the leadership and management of research and innovation policy and practice at Thgnstu University comprehensively as this performance relate to administrative, adaptive and enabling leadership practiced at university, college and project level, an integrated discussion on qualitative and quantitative research findings are discussed next.

6.3.4 An integrated interpretation of the results of the qualitative and the quantitative data

The research leaders at Thgnstu University should use administrative leadership to manage the research and technology transfer policy formulation and implementation of the University in line with the national higher education research and technology transfer framework, and national STI policy. However, the results of the analysis of the three policy documents revealed that the research and technology transfer policy of Thgnstu University was not formulated in line with the two national policy documents though there were some similarities in terms of a vision, mission, objectives, priority areas, and research and innovation leadership and management prescriptions. The results of the qualitative data from the semi-structured individual interviewing showed, however, that the research and technology transfer policy of the University was developed in line with the two national policies. The results from the quantitative data depicted that two-thirds of the participants (67.7%) agreed while one-third of them (32.2%) disagreed on the development of the research and technology transfer policy of the University in line with the two national policies.

The research leaders at college level should manage the research and innovation activities of the colleges in line with the University research and technology transfer policy. In this regard, the results of the quantitative data showed that 47.7% of the participants disagreed while 52.3% agreed on research management of the colleges in relation to the University research activities, and 86.2% of them disagreed and 13.8% agreed on the innovation management of the colleges to be aligned to the University innovation activities. In contrast, the results of the qualitative data revealed that the research leaders managed the research and innovation activities of the colleges as per the University research and technology transfer policy.

In order to translate the research and technology transfer policy of Thgnstu University into practice, the research leaders at different levels of the University should be skilled at research and innovation project management. However, the results of the quantitative data showed that most of the participants (95.4%) questioned the research project management and 90.8% the innovation project management at university level. Also 86.1% of participants questioned research leaders' capacity for research project management and 100% participants mistrusted research leaders' abilities to manage innovation with research conduct at college level. Most of the participants (93.9%) questioned research leaders' competency of research project management at project level and 99.9% of participants had misgivings on the innovation project management competency of the project leaders at project level. The results of the qualitative data also depicted that the leaders at university, college, and project level had

shortcomings in managing the research and innovation projects to be aligned to the real problems of the local community, industry and the country.

Exercising adaptive leadership, the research and innovation leaders of Thgnstu University should lead the research and innovation projects to be aligned to the specific and real problems of the local community, the University and the country, to seek practical solutions by producing relevant knowledge and adapting or developing appropriate technology. However, the results of the quantitative data indicated that more than three quarters of the participants (76%) questioned the adaptive leadership capabilities of research leaders to ensure that the real problems of the local community, the University, industry and the country are addressed. The results of the qualitative data also showed that the research and innovation projects were not managed to be aligned to the real problems of the local community, the University and the country. The qualitative data collected from the community leaders and industry managers around the University indicated that there were specific problems related to addressing waste management, unemployment, small scale enterprises' needs, skilled and trained work force inadequacies, and productivity challenges that were not addressed by the research and innovation projects of Thgnstu University.

As adaptive leaders, the leaders of the colleges should focus on specific problems of colleges, the local community and the country, and produce practical knowledge and develop the right technology to address the identified real problems. In this regard, most of the participants (95.3%) questioned leadership competency to arrange for the solving of colleges' internal problems, 86.1% participants questioned the ability of adaptive leadership to respond to the needs of the local community, and 73.8% of participants had misgivings about adaptive leadership's capacity to align research endeavour with socio-economic problems encountered nationwide. The results of the qualitative data revealed that there were no valuable contributions of the research and innovation projects of the University to address the real problems of the local community, industry and the country except providing need-based training for schools, enterprises, and industries.

To address the shortcomings and improve the research and innovation leadership practice of the University, the leaders should engage in consistent and continuous learning to prompt creativity in order to engender meaningful research outcomes but 73.8% of participants were skeptical about the innovative actions of the research leaders. The results of the qualitative data

confirmed that a culture of learning, creativity, and adaptability was not developed with the research and innovation practice at Thgnstu University. To adjust the research and innovation leadership practice of the University for improved performance, the research leaders should constantly accommodate emerging ideas but 81.5% of the participants questioned leadership's attempts to incorporate new ideas for change and improvement of the research and innovation leadership of the University. The qualitative data revealed that the University research leadership practice was being changed from small-scale basic research to interdisciplinary applied mega thematic research based on the demands from government and industry. Research leaders were not involved in decisions about this move from small scale basic research to mega applied thematic research conducted by means of interdisciplinary endeavour. In order to ensure the research and innovation projects of the colleges are productive, the leaders at college level should facilitate dynamic interactions among the stakeholders of the projects so that significant ideas might emerge to adjust the research and innovation practices of the colleges for improve performance but 98.5% of the participants questioned the competency of the leaders in facilitating this change.

In order to ensure quality outcomes from the research and innovation projects, the research leaders should facilitate conditions that are conducive for research conduct using enabling leadership to convince researchers to sustained research endeavour. To facilitate the interactions among key stakeholders of the research and innovation projects of the University, the research leaders should establish a functional innovation system but 73.9% of participants were not convinced that such a system is operational at Thgnstu University. The results from the qualitative data confirmed that an innovation system was established but not properly functional.

The leaders at college level should have functional networks with stakeholders who can benefit from the research and innovation projects of the colleges but the majority of the participants (86.1%) questioned the existence of such functional networks. The results of the qualitative data confirmed that the research leaders have not established functional networks with applicable stakeholders. One of the key conditions for the successful implementation of research and innovation projects is the allocation of sufficient budgeting. In this regard, the results of the qualitative data revealed that there were no serious problems encountered with budgeting for the research projects. However, the results of the quantitative data disclosed that more than half of the participants (58.4%) questioned the adequacy of budgeting for the

research projects, and 73.8% of participants had misgivings about adequate budgeting for research conduct focused on innovation endeavours at Thgnstu University.

Comprehensively considered, the main goal with research and innovation leadership and management at project, college and university level at Thgnstu University is to contribute with new knowledge, appropriate technology, and competent human capital to address the problems of the local community, the University, industry and the country. In this regard, the results from the qualitative data revealed that there were no valuable contributions from the research and innovation projects to address these problems. The results of the quantitative data regarding contributions of the research projects to address the problems of the local community, industry and the University in order to contribute to the development of a knowledge-based dispensation were found to be insignificant as indicated by more than three quarters of the participants (75%). The contributions of the research and innovation projects to the human capital development of the University, industry and the country were not significant as indicated by 72.3% of the participants. However, more than half of the participants (53.9%) indicated that the contributions of the research projects to the human capital development of the country were satisfactorily as is evident from Table 6.24.

6.4 SUMMARY

The research and innovation policies of the two higher education institutions representing third generation universities should be formulated and implemented in line with the national higher education research and technology transfer framework, and the national STI policy. The results of the document analysis revealed that Thgnu University had a research and development guidelines document while Thgnstu University had a research and technology transfer policy. However, it was found that there were close similarities between the Thgnstu University research and technology transfer policy document and the national STI policy, and also similarities between the Thgnu University research and development guidelines document and the two national policy documents with regard to priority area stipulations.

To translate the research and technology transfer policy and research and development guidelines of the Thgnstu and Thgnu Universities respectively, research conduct should be steered by effective research and innovation project leadership and management at project, college, and university level. However, the results of both the qualitative and quantitative data

showed that there were shortcomings with regard to the management and leadership of research and innovation projects at the selected higher education institutions, especially with regard to identifying real problems for the projects to be aligned to specific and real problems of the local community, the University, industry and the country. The research leaders of the two universities should facilitate enabling conditions, and one of the key conditions is allocating sufficient budgeting for the research and innovation projects. However, the results of both the qualitative and quantitative data showed that there was a shortage of enough money for the research and innovation projects at Thgnu University while the research budget at Thgnstu University was adequately arranged. In order to ensure adequate human, material, and financial resources for the research projects, the research leaders of both universities should establish a functional innovation system. The results of both the qualitative and the quantitative data depicted that a structure for an innovation system existed, but it was not properly managed to functional utilisation.

Comprehensively considered, the goals of the research and innovation projects of both Thgnu and Thgnstu University related to contributing with practical and relevant knowledge to address internal and external problems, and to adopt or develop the right kind of technology for application with responding to internal and external demand in pursuit of contributing to the development of a knowledge-based dispensation. However, the results of both the qualitative and quantitative data showed that no significant contributions emerged from research project engagement at the two research sites. There were, however, some successful initiatives to adapt and transfer some improved seeds and crops to the farmers, sustaining good quality roads by using red ash, and identifying mediating plants to reduce water pollution by industries based on research conducted at Thgnu University.

CHAPTER 7
CROSS CASE ANALYSIS AMONG THE FOUR UNIVERSITIES - A CRITICAL COMBINING OF QUALITATIVE AND QUANTITATIVE RESEARCH FINDINGS

7.1 INTRODUCTION

In order to translate the Science, Technology and Innovation (STI) policy, and the framework for higher education research and technology transfer document into the research and innovation policies of the higher education institutions in Ethiopia, the policy and research planning experts at the Ministry of Science and Technology (MoST), and the higher education academic and research managers at the Ministry of Education (MoE) should introduce the two national policies to the higher education institutions. The two ministries should ascertain if the vision, mission, objectives and priority areas, the research and innovation management and leadership of the research and innovation policies and the actual practice at universities across the different university generations are in line with the two national policy documents. In doing so, the two ministries should determine whether each university has developed a research and innovation policy in line with the two national policies; whether there is research project identification, whether the development and implementation of research projects are aligned to the real shortcomings and needs of the local community, each university, industry and the national development agenda. The two ministries should also ascertain that there is no duplication of efforts by conducting the same research project in different universities, and confirm the quality of the research and innovation projects to address real local, institutional and national problems.

As the first-, second- and third-generation universities are mandated to conduct research, to transfer relevant knowledge and the right technology to address real problems of the local community, the university, industry and the country, the differences and similarities of the results of the qualitative and quantitative data were compared in terms of research and innovation policy formulation and the actual practices across the four universities.

The discussions in this chapter relate the results of the empirical investigation to the theoretical framework and the results of the literature review. This is achieved with a cross case analysis among the four universities.

7.2 CROSS CASE ANALYSIS ACROSS THE FOUR UNIVERSITIES

In analysing the cross case analysis among the four universities, the results of the qualitative data at national level were synthesised with the results of both the qualitative and quantitative data across the four universities followed by the findings of the quantitative data among the universities to explain the mean differences at administrative, adaptive and enabling leadership level. In order to understand the roles of the two ministries in managing and facilitating the formulation and implementation of the research and innovation policy at each university in line with the two national policy documents, one participant from each ministry was interviewed. To make the verbatim excerpts from the semi-structured individual interviews at the two ministries anonymous and confidential and the interpretations meaningful, the labels PRPD for Policy, Research and Planning Director at Ministry of Science and Technology (MoST) and HEARD for Higher Education Academic and Research Director at Ministry of Education (MoE) are used.

MoST is responsible for facilitating the formulation of STI policy in line with African and global experiences. The policy and research planning expert was asked if the national STI policy of Ethiopia was in line with the STI policies of the African continent and the world. The expert described that "*the national STI policy of Ethiopia was formulated based on 20 countries experiences, and among these countries, seven countries were chosen that have similar experiences with Ethiopian real context. They are Singapore, China, South Korea, Malaysia, German, South Africa, Kenya and Egypt"* (PRPD). At national level, MoST is responsible and is a head to facilitate not only the formulation of the STI policy in line with continental and global experiences but also to assist with the formulation and implementation of sectorial policies, especially at higher education institutions related to research and innovation policies in line with the national STI policy. In this regard, the expert disclosed the shortcomings at different levels of governance and the effort exerted to address the shortcomings. The expert explained:

> "*The researchers, the institutions and everybody talk about research but there is no organised research, and there is no master plan on how to do research and transfer to the community and how the researchers can be benefited from their research. We have organised national research and innovation council, but it is working only funding five million Birr. We have big weakness is translating the STI policy into*

higher education, other sectors and industries research and innovation policies" (PRPD).

In this regard, MoE is also responsible for translating the national STI policy into its research and innovation transfer framework, and into research and innovation policies of the higher education institutions in the country. The higher education academic and research manager at MoE was asked how the Ministry facilitated the translation of the national STI policy to the Ministry research and technology transfer framework and into the research and innovation policies of the universities across the country. The manager conceptualised policy at different levels and what the Ministry did and what each university should do as directed by the national policies. The manager described:

> "The *government policy is simply the reflection of the commitment of the ruling party to the social, economic and political issues. However, when we consider the policy at ministry level, operational policy exists at any level so that higher education institutions can formulate their own policies based on national STI policy as well as education and training policy. Therefore, we tried to produce directives, especially for research and technology transfer, for university-industry linkage and community engagement. For the purpose of implementation, details and clear directions with clear procedures are very important and the institutions have the capacity and the mandate to develop operational guidelines as per the national directives*" (HEARD).

However, the results of the qualitative data from the policy documents analyses revealed that the four universities had different policy documents that were not formulated consistently in line with the national STI policy and the higher education research and technology transfer framework. As a result, Segnu University had 'research policy and guidelines'; Fignu University had 'research thematic areas', Thgnu University had 'research and development guidelines' and Thgnstu University had a 'research and technology transfer policy'. While the policy document of Fignu and Thgnstu Universities had a vision, mission and objectives, the policy documents of Segnu and Thgnu universities did not have vision and mission statements but Segnu University had objectives formulated.

To translate the national STI policy into practice, MoST should prioritise areas to be accomplished first. According to expert PRPD, the priority areas of MoST were determined in

line with the development agenda of the country. PRPD described the focus of the priority area, justified the reason for choosing the area, questioned the capacity of different institutions to produce relevant knowledge and to develop the right technology, and listed the specific priority areas of MoST. PRPD explained:

> "*The first is transferring effective foreign technologies important for development and reduces poverty as there is no self-sufficient country in technology. Which university is ready for technology development? Which research institute is producing new knowledge and developing new technologies? MoST has nine priority areas like textile, leather, meat and milk, biotechnology, sugar, and cement*" (PRPD).

Although technology transfer was one of the priority areas of the national STI policy, it was found that the priority areas of MoST and the priority areas of the national STI policy were different but the focus of the STI policy was on manufacturing and service-providing enterprises. It was found that the framework for higher education research and technology transfer did not have priority areas. In this regard, the higher education academic and research manager HEARD at MoE described the priority areas as the integration and application of education, research and technology development. HEARD explained:

> "*Without higher education, we cannot talk about science and technology. Science is knowledge generation that can be linked to how to solve the problem of the community, and the problem of the society. The knowledge produced through research should be developed to technology, as technology is problem solving, technology is for production and productivity in industries, and technology is for service delivery that comes through education and training by preparing competent human resources. Therefore, we can easily understand that science and technology cannot exist without education and training*" (HEARD).

While the research policy documents of the four universities and the national STI policy focused on adaptation of foreign technology, the framework for higher education research and technology transfer emphasised both research and technology transfer. It was found that the two national policy documents, Thgnu University's research, and development guidelines accommodated indigenous knowledge and technology application.

To translate the national STI policy with reference to its priority areas, there should be a well-established and functional national innovation system that comprises different stakeholders including higher education institutions. In this regard, the expert PRPD at MoST described the misconception regarding the innovation system, the components and the practicality of the system. PRPD stated:

> "*People mix innovation with innovation system. At national level, we have the structure and the skeleton. We have STI council that leads the system by top leadership and MoST and related ministries are executing. The members are financial institutions, universities, science and technology parks, Science, Technology and Innovation Centres, Technical Vocational Education Training, medium and small-scale enterprises, national IP system and national quality controlling system basing the culture of the people and quality general education with expected outcomes of quality product, quality service, market penetration and higher productivity. The national innovation system was established and to some extent, it is functional*" (PRPD).

Along the same lines, the higher education academic and research manager, HEARD, at MoE reacted:

> "*It is very difficult to say national innovation system, but it is a council that is chaired by deputy prime ministry, MoST is a secretory, and MoE, Ministry of Agriculture, Ministry of Finance and others ministries are members. This council oversees how STI policy is really practising in the country in regular bases. So, I think there is initiation, there is somehow established and through time it is possible to strengthen and to create innovation system*" (HEARD).

However, like the national STI policy that gave emphasis to the national innovation system, the research and innovation policy documents of the four universities did not discuss the innovation systems of the universities. The results of the qualitative data from the four universities also showed that the innovation systems of the universities were not properly established and functional. Segnu University tried to liaise with industry although there was no established and functional innovation system. At Fignu University, there was an innovation

structure, but it was not well established and functional. At Thgnu University, there was a weak innovation structure. At Thgnstu University, an innovation system was established but not functional. The findings of the quantitative data showed that the participants were of the opinion that there was not an established and functional innovation system at Segnu University (65.6%), at Fignu University (93%), at Thgnu University (89.6%) and at Thgnstu University (98.4%). While 34.1% of the participants of Segnu University agreed on the establishment of a working innovation system at the University, the results of the qualitative data at Segnu University revealed that there was not an innovation system.

To implement the priority areas of the national STI policy, especially with regard to higher education institutions, there should be effective research and innovation leadership and management. The results of the research policy document analysis from the four universities showed that the research management focused on the research processes pertaining to calls for proposals, proposal selection, and funding of the successful proposals. Monitoring the implementation and evaluation of research conduct were included in the policy documents of the selected universities except for Segnu University. With regard to funding, an innovative research fund was included in Thgnu University's research and development guidelines as suggested by the framework for higher education research and technology transfer whereas the other three universities focused on internal research grants. At Thgnstu University, the responsibility was delegated to both the researchers and the University to obtain external research grants.

The national STI policy focused on competitive research grants and incentive mechanisms, and the higher education research and technology transfer framework advised that the higher education institutions had to secure their research and technology transfer funds from different sources in addition to government allocations. While the research policy document of Segnu University accommodated partnership with different stakeholders, the other three universities did not include in their policy documents the possibility of establishing partnerships for research project functioning. Attention was not given to research leadership at the four universities except creating an environment that was conducive for cooperation and skill development of the academic researchers as described in the research and technology transfer policy of Thgnstu University. Innovation leadership and management was not emphasised in the research policy documents of the four universities, but the higher education research and technology transfer framework document advised that higher education institutions had to use result-based professional research management and scientific leadership.

In order to translate the research and innovation policies, and thematic areas or guidelines of the universities into practice, the research and innovation leaders of the four higher education institutions should be competent at administrative, adaptive and enabling leadership at university, college and project level. Using administrative leadership, the research and innovation leaders of the universities at university level have to facilitate the formulation of the research and innovation policy of their universities in line with the national STI policy and the framework for higher education research and technology transfer. The results of the qualitative data across the four universities revealed that the leaders at university level developed the research policy documents in line with the national STI policy and the higher education research and technology transfer framework. However, the research policy and guidelines of Segnu University were formulated before the formulation of the STI policy and the framework for higher education research and technology transfer.

In this regard, 74.7% of the participants of Segnu University, 77.1% of Fignu University, 58.4% of Thgnu University and 67.7% of Thgnstu University were of the opinion that the formulation of the universities' research policies was not in line with the two national policies. The results of the qualitative data from the four universities also revealed that the priority areas of the universities were set in line with national priorities though the results of the document analysis revealed that there were no priority areas or thematic areas listed in the research and technology transfer policy document of Thgnstu University. The results of the quantitative data depicted, however, that the participants were of the opinion that the priority areas of Segnu University (64%), Fignu University (72.3%), Thgnu University (45.9%) and Thgnstu University (55.4%) were aligned to the priority areas of the national related policies but 36%, 27.7%, 54% and 44.6% of participants from Segnu University, from Fignu University, from Thgnu University, and from Thgnstu University respectively disagreed about developing the priority areas of the universities in line with the priority areas of the national related policy documents.

Translating the national policies and priority areas of the universities into practice, the leaders at MoST and MoE should fulfill their part in project identification, project development, project implementation, and monitoring and evaluating the research conduct transpiring into research outcomes with each research project, especially regarding alignment with the national development problems. Expert PRPD at MoST and the manager, HEARD, at MoE were asked

how they managed the research project identification, planning, implementation and the application of the research outcomes. PERP stated that "*there are calls for proposals, and the best proposal will be awarded around five million Birr on competitive base at national level"* (PRPD). HEARD stated:

> "*We are trying to coordinate research and development activities, teaching-learning process and the community engagement rendered by the higher education institutions. In the case of research activity, we just try to follow-up the institutions including the private ones. We advise and try to coordinate to do problem solving research. In so doing, they have to identify thematic areas that can address the problems of the community related to health, education and agriculture; and the problems of industry to improve productivity. Because we do not have the directorate for research and community engagement, we are facing serious problem and we are not supporting the institutions. Concerning the budget, the public universities are expected to use at least 5% of their allocated annual budget for research and community engagement though the practice showed on average 2.6 % nationally. In higher education research, female teachers are also expected to involve and carry out the research activities but it is not up to our expectation so far*" (HEARD).

Implementing the priority areas and achieving the research and innovation objectives of the projects of the universities, the research and innovation leaders at university level of each university should be skilled at research and innovation project management. The results of the quantitative data from the four universities showed that the participants of Segnu University (82.7% & 86.7%), Fignu University (78.8% & 84.1%), Thgnu University (95.9% & 95.9%) and Thgnstu University (95.4% & 90.8%) questioned research leadership's capacity at university level respectively with regard to managing and leading research conduct and with regard to encouraging innovative endeavour with research conduct. The results of the qualitative data of the four universities also revealed that the leaders at university level did not manage research project identification in line with the real problems of the local community, the universities' own internal problems and the problems of industry and the country.

The research and innovation leaders at MoST and MoE level should also manage the STI policy and the research and technology transfer framework for higher education to be planned and implemented at the higher education institutions in line with their specific contexts to address

local socio-economic problems, the problems of higher education institutions and the national development agenda of the country. In this regard, expert PRPD confessed the management shortcomings at MoST. PRPD described, "*This is our main problem in managing the research projects and collecting the results though we are working on how to import, use and dispose technologies*" (PRPD). According to the manager HEARD at MoE:

> "*Because of the shortage of academic staffs as they are very loaded in teaching, they have time constraint to carry out the research activities. However, at first generation universities, there are research staffs that are expected to conduct research either 100% or 75% of their time while other academic staffs of all universities should engage in research and community engagement 25% of their time and 75% for teaching. This is the idea that we have but the objective reality in each university cannot allow academic staffs to contribute in research activity. In near future, everyone could have the possibility to conduct research by reducing teaching load like nine or eight or seven lecture hour per week. Then the remaining time can be allocated for research*" (HEARD).

As adaptive leaders, the research leaders of the four universities should lead the research and innovation projects of the universities as per the specific needs, shortcomings and problems of the local communities, the universities, industry and the country at large. However, the results of the quantitative data depicted that nearly three quarters of participants at Segnu University (72%), more than two-thirds of participants at Fignu University (69.5%), 89% of participants at Thgnu University and more than three quarters of participants (76.9%) at Thgnstu University questioned the competency of their research leaders to ensure that research and innovation projects are aligned to the specific needs of their stakeholders. To address the real problems of the stakeholders, the research leaders should choose the right type of research to produce practical and relevant knowledge, and to adapt and develop the right kind of technology in liaison with the indigenous context, or the global context or as directed by the research goals of the specific research project. In this regard, the results of the qualitative data showed that the four universities still conduct basic research but are moving to applied interdisciplinary mega thematic research to solve societal problems. In this regard, the results of the quantitative data showed that the participants of Segnu University (73.3% & 68%), Fignu University (77.1% & 64.7%), Thgnu University (77% & 93.8%) and Thgnstu University (81.6% & 60%) opined that research leaders respectively choose to undertake discipline-based basic research,

or to undertake interdisciplinary applied research within the specific context for practical application to solve real problems encountered internally or externally.

One of the main goals of research and innovation activities in higher education institutions was to contribute relevant knowledge and technology to address the problems of the local community, the university's own internal problems, the problems of industry and the problems of the country in moving to a knowledge-based dispensation. However, the results of the quantitative and the qualitative data showed that there were no significant and valuable contributions for the aforementioned parties except, with regard to Fignu University, improving some crop productivity, adaptation of good seed varieties and transfer to many farmers by the College of Agriculture, and reducing neonatal deaths and preventing waterborne diseases. The results of the qualitative data from the semi-structured individual interviewing also showed that Segnu and Thgnu universities had made efforts to adapt and transfer different crop and vegetable varieties to the farmers and there were efforts to improve road quality using red ash at Thgnstu University. Regarding the contributions of the research and innovation projects of the universities, expert PRPD at MoST described the contributions of different research centres that overpowered the contributions of the universities. PRPD described:

> "*We have established research institute for industries, for agriculture and for health at national level. Regarding health issues, digitalize patient record keeping is started so that each hospital can access the record of any patient from different hospitals. Regarding agriculture, to support the traditional agricultural practice, we designed ploughing material (Maresha). To support the education system, labs at high schools and universities, we have developed softer ware for virtual labs and started in some high schools. We have developed aircraft for spraying different pesticides. The big contribution is establishing system in regions, in research centres and universities*" (PRPD).

With regard to the contributions of the research and innovation projects of the universities, according to the manager HEARD at MoE almost two thirds of the number of research outputs delivered at higher education institutions are focused on practical application for societal development:

> "*From the data we collected from the reports, overall, around 420 research outputs, from those 290 are effective and the others are put on shelf. This is the information we have but we did not check whether it is true or not*" (HEARD).

In ensuring the research and innovation projects contribute with relevant knowledge and applicable technology, the research leaders should pursue continuous learning engendering creativity and innovation for adaption in their research and innovation leadership practice to be integrated with the administrative leadership structure of the higher education institution. However, 67.6% of the participants at Segnu University, 88.2% at Fignu University, 87.5% at Thgnu University and 73.8% at Thgnstu University believed the leaders were not competent in continuous learning to prompt creativity for adaption by the higher education institution's governance structure. 32.4% of participants at Segnu University and 26.2% of participants at Thgnstu University agreed that their research leaders were practising research and innovation leadership as a process to be monitored consistently. However, the results of the qualitative data revealed that a culture of learning, creativity and adaptability were not well developed with regard to the research and innovation leadership practices of the four universities. The results of the qualitative data of the four universities disclosed that the research leadership practices were moving from small-scale basic research to interdisciplinary thematic mega research due to the pressure from government resulting in an approach of adopting interdisciplinary research conduct know-how from first-generation universities. The results of the quantitative data showed that more than three quarters of the participants of the four universities (76%) perceived the leaders at university level not to be accommodating emerging ideas from the interactions within and outside the universities to adjust their research leadership practices.

As enabling leaders, the research leaders of the four universities should create enabling conditions for researchers to engage passionately with their research endeavours. Consequently, the leaders can facilitate interactions among education, research and innovation working with their key stakeholders and beneficiaries so that they can counter constraints collaboratively relating to human resources, finance, knowledge and technology. However, the results of the quantitative data disclosed that the participants of Segnu (60%), Fignu (90%), Thgnu (93.8%) and Thgnstu (98.4%) universities questioned the competency of their research leaders to arrange for the interconnecting of the three pillars of knowledge, namely education, research and innovation. The other key enabling conditions for research endeavour is the

availability of adequate budgeting and the arranging of realistic timelines for research and innovation projects to be managed and carried out successfully. In this regard, the results of the quantitative data showed that the participants of Segnu University (87.8% & 89%), Fignu University (83.5% & 85.3%), Thgnu University (95.8% & 95.9%) and Thgnstu University (58.4% & 73.8%) had misgivings on leadership's ability to ensure adequate budgeting and realistic timelines for research and innovation project implementation and completion respectively. The results of the qualitative data revealed that there was a shortage of budgeting to undertake good quality research conduct and to implement the research outcomes, however, a shortage of funds was not experienced at Thgnstu University.

The results of the quantitative data from document analysis considering the annual performance reports of the selected universities for the five-year period 2012 to 2017 depicted that Fignu University allocated the best budget share for research and community engagement (from 2.7% in 2012 to 5.9% in 2017). The framework for higher education research and technology transfer suggested at least 5% from the total annual budget for research. Thgnstu University allocated the least followed by Segnu University, with Thgnu University faring well compared to the other universities insofar as having a consistent increment (from 1.5% in 2012 to 4.3% in 2017) and steadily approaching the prescribed level of 5% of the total budget allocation per annum. The results of the qualitative data from the semi-structured individual interviews revealed that the research sites were found engaging in the same researcg projects such as waste management. This was a duplication of efforts and a waste of public money. In this regard, the interviewees at MoST and MoE were asked how they managed the resources of the research and innovation projects (human, material and financial) at national level. Their answers relate to admitting that albeit efforts are implemented to control research conduct, it is difficult to avoid duplication:

> "*One is managing the human resources and to do so, the two science and technology universities are expected to prepare at master and PhD levels for research and innovation. The second is assessing the number of researchers and their contributions yearly. Third, regarding research and development expenditure, now at national level, we reached 0.61%. The East African benchmark is 1% of GDP so we are challenging the government to allocate this budget. The other is searching special talent students and teaching them separately, we are building special school for them. The other is sending some human resource abroad for education and*

bringing back to get the required skilled and knowledgeable in different areas" (PRPD).

"*There are no mechanisms to manage and control unnecessary duplication of efforts and finance expenditure nationally. Even this is our willing and effort to begin thematic research areas to address the community problems though the thematic areas identified and planned to carry out are not thematic areas that can address community or national problems. The thematic areas identification in the universities is not as such strong, and understanding and solving the community problem is not an easily task. Therefore, some researches are taken place in the same theme in different places but somehow because of the involvement of the academic staffs in those researches rather than not doing research. We accept for the time being but this not our direction in the future, as we have outstanding problems supposed to be solved. In general, there are no as such clear mechanisms to control those issues across the universities*" (HEARD).

To make research and innovation leadership and management effective, administrative, adaptive and enabling leadership should also be practised at college level. In order to understand research leadership at college level, the results of the quantitative and qualitative data were compared across the four universities.

As administrative leaders, to translate the priority areas of the universities into action, the research leaders at college level should cascade their own research initiatives. In this regard, the results of the qualitative data showed that the colleges at Segnu and Fignu University did not have their own priority areas; rather they took their share from the priority areas from their respective universities. The colleges at Thgnu and Thgnstu University did not set priority areas as it was found that priority areas of MoST were the priority areas of these two universities. The results of the quantitative data illustrated that the participants of Segnu University (74.7% & 69.3%), Fignu University (61.8% & 55.2%), Thgnu University (68.8% & 62.5%) and Thgnstu University (47.7% & 86.2%) were sceptical about their research leaders respectively managing research activities and managing innovation activities at college level to be aligned to the priority areas of their respective universities. To manage the research and innovation activities of the colleges effectively, the leaders of the colleges at the four universities should be competent at research and innovation project management. The results of the quantitative

data of the four universities showed that the participants of Segnu University (62.7% & 79.7%), Fignu University (76.4% & 97.6%), Thgnu University (91.7% & 93.7%) and Thgnstu University (86.1% & 100%) had misgivings about the competencies of their research leaders at college level to manage research and to manage innovation with their research projects respectively. The results of the qualitative data confirmed that the research leaders at college level had capacity shortcomings with regard to the management and leadership of research and the management and leadership of innovation with the research projects across the universities.

As skilled adaptive leaders, the research leaders should lead the research and innovation activities of the colleges to be aligned to their own tuition problems, the problems of the local community, industry, and the country. The results of the quantitative data showed that more than three quarters of the participants of Segnu University (80%), Fignu University (78.5%), and Thgnu University (85.5%) and nearly three quarters of participants at Thgnstu University (73.8%) were skeptical about their research leaders' ability to employ adaptive leadership in order to respond to the needs of the specific context pertaining to real problems of the colleges, the local community, industry and the country. The results of the qualitative data confirmed that the research leaders did not have any research and innovation projects that addressed the internal teaching problems of the colleges. Instead of research leaders leading and managing the research and innovation projects to be aligned to the real problems of the local community, industry and the country, they were rather focusing on research relating to their own personal interest and benefit. The mismatch between research projects at the universities and the real problems encountered by the local community and industry was confirmed by community leaders and industry managers. However, at Thgnu University alignment was difficult to achieve because of a lack of manufacturing industries close to the University.

In exercising adaptive leadership at college level, the research leaders of the colleges have to engage in continuous learning to engender creativity and innovation to be adapted in improved management and leadership of research projects. The results of the quantitative data showed that 70.7% of the participants at Segnu University, 97% at Fignu University, 89.6% at Thgnu University and 90.8% at Thgnstu University questioned the competency of their research leaders at college level to exercise research and innovation leadership and management based on continuous learning prompting creativity and innovation for improved research conduct. The results of the qualitative data confirmed that continuous learning by leadership prompting creativity and innovation to be adapted for improved research performance was under an

establishment phase at Segnu University, was not present at all at Fignu University, was not developed yet at Thgnu University, and was anticipated to become part of future research endeavour at Thgnstu University.

To adjust the research and innovation leadership practice of the colleges at the four universities, there should be dynamic interactions among the key stakeholders of the research and innovation projects so that some important ideas might emerge from their interactions though 70.7% of the participants at Segnu University, 87.7% at Fignu University, 89.6% at Thgnu University, and 98.5% at Thgnstu University questioned the practice of vibrant interactions between the colleges and their stakeholders at the four universities. There was a change from small-scale basic research into interdisciplinary mega thematic research at college level at the four universities. However, the results of the qualitative data revealed that the change was adopted, not one that emerged from the practice of Segnu University. The change was based on the national directions and the initiatives of Fignu University to make the research relevant to solve public problems. The change was introduced by the Vice President for Research and Community engagement, typically by the Research and Development Directorate at Thgnu University, and the leaders of the colleges did not have the idea that the move emerged from their interactions at Thgnstu University.

The research leaders of the colleges at the four universities have to use enabling leadership to create enabling conditions for the project leaders and researchers. In using enabling leadership, the leaders have to motivate and encourage researchers to undertake interdisciplinary research to solve real problems and collaborative research to promote research-based innovation though the participants of Segnu University (54.7% & 69.3%), Fignu University (71.8% & 78.2%), Thgnu University (83.4% & 87.5%) and Thgnstu University (90.7% & 69.3%) did not encounter any significant motivation and encouragement from their research leaders to respectively conduct interdisciplinary research or to conduct collaborative research. The results from the qualitative data confirmed that there was a lack of motivation and encouragement for researchers to get involved in either interdisciplinary research or collaborative research at the four universities. To counter the constraints in terms of human, material and financial resources, and skill and technology inadequacies at the colleges and as encountered by beneficiaries of the research and innovation projects of the colleges, the research leaders should have functional networks with the stakeholders of the research and innovation projects of the

colleges but more than 80% of participants perceived a complete absence of practical networks at the colleges of the four universities.

Administrative, adaptive, and enabling leadership functions of complexity leadership theory should also be practised at project level. In order to understand research and innovation leadership and management at project level among the four universities, the findings of the quantitative and the qualitative data are compared.

As administrative leaders, the project leaders should be competent at research and innovation project management although the participants of Segnu University (68% & 69.4%), Fignu University (87.6% & 87.6%), Thgnu University (99.9% &100%) and Thgnstu University (93.9% & 99.9%) questioned the competencies of their research leaders to respectively manage research and to manage innovation convincingly with their project management and leadership responsibilities. One of the competencies of the project leaders is setting realistic and functional objectives for the research and innovation projects but the participants of Segnu University (68%), Fignu University (79.5%), Thgnu University (93.8%) and Thgnstu University (81.3%) were sceptical about their research leaders' capacity to direct them to the realising of objectives that were realistically and functionally set. The results of the qualitative data confirmed that the projects leaders at Segnu University experienced inadequacies in meaningful research project identification, as project identification was influenced by the personal experiences of research leaders rather than the real problems of the community, the colleges, industry and the country.

It was also confirmed that the project leaders at Fignu University had shortcomings with both project management and leadership competency as they did not have the capacity to manage the projects due to poor resource allocation, poor communication and coordination, and limited leadership qualities as they focused on ethnocentrism while building research teams and evaluating and funding research proposals. The project leaders of Thgnu University also had shortcomings in project management related to proposal selection with unclear criteria and evaluation by unprofessional evaluators, and although having criteria for funding the research projects, the outcomes of research projects were not monitored. The project leaders at Thgnstu University experienced challenges with project management relating to an inability to arrange proper interaction between stakeholders and a thorough coordination of research activities.

As adaptive leaders, the project leaders of the four universities are responsible to lead the research projects to contribute relevant knowledge and the right technology to address the real problems of the local community, the University, industry and the country at large. However, the results of the quantitative data showed that participants at Segnu University (66.6%), at Fignu University (80%), at Thgnu University (85%) and at Thgnstu University (90%) had misgivings about their research leaders' ability to act as competent leaders who are able to exert adaptive leadership in terms of responding to societal needs with their research endeavour. The results of the qualitative data relating to interviews with local community leaders and industry managers confirmed that there were burning problems encountered in the local communities and industry, which could functionally have been addressed by research initiatives at the universities. The results of the qualitative data relating to interviews with the project leaders and co-investigators also confirmed that the research and innovation projects of the four universities did not focus on real problems encountered internally at the colleges, or externally at the local community, industry and country at large.

In order to ensure the research and innovation projects contribute with practical knowledge and applicable technology, the project leaders should create enabling conditions by exercising enabling leadership. In this regard, the project leaders should encourage and motivate researchers to passionate research conduct but participants at Segnu University (60%), at Fignu University (76.5%), at Thgnu University (90%) and at Thgnstu University (73.9%) denied experiencing any inspiring motivation from their research leaders for consistent and passionate research conduct. The results of the qualitative data from Segnu University revealed that problems were encountered with a lack of motivation, a lack of capacity building, a lack of honest feedback on research endeavour, a lack of transparency with research activities and the management thereof, a lack of cooperation, and a lack of proximity and belonging with team building endeavours. At Thgnu University, it was found that the academic researchers were not inspired to engage in research projects. At Thgnstu University, researchers were not encouraged to undertake innovative research. At Fignu University, the researchers were encouraged to participate in different research projects, and there was the potential to obtain research grants at the College of Agriculture at Fignu University.

7.3 DISCUSSION

The results of this study on leadership and management of research and innovation endeavour at higher education institutions suggest that the research and innovation activities of the four selected higher education institutions were not effectively managed and led at project, college, and university level to address the University's own internal teaching-learning problems, and the external problems experienced in the local community, industry, and the country. Higher education institutions as knowledge producing entities should be guided by complexity leadership theory that consists of administrative, adaptive, and enabling leadership in order to contribute to knowledge production in a knowledge-based dispensation. As knowledge is a commodity in the 21st century, the higher education institutions should produce new and practical knowledge and adapt or develop applicable technology to be facilitated and utilised to address internally experienced problems and the problems of the local community, industry, and the country at large. In doing so, the higher education institutions have to develop their own research and innovation policies in line with related national policies by accommodating important elements from first and third world policy experiences.

Although the qualitative data from the semi-structured individual interviewing revealed that the research policy documents of the selected higher education institutions were formulated in line with the two national research-related policies, the results of the qualitative data from an analysis of the applicable policy documents revealed that there were inadequacies with regard to vision, mission and objectives formulation and with regard to priority areas setting and research and innovation leadership and management conduct. In this regard, among the eight flagship universities in sub-Saharan Africa, the University of Cape Town was found to be fulfilling the goal of producing relevant knowledge that can contribute to national and regional development through high-quality research endeavour (Cloete *et al*., 2015:29).

The results of this study indicate that the four selected universities did not have consistent research and innovation policy documents as the second-generation university and the third-generation science and technology university had a research policy and guidelines, and research and technology transfer policy respectively while the first- and the third-generation general university had thematic research areas and research and development guidelines respectively. It was also found that the selected universities did not accommodate knowledge as a commodity for a knowledge-based dispensation which relates to similar findings by Cloete *et al.* (2011:165), Jowi *et al*. (2013:6) and Nyerere (2012:20). Except for Thgnstu University representing a science and technology university that considers and acknowledges a

knowledge-based industry, all of the selected research sites emphasised foreign technology adaptation as prescribed by the two national research policies. The universities of South Africa acknowledge that their research and development actions have a key role to fulfill in a knowledge-based dispensation (Cloete *et al*., 2011:167).

One of the results of this study was that the national STI policy and the framework for higher education research and technology transfer did not emphasise knowledge as the basis for a knowledge-based dispensation in Ethiopia, whereas the African Union Commission STI strategy (African Union Commission, 2014:11), and the developed countries' research and innovation policies acknowledged the existence of a knowledge-based dispensation (OECD, 2015:13; Tamtik, 2016:15). A further result is that the vision and mission of the national STI policy of Ethiopia focuses on adaptation of foreign technology by establishing a system for adaption and developing capacity to transfer technology but one of the objectives of the STI policy document emphasises studying and utilising indigenous knowledge and technology. The purpose of the national STI policy of a country should be mission and invention-oriented to seek new solutions for specific problems and invent tailormade knowledge and technology through research and development, as suggested by Edler and Fagerberg (2017:4).

Focusing only on foreign technology adaptation, Ethiopia will remain dependent on other countries. Consequently, the Ethiopian universities should also focus on researching and utilising indigenous knowledge and technologies and producing new knowledge and technologies from their research projects by developing their research capacity and skills. Although Ethiopia is focusing on industrial development through establishing industry and science parks and encouraging manufacturing industries to export commodities, the knowledge-based economy should receive equal emphasis if Ethiopia is expected to be competent in the global economy motivated by knowledge and technological advancement through research-based innovation at universities. Therefore, the research policy or research thematic areas or guidelines as identified at the four selected universities, and the national research-related policies should be questioned, revisited, reformulated, and practised in line with the continental and global research and innovation policy focus of the 21st century.

The national STI policy should also give emphasis to the production of new knowledge and technology in addition to adapting selected foreign technology so that the country does not remain a follower of technologically developed countries. This is supported by Cornell

University (2015:82) that low-income countries should invest in research and innovation policy to develop their own technology that enables them to solve their context specific problems. In doing so, and in line with national research-related policy changes, the universities should revise and align their research and innovation policies, but the results showed that Segnu University did not revise its research policy, and Fignu, Thgnu and Thgnstu universities did not formulate their own research and innovation policies strictly in line with the national research-related policies. In this regard and although the national STI policy has shortcomings in incorporating continental and global experiences of related policies, the four selected universities should formulate their research and innovation policy documents by countering the inadequacies of the national research-related policy documents and not perceiving their policy documents as finished documents, but as documents prone to continuous change as demanded by a dynamic, knowledge-based dispensation.

MoST and MoE (the most recent Ministry of Science and Higher Education (MoSHE) and the Ministry of Innovation and Technology (MInT) should introduce the national STI policy, and the research and technology transfer framework to the universities and manage and lead the translation of the two national policies into the universities' research and innovation policies. However, the results of the qualitative data from the concerned expert of MoST and the manager of MoE revealed that they did not know whether the Ethiopian universities formulated and practiced their research and innovation policies to be aligned to the two national policy documents. The possible explanation for this lack of knowledge about university research conduct relates to capacity inadequacies of the experts at MoST, the managers at MoE, and the research managers of the universities to formulate and implement meaningful research conduct based on research policies that are aligned to the specific demands of the national, continental and global context. This finding agrees with the findings of Wamae (2008:42), namely that the STI policy documents of African countries are not implemented or the policy documents are out-dated and without focus.

Apart from formulating their own research and innovation policies to be aligned to the two national research policies, Ethiopian higher education institutions should set their own priority areas as prescribed by the national development priority areas of the country. However, the results from document analysis actions and the semi-structured individual interviews revealed that there were inconsistencies as Segnu University has priority areas, Fignu and Thgnu Universities have research thematic areas and Thgnstu University does not have either. As

found, the priority areas of MoST correlate with the priority areas of Thgnstu University although MoE suggested in the framework for research and technology transfer document that universities develop their own thematic areas as also suggested by the Institut für Technologie und Regionalpolitikn (2004:4). However, Georghiou and Harper (2011:245) stated that thematic priority setting focuses on the fields of science and technology while mission-oriented priority setting focuses on socio-economic goals, and functional priority on the nature of research and the innovation system of a country. Therefore, the role of MoSHE is preparing a framework and directives for the universities and managing the inconsistencies of policy formulation and implementation, and priority setting through monitoring the actual practice at the universities by establishing an applicable Department for Research and Innovation.

Higher education institutions should use functional pragmatism, that is, setting priority areas in their strategic planning rather than setting their priority areas based on big-science and top-down approaches (Institut für Technologie und Regionalpolitikn (2004:3). In this regard, each university should set its own priority or thematic areas using a mixture of methods of priority setting as the universities in Ethiopia and the developing countries are responsible for producing relevant knowledge and developing applicable technology from their research and innovation projects to address real problems encountered in the local community, the University, industry and the country at large. To translate the priority or thematic areas of the universities into action, each university should develop research strategic plans, but the results of the qualitative data revealed that there were no research strategic plans developed at the four research sites. This finding correlates with the finding of Nguyen and Gramberg (2017:7) that there were no research strategic plans developed for universities in Vietnam.

In order to implement the research strategic plan of each university constructively, there should be effective research and innovation leadership and management at university, college, and project level using administrative, adaptive, and enabling leadership. This demands that the research leaders should have adequate competencies in research and innovation leadership and management. In this regard, the results of the document analysis of the framework for higher education research and technology transfer indicates that research management professionals having research leadership experience should manage the research activities of the universities. However, the results of the qualitative data from the open-ended questions of the structured questionnaire revealed that the research management and leadership positions at the selected universities were occupied based on political affiliations and personal relationships and were

not merit-based and based on genuine research leadership and management competencies. The finding of Nguyen and Meek (2016:70) also showed that research management was not professionalised in Vietnam universities. Consequently, it was also found that the leaders lacked research and innovation leadership and management skills and knowledge.

Research leadership requires leaders to have qualities relating to scientific capital and charisma, being a broker arranging optimal research endeavour, being effective in using rules to negotiate optimal functioning in bureaucracy settings and being able to develop organisational openings in a creative way ensuring an environment conducive to the self-management of research conduct (Hansson & Monsted, 2008:667). In this regard, research and innovation leaders and managers at Ethiopian universities should be appointed based on their leadership and management competencies. These managers should not be appointed based on their political affiliations but should be appointed based on adhering to the appropriate research leadership qualities in order to manage and lead research and innovation projects to be aligned to the demands of the specific internal context and the demands of the local community, industry and the national development agenda contributing with appropriate knowledge and applicable technology.

In implementing the research and innovation projects of the universities, the research and innovation leaders of the universities at university and college level should be skilled at research and innovation project management. Skill is needed for research leaders at universities to manage research project identification, project development, project implementation, project monitoring and project evaluation constructively. However, the results of both the qualitative and the quantitative data of this study depicted that at both university and college level the leaders had shortcomings with regard to research and innovation management competencies which correlates with the study by Nguyen and Meek (2016:70) on management and leadership inadequacies at the higher education institutions of Vietnam as a developing country. Research leaders should practice their research leadership skills starting with applicable research project identification related to the real problems encountered in the local community, the University, industry and the country as based on consultations with applicable beneficiaries and key stakeholders. Research leaders should manage research project development, monitor the implementation of the research project and the quality of research conduct, evaluate the research outcomes, and manage the functional application of research outcomes in terms of contributing innovatively to improve societal functioning.

At project level, the project leaders should also exercise administrative leadership to manage the research and innovation projects constructively. However, this study has shown that project leaders were not effective in managing the projects in line with their University's and college's priority or thematic areas, but they chose research problems based on their personal experience, or based on preliminary literature reviews, or based on suggestions by a specific department or the University. Project leaders chose their research teams based on proximity, but also on expertise. This is supported by findings of Owns *et al*. (2017:235) that the project leaders did not lead the research projects effectively as they did not have adequate leadership qualities regarding the research process, honesty, transparency and punctuality in meeting deadlines. The problem or theme of the research and innovation project should be chosen based on real and practical internal or external problems. The research and innovation project teams should be selected based on their expertise and competencies, and not based on friendship and personal relationships. Project leaders should manage project identification and implementation in line with the specific contexts and the real problems encountered internally or externally to adhere to ethical considerations of not wasting public money for personal or acquaintances' financial benefit.

As adaptive leaders, the research leaders have to lead the research and innovation projects focusing on specific and real problems internally or externally encountered However, the results of both the qualitative and the quantitative data showed that the research projects were designed based on the interests of the University to correlate with thematic areas or priority areas, and also based on individual interests of project leaders and the researchers. In this regard, findings by Cloete *et al*. (2011:167); and Martin and Marion (2005:140) point out that research leaders focus on control and influence and that research leadership conceptualise a 'carrot and whip' approach without operating in a competitive environment (Saltmarsh *et al*., 2011:303). In this regard, universities should research and improve their tuition problems to produce competent and skilled graduates for their own research and innovation activities and for industry. However, the results of both the qualitative and quantitative data disclosed that the selected universities had no research and innovation projects to address their own internal problems but some of the leaders at university and project level emphasised action-research to address local community problems without first addressing internal challenges.

With regard to universities addressing their internal problems first, studies by Robson *et al*. (2013:97) about teaching innovation in higher education, by Deem (2006:223) about higher

education management and by Wilson-Medhurst (2010:9) about innovation to address problems of evaluation in higher education guide contextual practices. In this regard, if research leaders do not have the required training and skills to lead and manage research and innovation research projects adequately, beneficiaries and key stakeholders should collaboratively act as co-managers of research and innovation projects. This will enhance the initiation of research projects to be based on real problems encountered in the specific community and industry with research outcomes implemented to counter the identified problems or to be commercialised to generate income. However, it was found that when there were too many different problems with equal importance, the research and innovation projects of the colleges were designed mainly based on personal interest (Schwwaag-Serger & Grobbelaar, 2016:32).

Universities should study their own research and innovation leadership and management practices to contribute relevant knowledge and technology and to become change agents for the socio-economic development of the local community and the country at large. In this regard, universities should focus on their indigenous knowledge and technology systems to address typical problems experienced within context such as the problems relating to HIV/AIDS and nutrition as determined by Ivey and Henry (2016:5). As competent enabling leaders, the research leaders at university and college level should facilitate enabling conditions and environments conducive for research conduct for the project leaders and the researchers.

One of the key enabling conditions relates to allocating adequate budgeting. The results of both the qualitative and the quantitative data depicted that there were not enough budgeting for the research projects at the research sites. This concurs with the findings of Evoh *et al*. (2013:310) on inadequate budgeting for research endeavour typically encountered in developing countries. It was found that there were fixed budgets set by MoE like 30, 000 or 40, 000 Birr at Segnu, Fignu and Thgnu Universities without considering the nature of the research projects, whereas at Thgnstu University the budgets for the research projects range from 500, 000 to millions of Birr for a research project. Budget allocation for research and innovation projects should not be limited by MoSHE; rather it should be determined by the researchers and research managers as per the nature of the specific research project and the expected contributions for societal development irrespective of university-type. This approach concurs with the funding of research projects at the University of Technology in Jamaica based on the impact of research conduct on policy and societal life (Ivey & Henry, 2016:5). The research leaders should also encourage and inspire researchers and project leaders through different mechanisms, but both

the results of the qualitative and the quantitative data showed that there were shortcomings as there were no mechanisms to motivate and encourage researchers and project leaders to perform well, which concurred with findings by Saltmarsh *et al*. (2011:303) on inadequate incentive for researchers.

The research leaders should facilitate enabling conditions and environments conducive to research conduct by providing constant training to address research skill shortcomings and address funding constraints so that the researchers and leaders at project and college level can be inspired, motivated, encouraged and committed to be productive in their research and innovation project engagement. However, these actions were not exercised by the research leaders at the four universities studied. It was also found that there was not a well-established and functional innovation system to facilitate interaction among the key stakeholders of the research and innovation projects of the universities. This study found that there was limited linkage between industry and the universities as industry did not anticipate the academics' research to address their industry-related problems. This lack of linkage between university and industry is similar with the findings of EI Hadidi and Kirby (2017:195) about the Egyptian situation, Iizuka and Gault (2015:5) about situations in Southern and Eastern Africa and Mahdi (2015:215) with regard to the Iran situation. The results of this study concur with the findings of Mpehongwa (2013:2096) that universities focused only limitedly on traditional relationships like internships, consultancy services and inviting guest lecturers from industry and the findings of Iizuka and Gault (2012:7) about a weak linkage between government, universities and industry.

In order to address the shortage of human resources for research and innovation activities at the university and industry, the leaders should ensure interrelationship between education (postgraduate), research and innovation by facilitating dynamic interactions within and among the universities by creating horizontal relationships among key stakeholders. However, the results of this study suggest that such integration was weak except for some efforts that were observed in the postgraduate training at masters and PhD level and that concurred with suggestions by Jumna (2016:2) for meaningful integration. It was found that although integration between education and research in the two national research policies and the universities' research policy documents were prescribed, little effort has been made for integration in the actual university practices which concurs with the situation in Norway where

integration of education, research and innovation is included in the policies and strategies of the universities but not implemented in practice (Borlaug *et al*., 2016:9).

It was found that the industries did not recognise the need to work collaboratively with the universities' research and innovation projects like those of Segnu University. The managers of the industries perceived that academic researchers are theoretically inclined and cannot provide practical training, and do not conduct relevant research to address the problems of industry. Universities therefore do not have the capacity to address the productivity needs encountered by industry which concurs with the findings of EI Hadidi and Kirby (2017:195) and Janischewski and Branzk (2008:3) about higher education incapacity to deliver appropriately skilled manpower. As higher education institutions in Africa should be the main source for research-based innovation (Mohamedbhai, 2012:21), universities should ensure that the research and innovation leaders have research and innovation projects to address their own internal teaching problems so that they can produce graduates who are skilled to be employed at university and industry to contribute with knowledge and technology needed for a knowledge-based dispensation. The universities should also develop the research and innovation skills of their academic researchers through on-going capacity building training and experience sharing within and outside the country.

In using enabling leadership, the results of this study indicate that the research leaders did not create enabling conditions and environments except for load reduction endeavours recognised at university level. The research leaders were found to be subjective in proposal selection and approval. Research leaders can facilitate conditions for the researchers by designing different encouraging mechanisms like accommodating research undertakings, facilitating experience sharing and advanced training, acknowledging exceptional research conduct publicly and having awards for excellence of efforts and contributions. To create such conditions, the leaders should have functional networks within and among colleges, with other universities locally and abroad and with all possible stakeholders. However, the results of the study suggest that the leaders at university, college and project level have capacity challenges associated with enabling leadership.

As pointed out by the project leaders and co-investigators, enabling leadership requires personal qualities and competencies relating to being part of the research team, being a passionate team builder and being an effective financial manager with eloquent communication

skills. These qualities concur with the findings of Owusu *et al*. (2017:241) on research leaders' competencies ensuring successful research conduct by research team members. Personal qualities like proper ethical research conduct and good communication are main shortcomings identified to prevail at the studied universities. Personal competencies like knowledge and skills of research methods and design, content analysis, writing-up skills, research and innovation leadership and management, and research and innovation project management and leadership were also inadequacies identified to be addressed at different levels of governance at higher education institutions in Ethiopia.

It was found that the selected universities have moved from small-scale basic research to mega thematic interdisciplinary applied or action research, but basic research is still one of the thematic areas of Fignu University and one of the priority areas of Segnu University. The major intention of this move was to contribute with new knowledge and appropriate technology to address real problems experienced at the local communities, industry and the country. However, except for some limited contributions, the influence of the research and innovation projects of the universities on internal or external betterment were found to be limited to almost nonexistent as shown by the results of both the qualitative and the quantitative data. This concurs with the findings by Evoh *et al*. (2013:286) about research and innovation in the higher education institutions of Kenya and Uganda that failed to contribute effectively to the knowledge-based economies of the countries due to inadequacies relating to a lack of proper skills, funding, university-industry linkage, curriculum delivery, and infrastructure.

Considering that universities should conceptualise basic, interdisciplinary, multidisciplinary and collaborative research accurately, the results of this study showed that there were many basic research projects of which the research outcomes remained outcomes put-on-the-shelf. These research outcomes were reported as not representing theoretical contributions for the international community to contribute to the existing pool of knowledge and published in highly prestigious peer-reviewed international journals. Along the same lines, what has been practiced as mega thematic research might not be interdisciplinary or multidisciplinary applied research although it was reported as such by the research leaders. With reference to these findings, the Ethiopian universities should choose the type of research (basic vs applied, interdisciplinary vs multidisciplinary, individual vs collaborative) based on the nature of the research problem and the expected outcomes in terms of relevant knowledge or technology contributing to internal or external development. The change from small-scale basic research

to mega research is prescribed by the MoE as confirmed by researchers and research managers. In line with suggestions by Campbell and Caraynnis (2016:11) on modes of knowledge, universities should integrate different modes of knowledge production (mode 1, 2 or 3) to produce discipline-based, or practical problem-solving research characterized by a high standard of quality of knowledge and innovation for meaningful application in collaboration with concerned stakeholders.

With regard to effective leaders at project, college, and university level, the study found that there were no clear mechanisms to maintain the quality of research conduct of the research and innovation projects and their successful implementation except counting the number of research projects and reporting to the concerned bodies. Therefore, the leaders at different levels of governance at higher education institutions should give priority to the quality of the research process by setting clear criteria to determine success, and monitoring and evaluating the implementation and the outcomes of the research projects. As found by Nguyen and Meek (2016:70) with regard to creating a constructive research management structure, crucial factors to consider relates to developing rules and procedures for research integrity such as evaluating the quality of the research outcomes and preparing researchers and research managers for good quality research conduct to ensure that research activities are carried out by professionally skilled researchers. Research outcomes should be implemented to address the problems identified with project implementation and should be patented and commercialised for the benefit of all stakeholders including the researchers, the University and the country. In order to achieve these research-related conduct, research leaders at different levels of governance should exercise administrative, adaptive, and enabling leadership representing the three leadership functions of complexity leadership theory determined to be applicably associated with research and innovation leadership and management practice at higher education institutions.

7.4 SUMMARY

Comparing the results of the research and innovation management and leadership performance at policy and practice level among the four universities, it was found that the first-generation university did not have a research policy while one of the third-generation science and technology universities had a research and technology transfer policy, but it was not properly formulated to be in line with the two national research-related policy documents. It was found

that the second-generation university also had a research policy and guidelines, but it was not revised in line with formulations of the national research policy, whereas one of the third-generation general universities had research and development guidelines. Therefore, the results of the document analysis revealed that there were inconsistences in the formulation of the research and innovation policies of the four universities as being aligned to the framework for higher education research and technology transfer and the STI policy.

In order to translate the research and innovation policy or research policy or thematic areas or research guidelines of the universities into practice, the universities should have effective research and innovation leadership and management competencies at project, college, and university level. It was found that the leaders at project, college, and university level did not manage and lead the research projects constructively in terms of project identification, project development, project implementation, project monitoring and project evaluation and with regard to research outcomes that address internal or external demands relating to the needs of the University, the local community, industry, or the country at large.

The results of the qualitative data revealed that there were some contributions regarding increasing productivity through adapting and transferring improved seeds and vegetables, reducing neonatal death and water borne diseases as carried out at Fignu University. Segnu and Thgnu Universities attempted to adapt and transfer some improved seeds and crops to the farmers while Thgnstu University attempted maintaining the quality of roads by using red ash and discovering mediating plants to reduce water pollution by industries. However, the results of the quantitative data from the structured questionnaire indicated that there were no significant contributions of the research and innovation projects to solve the problems of the local community, the University, industry, or the country at large acting as a vibrant source for the development of a knowledge-based dispensation.

CHAPTER 8
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1 INTRODUCTION

The main aim of this study was to understand the leadership and management of the research and innovation at higher education institutions in Ethiopia at policy and practice level. The main problem investigated in this study is the management and leadership competencies of the research leaders at university, college and project level in exercising administrative, adaptive and enabling leadership to address the real problems of the local community, the University's own internal teaching-learning problems, the problems of industry and the socio-economic development problems of the country. Although the higher education institutions in Ethiopia are categorised into first-, second- and third-generation universities, all the institutions are mandated to teach, undertake research and transfer technology, and partake in community engagement endeavour. To understand the research and innovation management and leadership practice across the three generations of higher education institutions, the cases of four universities were studied.

Chapter 1 describes orientation to the study briefly discussing the basis of research and innovation policy of higher education institutions, and the theoretical orientation of the study, and reviewing the literature regarding the research and innovation leadership and management at university, college and project level. The problem statement, the aims of the study, the methodological orientation, concept clarification and ethical issues are also discussed.

Chapter 2 provides the theoretical framework for the study. In this regard, concepts relating to research and innovation, different modes of knowledge production and the innovation system of a university are described. Concepts of project leadership and management, research and innovation project management and leadership are also described. Complexity leadership theory with its three leadership functions, universities as complex organisations, and a research approach to study complex problems are discussed. Among the different leadership theories, it was found that complexity leadership theory with its administrative, adaptive and enabling leadership functions was appropriate to guide the empirical investigation relating to research and innovation leadership and management at higher education institutions with as crucial

functions knowledge production and knowledge utilization together with tuition to represent a vibrant source for the development of a knowledge-based dispensation.

The findings from the review of related literature are analysed in Chapter 3. In this regard, the trends of STI policies in Ethiopia and globally are reviewed. In doing so, the trends of STI policies in developed countries, in African and in the Ethiopian context are discussed. As the STI policy of a country is a main directive for higher education institutions' research and innovation policies, research and innovation leadership and management at higher education institutions internationally in general and in Ethiopia in particular are reviewed. In this regard, the research and innovation management and leadership practice at university, college and project level are reviewed.

Chapter 4 discusses the research methodology and research design for the empirical investigation. In this regard, to understand the research problem and the research questions comprehensively, convergent parallel mixed-methods design was chosen from the different mixed-methods research designs. The choice of the research approach and the research paradigm, and the rationale for using a mixed-methods research approach and the specific research design are justified. The research sites and participants of the study and the sampling techniques used are described. The methods of data collection were document analysis, semi-structured individual interviews and a structured questionnaire. The qualitative and the quantitative data were analysed separately and integrated in each case, with a final cross case analysis among the four selected universities. Ethical considerations are accounted for.

In Chapter 5, the research findings from the first- and second-generation universities are discussed. In Chapter 6, the research findings from the two third-generation universities are discusses and in Chapter 7 the cross-case analysis across the four universities with related research findings are provided.

In this Chapter 8, the final chapter of the study, a summary of the main research findings and conclusions from both the literature review and empirical study are provided. The Chapter makes recommendations for policy makers, higher education institutions, and stakeholders. The Chapter also suggests areas for further study.

8.2 SUMMARY OF THE MAIN RESEARCH FINDINGS AND CONCLUSIONS

In the ensuing sub-paragraphs, the research findings and the conclusions from the literature review, and the research findings and the conclusions from the empirical study are presented.

8.2.1 Results and conclusions from the literature review

From the literature review regarding the trends of STI policy in the world, the results suggest that different countries have practised STI policy, research and innovation policy or innovation policy (par 3.2). The results from the literature review also suggest that there are different methods of priority setting though a functional method of priority setting is recommended for universities while preparing their strategic plans. The results of the literature review also suggest that there are capacity shortcomings in formulating constructive STI policies especially in developing countries and translating the national STI policies into the research and innovation policies of the higher education institutions (par 3.2.3). However, the results of the literature review revealed that higher education institutions are the main sources for research-based innovation for both developed and developing countries. In this regard, when the research and innovation projects of universities in the developed and developing countries are contributing relevant knowledge and technology for the knowledge-based economy of their countries, the capacity of the higher education institutions in developing countries is weak in preparing competent human capital and undertaking quality research and innovation endeavour.

Developing countries are not producing adequately relevant knowledge and applicable technology to address real problems related to technology inadequacies and the development challenges of their nations (par 3.3). This is because it was suggested in the literature that there were research and innovation management and leadership competency shortcomings in higher education institutions in developing countries like Ethiopia. In Ethiopia, the findings from the literature review showed that there were also limited studies conducted regarding the management and leadership of research projects and the application of the outcomes of the research projects to address real problems of the local community, the universities own internal teaching-learning problems, the problems of industry and the country (par 3.4). In conclusion, although complexity leadership theory with its administrative, adaptive and enabling leadership functions is recommended for knowledge producing and knowledge utilising

organisations like universities, the research leaders at higher education institutions in Ethiopia encounter shortcomings in applying the theory to guide the management and leadership of their research and innovation activities to produce new and relevant knowledge and to develop applicable technology for a knowledge-based dispensation.

8.2.2 Results and conclusions from the empirical study

As the basis for the research and innovation policies of the higher education institutions in Ethiopia are the national STI policy and the framework for higher education research and technology transfer, one of the aims of this study was to examine whether the research and innovation policies of the four selected universities are formulated in line with the two national policy documents (par 1.5). The results of the document analysis revealed that the visions, missions, objectives, priority areas and research and innovation leadership and management practices of the four selected universities were not developed in line with the visions, missions, objectives, priority areas, and the research and innovation leadership and management of the two national policy documents although there are some similarities in terms of priority areas and research management endeavour (par 5.2.2.1, 5.3.2.1, 6.2.2.1 & 6.3.2.1). The research findings of the document analysis depict that the research policy of Segnu University and the research and development guidelines of Thgnu University did not have vision and mission statements (par 5.3.2.1 & 6.2.2.1). The research findings suggest the research leadership and management of the four selected universities have shortcomings in formulating constructive research and innovation policies for their universities in line with the two national policy documents and by considering formulations based on experiences of African and global research-related policies.

In order to understand research and innovation management and leadership at policy and practice level at the four selected universities in exercising administrative, adaptive and enabling leadership at university, college and project level, both qualitative and quantitative data were collected using semi-structured individual interviews, and a structured questionnaire (par 4.8). Quantitative data were also collected from the four selected universities' five-year annual performance reports for the period 2012/13-2016/17 regarding their achievements with research and innovation project activities. After each type of data was analysed separately and integrated for each university separately based on the three themes of administrative, adaptive

and enabling leadership at university, college and project level, a comparison was made among the four selected universities. The results of the empirical study depict that:

- Both the results of the qualitative and the quantitative data showed that the research policy documents and their priority areas were formulated in line with the national STI and the framework for higher education research and technology transfer policy documents as indicated by the majority of the participants although these results were contradicted by the results of the research policy document analysis of the four universities (par 5.2.2.2, 5.2.3, 5.3.2.2, 5.3.3, 6.2.2.2., 6.2.3, 6.3.2.2. & 6.3.3).
- As competent administrative leaders, the research leaders at university and college level at the four selected universities did not manage the research project identification (a core element of the research project management), the research project development, the research project implementation, and the research project monitoring and evaluation. Rather they focused on managing the calls for proposals, proposal review and funding the selected research projects (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- As research managers are also innovation managers, the results of the empirical study showed that the research leaders at university and college level at the four selected universities did not manage the application of the outcomes of the research projects constructively (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- The project leaders, as administrative leaders of the research and innovation projects, chose research problems and developed research proposals based on their personal observations and interests, and the interests of each university and the priority or thematic areas of the university rather than identifying real problems from the local communities, the colleges and the universities' own internal problems, the problems of industry and the socio-economic development constraints of the country (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- Although the project leaders should build research teams based on their professional expertise, it was found that they gave undue attention to proximity and personal relationships. The results also showed that the research leaders were subjective while evaluating and funding the research projects and giving research leadership positions at university and college level as they were biased towards friendship, ethnicity and political affiliation. The results of the empirical study depicted that the research

leaders at university and college level and the project leaders had research and innovation project management competency shortcomings as indicated by both the qualitative and the quantitative data (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).

- As capable adaptive leaders, the research leaders at university, college and project level should lead the research and innovation projects in line with the specific contexts and real problems of the local communities, the universities own problems, industry and the country at large. However, the results of the empirical study depicted that the research and innovation projects of the four selected universities were not led to address real and specific problems of the applicable stakeholders, in spite of their efforts in adapting improved seeds and vegetables and transferring them to end users at Fignu, Segnu and Thgnu University, and in improving the quality of roads using red ash at Thgnstu University (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- The results of the empirical study from the semi-structured individual interviews with community leaders and industry managers revealed that the research and innovation projects of the universities did not focus on and address real and serious problems of the local communities and industry although there were need-based training, consultation and material support provided by the universities (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- In order to improve the research and innovation leadership practices of the four selected universities, the research leaders at university, college and project level should engage in continuous learning engendering creativity and innovation for adaption in their research leadership practices. However, the results of the empirical study showed that the leaders had competency shortcomings in practising research and innovation leadership as a process. In order to adjust the research and innovation leadership practices of the four selected universities, the research leaders should accommodate emerging ideas from their dynamic interactions within and outside the universities (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- The results of the empirical study depicted that although the research leaders at university and college level at the four selected universities indicated that the move from basic research to interdisciplinary applied thematic mega research emerged from the interaction amongst researchers and from policy directions from the higher officials, the project leaders and co-investigators proclaimed that the change was

prescribed by the research leaders at university level by adopting the research leadership practices of other universities (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).

- As competent enabling leaders, the research leaders at the four selected universities should create enabling conditions by exercising enabling leadership. However, the results of the empirical study showed that the research leaders at university and college level at the four selected universities were not competent in motivating and encouraging the researchers to conduct research and find innovative solutions for complex problems in a specific context. The leaders were also not utilising the university research system using their managerial authority to undertake quality research and innovation that results in new ideas and technology to address real problems by facilitating the required resources. As the universities, the beneficiaries and the stakeholders of the research and innovation projects should interact and they are interdependent for human, material and financial resources, and for relevant knowledge, skills and technology, the research leaders of the universities should establish strong linkages among the University, industry, the local community and private institutions. However, the results showed that there was a weak linkage between the University and industry with each case, and there were no linkages with the local community, government and other relevant stakeholders (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- The results of the empirical study revealed that there were no well-established and functional innovation systems in the four selected universities to facilitate the research and innovation activities of the universities. One of the main enabling conditions for undertaking quality research and innovation projects is allocating adequate budgets. The results of the empirical study indicated that there was a shortage of budgeting for the research and innovation projects especially at Fignu, Segnu and Thgnu University (par 5.2.2.2, 5.3.2.2, 6.2.2.2 & 6.3.2.2).
- Although the research leadership practices of the four selected universities moved from discipline-based small-scale basic research to interdisciplinary applied thematic mega research, the contributions of the research and innovation projects to solve real problems of the local communities and the universities, to address the constraints of relevant knowledge and technology for the country, and to produce competent human capital for the universities, industry and the country at large were not meaningful and significant as shown by the results of both the qualitative and

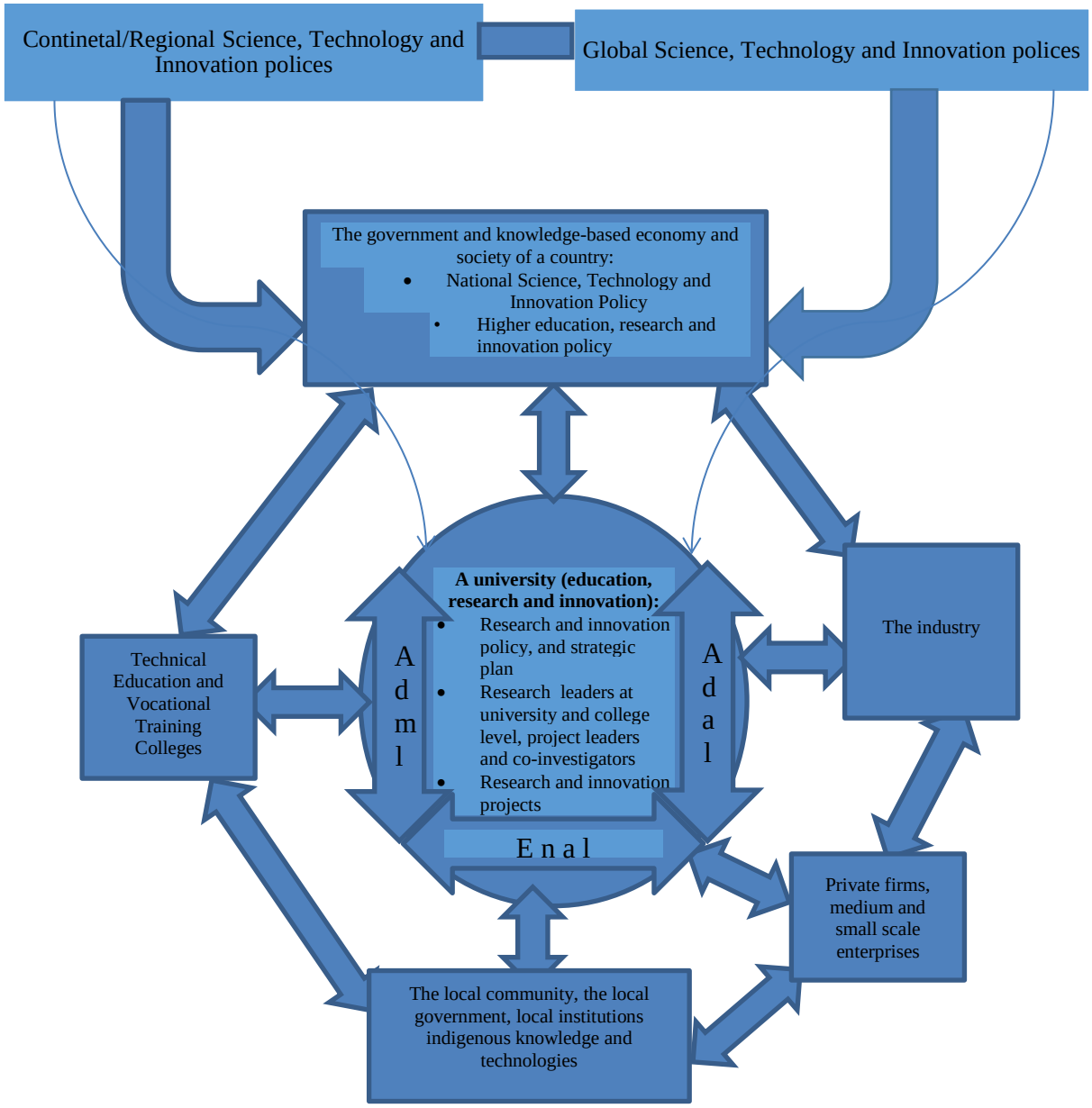
the quantitative data (par 5.2.2.2, 5.2.3, 5.3.2.2, 5.3.3, 6.2.2.2., 6.2.3, 6.3.2.2. & 6.3.3).

The research findings of the empirical study suggest that the research and innovation policies of the four selected universities were not formulated and practiced in line with the national STI policy and the framework for higher education research and technology transfer. The main goals of the two national policy documents were to address real problems of the local communities, the universities, industry and the country at large by producing relevant knowledge, and to adopt or develop applicable technology (par 5.2.2.1, 5.3.2.1, 6.2.2.1 & 6.3.2.1). However, to achieve these two goals, the research policy documents and the actual practices of the research and innovation activities of the four universities were not managed and led constructively by exercising administrative, adaptive and enabling leadership functions relating to complexity leadership theory to serve as vibrant source for a knowledge-based dispensation in the 21st century (par 5.2.2.2, 5.2.3, 5.3.2.2, 5.3.3, 6.2.2.2., 6.2.3, 6.3.2.2. & 6.3.3).

8.3 A PROPOSED MODEL FOR MANAGING AND LEADING RESEARCH AND INNOVATION AT HIGHER EDUCATION INSTITUTIONS IN ETHIOPIA

One of the aims of this study was to develop a model for research and innovation leadership and management at higher education institutions in Ethiopia. As discussed in paragraph 2.12, there were inadequacies in the models developed in the literature to manage and lead the research and innovation activities of the higher education institutions in this knowledge-based dispensation. Following the research findings from the theoretical framework, the literature review and the empirical study in paragraphs 8.1, 8.2.1 and 8.2.2, a model was developed for effective management and leadership of the research and innovation policy and practice of a university as a higher education institution. This model is discussed next.

Figure 8.1: A model for effective management and leadership of research and innovation in higher education institutions in Ethiopia



Keys:

A university is a centre of education, research and innovation.

Represents key stakeholders and beneficiaries of research and innovation.

Research and innovation project management and leadership is between the university the key stakeholders and beneficiaries.

Formulating national STI and higher education policies is usually one way.

While formulating the university' research and innovation policy, filling the gaps of the national related policies in line with continental and global experiences of related policies depends on the efforts of each university.

Adml=Administrative leadership
Adal=Adaptive leadership
Enal=Enabling leadership

In the diagrammatic representation of the model for effective leadership and management of research and innovation at policy and practice level, the centre represents a university that indicates that it is the main source for research and innovation in Ethiopia as a developing county. The model indicates that the research and innovation policy of a university should be formulated to be aligned to the national research-related policies and the research-related policies of the continental and global contexts. The curved right arrow shows that the regional, continental and global STI and related policies are the inputs for formulating or revising the national STI policy of the country although the curved arrow connector shows that a university can use these continental and global experiences and practices as additional inputs while formulating and revising the research and innovation policy of the university in line with the national research policies

The rectangle symbolises the main stakeholders and beneficiaries of research and innovation projects of the university, including the local community, the technical and vocational colleges, and small firms, medium and small scale enterprises. The major premises of the model is exercising administrative, adaptive and enabling leadership functions within and outside the university to produce relevant knowledge and adapt or develop applicable technologies to address real problems of the local community, the university, industry and the country. The model also accommodates the needs of stakeholders of the research and innovation projects of a university in general by developing competent human capital for a knowledge-based dispensation in the 21st century. In this regard, the left-right arrows of the model show that the research project identification, project development, project implementation, project monitoring and evaluation, and the application of the outcomes of the research project (innovation project) should be exercised with the active involvement of the stakeholders and beneficiaries of the research and innovation projects.

The model proposes that administrative, adaptive and enabling leadership should be practiced in the formulation and implementation of the research and innovation policy of the university. In this regard, the model assumes that there will be competent research leaders for research and innovation project management and leadership endeavour at university, college and project level. The model suggests that administrative, adaptive and enabling leadership can be

practiced across different organisations like the university, industry, government, private firms, and technical education and vocational training colleges. The model challenges the meso model of complexity leadership theory within a bureaucratic organisation (par 2.12).

The model also challenges the triple helix model of innovation that research and innovation activities of a university should be practiced with the active and inclusive involvement of all stakeholders rather than to focus on government, university and industry only. The model also challenges quadruple and quintuple models to suggest the external environment should be part of the knowledge production and application endeavour (par 2.12). However, although the model interconnects six key actors of research and innovation, the model proposes the local community to be a component of the model as the public is a too general concept. The model also suggests that the environment within and across the stakeholders of research and innovation may not be considered as one of the key components of the model of innovation because the natural environment can be facilitated or distracted by the research and innovation leaders within one of the stakeholders or among the stakeholders' research and innovation activities. The model proposes that the research and innovation activities of the university should produce relevant knowledge and advanced technology, to address real problems of the local community, industry, the university and the country and to ensure the higher education institution becomes a vibrant source for knowledge production in a knowledge-based dispensation. The main strength of the model is its contribution to research theory, policy and practice as these theories, policies and practices pertains to higher education institution functioning. The model is applicable to all developing countries in the world including the African developing countries such as Ethiopia.

8.4 RECOMMENDATIONS

In this paragraph, the researcher makes recommendations based on the main research findings of the study to improve the leadership and management of research and innovation at higher education institutions at policy and practice level in Ethiopia.

The results of both the qualitative and the quantitative data depicted that there are competency shortcomings in management and leadership of the research and innovation projects at higher education institutions to produce relevant knowledge and applicable technology to address internal and external problems. Therefore, to improve the competency shortcomings observed

in both the findings from the literature and the empirical study at both policy and practice level, the following are proposed:

1. The national STI and the framework for higher education research and technology transfer should be formulated in line with the best experiences of the East African, African and global research-related policies and practices by critically examining the past policies and practices of the country.
2. As the policy formulation might not be perfect at national level, the higher education institutions in Ethiopia, and developing countries like Ethiopia should not consider the national policies as flawless policy documents. Consequently, while developing the research and innovation policies of the institutions, higher education institutions have to review the continental and global experiences and practices and address competency shortcomings observed in the national policy documents. As change is dynamic, the higher education institutions should also revise their research and innovation policies periodically and adjust their practices.
3. While determining the priority or thematic areas in the research and innovation policy of each university, themes need to become operational in practice. As a result, each university should develop a strategic plan for the research and innovation function using the functionalist method of priority setting so that there will be room for periodic revision while changing the strategic plan into annual and action plans to give priority for the most serious problems in the local community, the university's own problems, and the problems of industry and the country. In doing so, each university should address its own internal problems relating to teaching and learning, curriculum facilitation, and leadership and management using action-research so that the university can develop competent human capital for its own consumption and for consumption by industry and government.
4. In translating the research and innovation policy goals of each university, the research leaders at university and college level, and the project leaders should be competent in research and innovation project management. In so doing, they should be competent at administrative, adaptive and enabling leadership.
5. As administrative leaders, as suggested by most of the participants of the study at the four selected universities, the research leaders, the project leaders, the co-investigators, beneficiaries and key stakeholders of the research projects should give special emphasis to the research project identification through intense debate and

discussion. The leaders should also manage the research project development, project implementation, and monitoring and evaluation of the project rather than merely focusing on calls for proposals and reviewing and funding the successful proposals. The leaders should also manage the quality of the research process, the outcomes of the research and the implementation of the research outcomes to be relevant to the end-users by managing the research team, the project resources, and the project timeframes.

6. As competent adaptive leaders, the research leaders at university, college and project level should lead the research and innovation projects in line with the specific and real problems of the local communities, the university, industry and the country by producing practical knowledge, and adapting or developing appropriate technology applicably. In doing so, rather than adopting other universities' research leadership practices, research leaders at all levels of governance should exercise leadership as a process of continuous learning to engender creativity in order to adapt and adjust their leadership practices based on emerging ideas from their dynamic interaction within and outside the universities.

7. In order to make the project leaders and the co-investigators productive in their involvement in the research and innovation projects, the research leaders should create enabling conditions and an environment that is conducive for research conduct. In doing so, the research leaders should manage the interrelationships among the three pillars of knowledge and the interdependence and interactions among the beneficiaries and key stakeholders of the research and innovation projects so that constraints in terms of human, material and financial resources, knowledge, skill and technology will be addressed. As one of the main enabling conditions is allocating adequate budgeting for the research and innovation projects, universities should allocate at least 5% of the total budget for research and community engagement as suggested in the framework for higher education research and technology transfer policy document. Research leaders should encourage and motivate the researchers to undertake and produce new ideas and creative solutions to address complex local problems by facilitating the required resources and the required conditions.

8. In order to develop the competencies of research leaders at university, college and project level, the universities should provide on-going training and experience sharing within and outside the country. This should ensure capacity with regard to

research and innovation leadership and management, and with regard to personal qualities applicable to ethically sound and competent research management and leadership.

9. The research leadership positions at university and college level should not be occupied based on the political affiliations and personal relationships of the candidates. Rather, the leaders should be appointed based on their research and innovation leadership and management competencies, their accomplishments in research and innovation, and their professional and personal qualities. In doing so, the managers at the Ministry of Science and Higher Education (MoSHE) should manage and support the formulation and implementation of the research and innovation policies of the universities in line with the national STI and the framework for higher education research and technology transfer. In this regard, MoSHE should develop criteria that are free from political influence, purely professional and merit-based for the research leadership position at university level, and the universities should also assign research leaders at university and college level based on merit.

10. In order to provide practical education and training at university level in particular, as suggested by the participants, the government should introduce regulations for each industry to organise a research and development unit that will collaborate with higher education institutions. This collaboration initiative should be based on budgeting some money from industries' annual profits to address the problems of the local community, education and training inadequacies in producing manpower relevantly skilled, and industry's own knowledge-related demands being addressed by actively participating in research and innovation endeavours in collaboration with higher education institutions.

8.5 SUGGESTIONS FOR FUTURE STUDY

This study focused on comprehensively understanding the leadership and management of research and innovation at higher education institutions at policy and practice level in Ethiopia. However, as the area is new and not studied excessively in Ethiopia and in Africa, the researcher suggests the following areas for further study using different research approaches and designs with large scale research samples in order to provide guidelines on each suggestion for improved practice.

- An extended study on the formulation and implementation of effective research and innovation policy at university to be convincingly aligned with national research policies.
- A study on the practice of appointing research leaders at university and college level according to constructive criteria.
- A study to examine the research and innovation management and leadership competencies of research leaders at university level.
- A focus on the research and innovation project management knowledge and skills required from project leaders at higher education institutions.
- A study on the leadership and management of interdisciplinary thematic mega research projects at higher education institutions for meaningful application in pursuit of societal development.
- Although the findings showed that there were many basic research projects conducted at universities in Ethiopia, the reports of these kind of projects should be examined to determine the theoretical and practical contributions of these research outcomes for societal development.
- The research culture and capacity of the universities in Ethiopia should be studied to provide guidelines for establishment, development and sustainment.
- A study on the practice and challenges with interrelating education, research and innovation at universities in Ethiopia.

8.6 LIMITATIONS OF THE STUDY

This study was focused on understanding the research and innovation management and leadership at four selected universities in Ethiopia. The main limitation of the study is that the findings may not be generalisable with regard to research and innovation leadership and management pertaining to research policy formulation and implementation at the other public higher education institutions in Ethiopia as the study focused only on one selected university from each generation of general universities, and on two science and technology universities. Another limitation of the study is that private higher education institutions were not included in the study. Therefore, to obtain knowledge on research and innovation leadership and management endeavour at policy and practice level at Ethiopian higher education institutions on a broader spectrum for a possible more in-depth understanding, further studies should be focused on incorporating public and private universities into this phenomenon of study.

8.7 CONCLUDING REMARKS

The government of Ethiopia has been budgeting some amount of money for research and innovation activities at public higher education institutions expecting meaningful contributions in terms of relevant knowledge and applicable technology to address real problems and fulfill the socio-economic needs at local, regional and national level. In order to achieve these goals, the research and innovation projects at universities should be managed and led effectively using administrative, adaptive and enabling leadership functions of complexity leadership theory that guide the production and application of knowledge and technology for advancement of a knowledge-based dispensation. However, the contributions of the research and innovation projects to address real and specific problems of the local community, the university's own problems, the problems of industry and the socio-economic development challenges of the country were not found to be convincingly achieved. However, there were efforts at improving agricultural productivity, addressing some health problems and providing training and consulting services for different stakeholders of the university. Universities were found not to even address their internal tuition-related problems by exercising action-research although research leaders at university level reported that universities have chosen action-research to address the problems of the local community.

For the research and innovation activities of the higher education institutions in Ethiopia to genuinely contribute to societal development by producing relevant knowledge and applicable technology for a knowledge-based dispensation, the research and innovation policy formulations and implementations of the universities should be examined closely. The leadership and management of the research and innovation projects of the universities should be questioned, and the research leadership and management at university, college and project level should be professionalised. The politicisation of leadership and management of the research and innovation projects at higher education institutions should be countered at all cost.

8.8 FINAL WORD

Research that produces nothing but books will not suffice - Kurt Lewin.

REFERENCES

Abari, A. O., Oyetola, I. O. & Okunuga, A. A. 2014. Institutional leadership effectiveness and higher education for innovation and development. *Journal of Educational Review*, 7(1):1-9.

The African Capacity Building Foundation. 2017. *Building Capacity in Science, Technology and Innovation for Africa's Transfromation, Africa Capacity Report 2017*. The African Capacity Building Foundation, Harare, Zimbabwe.

African Union Commission. 2014. *Science, Technology and Innovation Strategy for Africa 2024*. Addis Ababa, Ethiopia.

Ahola, S. & Hoffman, D. M. (Eds.). 2012. *Higher education research in Finland: Emerging structures and contemporary issues*. Finnish Institute for Educational Research Customer services, University of Jyväskylä.

Altbach, P. G. 2011. The Past, Present, and Future of the Research University In Philip G. Altbach, P. G. & Salmi, J. (Eds.). *The road to academic excellence: the making of world-class research universities,* 11-32. Washington DC: The International Bank for Reconstruction and Development / The World Bank.

Ambos, T. C., Mäkelä, K. Birkinshaw, J. & D'Este, P. 2008. When does university research get commercialised? Creating ambidexterity in research institutions. *Journal of Management Studies,* 45(8):1424-1447.

Andolfi, G. 2016. Development and innovation management on higher education institutions. *European Journal of Social Sciences Studies*, 1(1):65-70.

Areaya, S., Shibeshi, A. & Tefera, D. 2011. Academic staff's views and practices of modular course delivery: Graduate programme at Addis Ababa University in focus. *The Ethiopian Journal of Education*, XXXI (2):63-106.

Ary, D. Jacobs, L. C. & Sorensen, C. K. 2010. *Introduction to research in education (*8th ed). Wadsworth: Cengage Learning.

Asamoha, M. K. & Mackin, E. E. 2015. Breaking the fetters of higher education in Sub-Saharan Africa. *International Journal of Administration and Policy Studies,* 7(1):6-16.

Asgedom, A. 2007. Validity issues in qualitative research. *IER FLAMBEAU*, 14(2):1-5.

Association for the Development of Education in Africa. 2016. *Revitalizing research and innovation to address continental challenges and promote global competitiveness in Africa*. Concept paper for the fourth webinar on the 27th October 2016, working group on higher education (WGHE) webinar series.

Atkinson, R. D. & Stewart, L. A. 2011. University research funding: The United States is behind and falling. *The Infromation Technology & Innovation Foundation*, Washington, D.C.

Austin, C., Browne, W., Haas, B., Kenyatta, E. & Zulueta, S. 2013. Application of project management in higher education. *Journal of Economic Development, Management, IT, Finance, and Marketing,* 5(2,):75.

Balaam, B. B. 2014. The role of Innovation in Development - could lessons be drawn for Ethiopia? *Ethiopian e-journal For Research and Innovation Foresight,* 6(2):43-51.

Balanced Scorecard Institute. 2011. *How do I measure innovation?* By a Strategy Management Group company, Carolina: USA.

Barry, A. E., Chaney, E. H., Stellefson, M. L. & Chaney, J. D. 2011. So you want to develop a survey: Practical recommendations for scale development. *American Journal of Health Studies,* 26(2):97-105.

Bentley, P. J., Gulbrandsen, M. & Kyvik, S., 2015. The relationship between basic and applied research in universities. *Higher Education,* 70(4):689-709.

Bento, F. C. 2013. *Organisational complexity: Leadership and change in research-intensive academic departments*. Thesis for the degree of Philosophiae Doctor Trondheim, Norwegian University of Science and Technology, Faculty of Social Sciences and Technology Management, Programme for Teacher Education.

Berku, D. W., Andarege, D. & Getachew, M. 2017. *The impact of higher diploma programme on public higher education institutions academics' teaching, learning and research competencies in Ethiopia: Cases of three institutions*. A Paper presented on the 35 May Annual International Educational Conference, Higher Education in Ethiopia: Advancing Teaching, Research and Community Outreach Engagement, May 19-20, 2017, College of Education and Behavioural Sciences, Bahir Dar University, Ethiopia.

Bernardo, M. A., Baranovich, D. L. & Manueli, M. K. 2017. Moving from research management to transfromational research leadership: Exploring possibilities**.**

Bessant, J. & Tidd, J. 2015. *Innovation and entrepreneurship* (3rd ed.). United Kingdom: John Wiley & Sons.

Billot, J. 2010. The changing research context: Implications for leadership. *Journal of Higher Education Policy and Management,* 33(1):37-46.

Birkland, T. A. 2011. *An introduction to the policy process: Theories, concepts, and models of public policy making* (3rd ed.). New York: M.E.Sharpe.

Bolo, M., Odongo, D & Awino, V. 2015. *In Pursuit of the Third Mission: Universities and public research institutes as progenitors of technology and innovation in Kenya.* The Scinnovent Centre Discussion Paper 03. Nairobi, Kenya: The Scinnovent Centre.

Bonaccorsi, A., Daraio, C. & Geuna, A. 2010. Universities in the new knowledge landscape: tensions, challenges, change: An introduction. *Minerva,* 48(1):1-4.

Borlaug, S. B., Aanstad, S., Solberg, E. & Thune, T. M. 2016. *The knowledge triangle in policy and institutional practices - the case of Norway*. Oslo: Nordic Institute for Studies in Innovation, Research and Education.

Bosch, A. & Taylor, J. 2011. A proposed framework of institutional research development phases. *Journal of Higher Education Policy and Management,* 33(5):443–457.

Bowen, G. A. 2009. Document analysis as a qualitative research method. *Qualitative Research Journal*, 9(2):27-40.

Brennan, J. King, R. & Lebeau, Y. 2004. *The Role of Universities in the Transformation of Societies. An International Research Project: Synthesis Report*. London: Association of Commonwealth Universities and Centre for Higher Education Research and Information.

Brennan, J., Broek, S., Durazzi, N., Kamphuis, B., Ranga, M. & Ryan, S. 2014. *Study on innovation in higher education: final report.* European Commission Directorate for Education and Training Study on Innovation in Higher Education, Publications Office of the European Union, Luxembourg. ISBN 9789279350818.EAN

Bronstein, L. R. & Kovacs, P. J. 2013. Writing a mixed-methods report in social work research. *Research on Social Work Practice*, 23(3) 354-360.

Bryman, A. 2006. Integrating quantitative and qualitative research: How is it done? *Qualitative Research* 6(1): 97–113.

Buller, J. L. 2015. *Change leadership in higher education: A Practical Guide to Academic Transformation*. San Francisco: Jossey-Bass.

Bush, T. 2007. Educational leadership and management: Theory, policy, and practice. *South African Journal of Education,* 27(3):391-406.

Cai, Y. 2017. From an analytical framework for understanding the innovation process in higher education to an emerging research field of innovations in higher education. *Review of Higher Education,* 40(4), 585-616.

Cambodia Development Resource Institute. 2013. *Research project development and management - a handbook*. August 2013, Phnom Penh, Cambodia.

Cameron, R. 2011. Mixed-methods research: The five Ps framework. *The Electronic Journal of Business Research Methods,* 9(2):96-108.

Campbell, D. F. G & Carayannis, E. G. 2016. Epistemic governance and epistemic innovation policy in higher education. *Technology, Innovation and Education*, 2(2):1-15.

Carayannis, E. G. & Campbell, D. F. J. 2009. Mode 3 and quadruple helix: Toward a 21st century fractal innovation ecosystem. *Int. J. Technology Management*, 46(3/4):201–234.

Carayannis, E. G. & Campbell, D. F. J. 2011. Open innovation diplomacy and a 21st century fractal research, education and innovation ecosystem: Building on the quadruple and quintuple helix innovation concepts and the "mode 3" knowledge production system. *Journal of Knowledge Economy,* 2(3):327–372.

Carayannis, E. G., Samara, E. T. & Bakouros, Y. L. 2015. *Innovation and Entrepreneurship: Theory, Policy and Practice*. Switzerland: Springer.

Casas, M. & Stojanovic, L. 2013. Innovation in Ibero-American Universities. *Universities and Knowledge Society Journal,* 10 (1): 240-253.

Chen, S. 2015. Boundary objects and boundary brokering to make the research-policy-practice nexus possible: The case of the Chinese higher education field. *Higher Education Policy,* 28(4):441-457.

Cloete, N., Bailey, T., Pillay, P. Bunting, I. & Maassen, P. 2011. *Universities and economic development in Africa*. Wynberg: the Centre for Higher Education Transfromation.

Cloete, N. & Bunting, I. 2013. *Strengthening knowledge production in universities: Five South African case studies*. The Programme on Innovation, Higher Education and Research for Development (IHERD). Paris: OECD.

Cloete, N., Maassen, P. & Bailey, T. (Eds.). 2015. Knowledge production and contradictory functions in African Higher Education. *African Minds Higher Education Dynamics Series Vol. 1,* Cape Town, South Africa: African Minds.

Cohen, L., Manion, L. & Morrison, K. 2007. *Research methods in education* (6th ed). London and New York: Routledge.

Collins, K. M. T., Onwuegbuzie, A. J. & Jiao, Q. G. 2007. A mixed-methods investigation of mixed-methods sampling designs in social and health science research. *Journal of Mixed-methods Research*, 1(3): 267-294.

Collins, K. M., Onwuegbuzie, A. J. & Jiao, Q. J. 2006. Prevalence of Mixed-methods Sampling Designs in Social Science Research. *Evaluation and Research in Education,* 19(2): 83 -101.

Combs, J. P. & Onwuegbuzie, A. J. 2010. Describing and illustrating data analysing mixed research. *International Journal of Education*, 2 (2):1-23.

Creswell, J. W. 2014. *Research design: qualitative, quantitative, and mixed-methods approach* (4th ed.). Los Angles/London/ New Delhi/Singapore/ Washington D.C: SAGE.

Creswell, J. W. 2012. *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston: Pearson Education.

Creswell, J. W. 2009. *Research design: Qualitative, quantitative and mixed-methods Approaches.* 3rd ed. London: SAGE.

Creswell, J. W. 2007. *Qualitative inquiry and research design: Choosing among five appr*oaches (2nd ed.). Thousand Oaks, London and New Deli: SAGE.

Creswell, J. W. 2003. *Research design: Qualitative, quantitative, and mixed-methods approach* (2nd ed.).Thousand Oaks: SAGE.

Creswell, J. W. & Garrett, A. L. 2008. The "movement" of mixed-methods research and the role of educators. *South African Journal of Education,* 28(3):321-333.

Creswell J. W., & Plano Clark, V. L. 2007. *Designing and conducting mixed-methods research (*2nd ed.). Thousand Oaks: SAGE.

Creswell, J. W., Plano Clark, V. L., Gutmann, M. L. & Hanson, W. E. 2003. Advanced mixed-methods research designs. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed-methods in social and behavioural research,* 209 -240. Thousand Oaks: SAGE.

Crompton, H. 2007. Mode 2 knowledge production: Evidence from orphan drug networks**.** *Science and Public Policy*, 34(3):199–211.

Cornell University, INSEAD, and WIPO. 2015. *The Global innovation index 2015: Effective innovation policies for development*, Fontainebleau, Ithaca, and Geneva.

Corona, J. M., Dutrénit, G., Puchet, M. & Santiago, F. 2014. The changing role of science, technology and innovation policy in building systems of innovation: The case of Mexico. *Science, Technology and Innovation Policies for Development*, 7(2):15-43.

Cunningham, J., O'Reilly, P., O'Kane, C. & Mangematin, V. 2014. The inhibiting factors that principal investigators experience in leading publicly funded research. *Journal of Technology Transfer* 39(1):93–110.

Daft, R. 2011. *Leadership* (5th ed). Southwestern: Cengage Learning.

Debowski, S. 2010. Leading research in an evolving world: Implications for higher education development, policy and practice. *Research and Development in Higher Education: Reshaping Higher Education,* 33*:*213–222.

Deem, R. 2006. Changing research perspectives on the management of higher education: Can research permeate the activities of manager-academics? *Higher Education Quarterly*, 60(3):203–228.

Dellinger, A. B. & Leech, N. L. 2007. Toward a unified validation framework in mixed-methods research. *Journal of Mixed-methods Research*, 1(4):309-332.

Department for Business and innovation and Skills. 2014. *Innovation report*. Innovation, research and growth, March 2014.

Desta, D. 2004. Observations and reflections of the higher education teachers on the quality of teaching and learning in higher education in Ethiopia. *The Ethiopian Journal of Higher Education,* 1(1):63 – 81.

DeVellis, R. F. 2003. *Scale development: Theory and applications* (2nd ed.). California, UK and India: SAGE.

Edler, J. & Fagerberg, J. 2017. Innovation policy: What, why, and how**.** *Oxford Review of Economic Policy*, 33(1):2–23.

Eid, F. H. 2014. Research, higher education and the quality of teaching: Inquiry in a Japanese academic context. *Research in Higher Education Journal*, 24:1-25.

El Hadidi, H. H. & Kirby, D. A. 2017. University–industry collaboration in a factor-driven economy: The perspective of Egyptian industry. *Industry and Higher Education*, 31(3): 195–203.

Elliott, G. 2013. Character and impact of social innovation in higher education. *International Journal of Continuing Education and Lifelong Learning*, 5(7):1- 84.

Elkins, T. & Keller, R. T. 2003. Leadership in research and development organisations: A literature review and conceptual framework. *The Leadership Quarterly*, 14(4-5): 587- 606.

Emiru, Z. 2012. *An investigation into the research Culture of Addis Ababa University: The case of teaching English as a foreign Language (TEFL) PhD programme*. Unpublished PhD thesis, Addis Ababa University, School of Graduate Studies, Addis Ababa, Ethiopia.

Ethiopian Science and Technology Agency. 2006. *National science, technology and innovation policy of Ethiopia: Draft for Discussion*. Prepared by The Ethiopian Science and technology Agency, October 2006, Addis Ababa, Ethiopia.

Etzkowitz, H. 2003. Innovation in innovation: Triple Helix of university-industry-government relations. *Social Science Information*, 42(3): 293-337.

European Commission. 2017. *New Horizons: Future scenarios for research & innovation policies in Europe*.

European Commission. 2015. *A new role for EU research and innovation in the benefit of citizens: Towards an open and transformative R&I policy*. Policy Paper by the Research, Innovation, and Science Policy Experts (RISE). Luxembourg: Publications Office of the European Union.

Evans, L. 2012. Leadership for researcher development: What research leaders need to know and understand? *Educational Management Administration & Leadership,* 1-13, DOI: 10.1177/1741143212438218.

Evoh, C. J., Mugimu, C. B. & Chavula, H. K. 2013. Knowledge production in the knowledge economy: Higher education institutions and the application of innovations in ICT for capacity development in Africa. *The Development of Higher Education in Africa: Prospects and Challenges International Perspectives on Education and Society,* 21: 285–323.

Fatah, A. A., Thiruchelvam, K. & Ng, B. K. 2013. Understanding the regional innovation support systems in developing countries: The state of Sabah in Malaysia. *International Development Planning Review*, 35 (1):41-66.

Federal Democratic Republic of Ethiopia (FDRE). 2016. *Growth and transformation plan II (GTP II) (2015/16-2019/20) Volume I: Main Text*. National Planning Commission, May 2016, Addis Ababa, Ethiopia.

FDRE. 2012. *Science, technology and innovation policy*, February 2012, Addis Ababa, Ethiopia.

FDRE. 2010. *Growth and transformation plan (GTP) 2010/11-2014/15: Draft.* Ministry of Finance and Economic Development, September 2010, Addis Ababa, Ethiopia.

FDRE. 2009. *Higher Education Proclamation No. 650/2009*, Addis Ababa: Federal Negaret Gazeta.

FDRE. 1994. *Education and Training Policy*, Addis Ababa: St. George Printing press.

Feilzer, M. Y. 2009. Doing mixed-methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of Mixed-methods Research*, XX(X):1–11.

Feldman, M. P. & Stewart, I. I. 2007. *Well-springs of modern economic growth: Higher education, innovation and local economic development*, January 18, 2007.

Fielding, N. G. 2012. Triangulation and mixed-methods designs: Data integration with new research technologies. *Journal of Mixed-methods Research*, 6(2):124–136.

Fignu University. 2018. *Facts and figures*, Fignu University, Ethiopia.

Fignu University. 2017. *Research thematic areas final document*, Fignu University, Ethiopia.

Filippov, S. & Mooi, H. 2009. I*nnovation project management: A research agenda.* The 6th International Conference for Innovation and Management (ICIM2009), UNU-MERIT Conference publications, Sao Paolo.

Fussy, D. S. 2017. Policy directions for promoting university research in Tanzania. *Studies in Higher Education*, DOI: 10.1080/03075079.2016.1266611.

Galland, J. C., Mccutcheon, J. R. & Chronister, L. U. 2008. Laboratory Management Institute: A Model for the Professional Development of Scientists**,** *The Journal of Research Administration,* XXXIX (2):51-67.

Gebremeskel, H. H. 2015. *Academic leaders' views of the role of organisational culture in implementing management innovation: The case of Bahir Dar University, Ethiopia*. Master's Thesis, University of Tampere, School of Management, Higher Education Group.

Georghiou, L. & Harper, J. C. 2011. From priority setting to articulation of demand: Foresight for research and innovation policy and strategy. *Futures,* 43(3):243–251.

Gibbons, M. 2008. *Why is Knowledge Translation Important? Grounding the Conversation*. KT08: Forum for the Future; Banff, Alberta, Canada.

Gliem, J. A. & Gliem, R. R. 2003. *Calculating, interpreting, and reporting Cronbach's Alpha Reliability Coefficient for likert-type scales*. Presented at the Midwest Research-to-Practice Conference in Adult, Continuing, and Community Education, The Ohio State University, Columbus, OH, October 8-10, 2003.

Goatley, V. J. & Johnston, P. 2013. Innovation, research, and policy: Evolutions in classroom teaching. *Language Arts,* 91(2): 94-104.

Government of India .2013. T*he science, technology and innovation policy,* New Delhi, January, 2013.

Guetterman, T. C. 2017. Designing a rigorous mixed-methods research study. *Journal of Qualitative Research,* 18(1):1-16.

Guimón, J. & Agapitova, N. 2013. Why should governments of developing countries invest in R&D and innovation? *African Journal of Business Management,* 7(12): 899-905.

Gülcan, M. 2015. Complexity theory and new leadership paradigm. *British Journal of Education, Society & Behavioural Science*, 10(2): 1-12.

Hall, R., 2012. *Mixed-methods: In search of a paradigm*. Vortrag, from http://www. auamii. Com/proceedings_Phuket_2012/Hall.Pdf.

Hamida, M. R., Abdullah, M., Shouldafa, Z., Abidind, N. Z., & Ahmad, H. 2015. Conceptual framework of innovation excellence model for higher education institutions. *Procedia - Social and Behavioural Sciences,* 174: 2846-2848.

Hansson, F. & Mønsted, M. 2008. Research leadership as entrepreneurial organising for research. *Higher Education,* 55(6): 651-670.

Harmonized Academic Policy of Ethiopian Public Higher Education Institutions. 2013. Addis Ababa, Ethiopia.

Harries, S. 2012. *Records management and knowledge mobilization: A handbook for regulation, innovation and transfromation*. UK: Woodhead publishing.

Hatch, M. J. & Cunliffe A. L. 2006. *Organisation Theory: Modern, Symbolic, and Postmodern Perspectives* (2nd ed.). New York: Oxford University Press.

Hazy, J. K. & Uhl-Bien, M. 2013. Towards operationalizing complexity leadership: How generative, administrative and community-building leadership practices enact organisational outcomes. *Management Department Faculty Publications.* Paper 108. htp://digitalcommons.unl.edu/managementfacpub/108.

Hazy, J. K. & Uhl-Bien, M. 2015. Towards operationalizing complexity leadership: How generative, administrative and community-building leadership practices enact organisational outcomes. *Leadership*, 11(1):79-104.

Hessels, L. K. & van Lente, H. 2008. Re-thinking new knowledge production: A literature review and a research agenda. *Research Policy,* 37(4):740–760.

Hjelt, M., den Hertog, P., te Velde, R., Syrjänen, M. & Ahonen, P. 2008. Major challenges for the governance of national research and innovation policies in small European countries. *Tekes Review*, 236/2008.

Ho, D. 2007. *Research, Innovation and Knowledge Management: The ICT Factor*. Commissioned paper for the UNESCO Forum on Higher Education, Research and Knowledge, Paris: UNESCO.

Hoareau, C. Ritzen, J. & Marconi, G. 2012. The State of University Policy for Progress in Europe Policy Report, December 2012.

Hobeanu, L. V. 2011. New tendencies in higher education in the knowledge society. *Journal of Research in Educational Sciences*, II (4):12-22.

Holzbaur, U. D. 2005. Supporting innovation and entrepreneurship: University's contribution to sustainable economic development. *Journal for New Generation Sciences*, 3(1):49-61.

Hood, D. P. 2003. *Scientific research and evidence-based practice*. WestEd: Improving education through research, development and service.

Horth, D. & Buchner, D. 2014. *Innovation leadership: How to use innovation to lead effectively, work collaboratively, and drive results*. Centre for Creative Leadership.

Hughes, A., 2011. Open innovation, the Haldane principle and the new production of knowledge: science policy and university–industry links in the UK after the financial crisis. *Prometheus*, 29(4):411- 442.

Ilon, L. & Kantini, M. S. 2013. Universities as leaders in community development: The case of the University of Zambia. *Collective Efficacy: Interdisciplinary Perspectives on International Leadership Advances in Educational Administration,* 20:137-162.

Iizuka, M. & Gault, F. 2015. *Innovation for development in Southern and Eastern Africa: Challenges for promoting ST&I policy*. Policy Brief, number 1, 2015, United Nations University.

Institut für Technologie und Regionalpolitik. 2004. *Priorities in science & technology policy - an international comparison*.

International Organisation for Knowledge Economy and Enterprise Development. 2006. *Ethiopia: Innovation and growth in international comparison.* Prepared for triple helix conference on transforming university-industry-government relations in Ethiopia, 29th - 31st May, 2006, Addis Ababa, Ethiopia.

Ivey, P. W. 2015. *Research and innovation management: A key value-adding function deserving support in Caribbean HEIs***.** University of Technology, Jamaica. DOI: 10.13140/RG.2.1.5168.4003

Ivey, P. W. & Henry, M. 2016. Research managers at Jamaica's National University are strategically deploying a modest research development fund in support of impactful research. *Research Management Review,* 21(1):1-16.

Jacob, M. & Hellström, T. 2014. Opportunity from crisis: A common agenda for higher education and science, technology and innovation policy research. *Studies in Higher Education,* 39(8):1321-1331.

Janischewski, J. & Branzk, K. 2008. *Innovation policy trends in selected Countries: Discussion Paper*. Published by Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ).

Jasimuddin, S. M. 2012. *Knowledge management: An interdisciplinary perspective. Series on innovation and knowledge management*. Singapore: World Scientific Publishing.

Jebessa, F. 2007. Action research practices in teaching English as a Foreign Language (EFL) at Addis Ababa University: Implication for quality language teaching. *The Ethiopian Journal of Higher Education,* IV (2):1-21.

Jenkins, I. Breen, R. Lindsay, R. & Brew, A. 2003. *Reshaping teaching in higher education: Linking teaching with research.* London and Sterling, VA: Kogan.

Johnson, A. M. 2013. *Improving your research management (* 2nd ed). Amsterdam: Elsevier.

Johnson, B. & Christensen, L. 2008. *Educational research: Quantitative, qualitative, and mixed approaches*. Los Angles and London: SAGE.

Johnson, R. B. & Onwuegbuzie, A. J. 2004. Mixed-methods research: A research paradigm whose time has come. *Educational Researcher*, 33(7):14–26.

Johnson, R. B., Onwuegbuzie, A. J. & Turner, L. D. 2007. Toward a definition of mixed-methods research. *Journal of Mixed-methods Research*, 1(2):112-133.

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. 2005. *Mixed-methods research: Is there a criterion of demarcation?* Paper presented at the annual meeting of the American Educational Research Association, Montreal, Canada.

Jongbloed, B., Enders, J. & Salerno, C. 2008. Higher education and its communities: Interconnections, interdependencies and a research agenda. *Higher Education,* 56(3):303–324.

Jowi, J. O, Obamba, M. Sehoole, C., Alabi, G., Oanda, O. & Barifaijo, M. 2013. *Governance of higher education, research and innovation in Ghana, Kenya and Uganda*. Programme on Higher Education and Research for Development (IHERD). Paris: OECD.

Juma, C. 2016. *Education, research, and innovation in Africa: Forging strategic linkages for economic transformation: Discussion paper 2016-01*. Belfer Center for Science and International Affairs | Harvard Kennedy School.

Juma, C. 2008. Agricultural innovation and economic growth in Africa: Renewing international cooperation. *International Journal of Technology and Globalisation*, *4*(3):256.

Kang, J. S. 2015. Initiatives for change in Korean higher education: Quest for excellence of world - class universities. *International Education Studies,* 8(7):169-180.

Kantola, M. & Kettunen, J. 2012. Integration of education with research and development and the export of higher education. *On the Horizon*, 20(1):7-16.

Kezar, A., Carducci, R. & Contreras-McGavin, M., 2006. *Rethinking the" L" word in higher education: The revolution of research on leadership: ASHE higher education report*. John Wiley & Sons.

Kirkland, J. 2008. University research management: An emerging profession in the developing world. *Technology Analysis & Strategic Management*, 20(6):717–726.

Kirkland, J. & Ajai-Ajagbe, P. 2013. *Research management in African universities: From awareness raising to developing structures*. The Association of Commonwealth Universities, Woburn House, London.

Kowang, T. O., Long, C. S. & Rasli, A. 2015. Innovation management and performance framework for research university in Malaysia. *International Education Studies*, 8(6):32-45.

Kraft, M. E. & Furlong, S. R. 2010, *Public policy: Politics, analysis alternatives (*3rd ed). Washington, DC: CQ Press.

Kuhlmann, S. 2003. Evaluation of research and innovation policies: A discussion of trends with examples from Germany. *International Journal of Technology Management,* 26(2/3/4): 131-149.

Kuratko, D. F., Goldshy, M. G. & Hornsby, J. S. 2012. *Innovation acceleration: Transforming organisational thinking*. New Jersey: Pearson Education.

Lasambouw, C. M. 2015. Research management in vocational higher education in Indonesia: Policy and practice in Bandung State Polytechni. *TVET@Asia*, 4:1-16.

Lichtenstein, B. B. & Plowman, D. A. 2009. The leadership of emergence: A complex systems leadership theory of emergence at successive organisational levels. *The Leadership Quarterly,* 20: 617–630.

Lichtenstein, B. B., Uhl-Bien, M., Marion, R., Seers, A., Orton, J. D., & Schreiber, C. 2006. *Complexity leadership theory: An interactive perspective on leading in complex adaptive systems*. Management Department Faculty Publications. Paper 8. http://digitalcommons.unl.edu/managementfacpub/8.

Liu, F., Simon, D. F., Sun, Y. & Cao, C. 2011. China's innovation policy: Evolution, institutional structure, and trajectory. *Research Policy,* 40: 917 -931.

Lodico, M. G., Spaulding, D. T. & Voegtle, K. H. 2010. Methods in educational research: From theory to practice (2nd ed.). San Francisco: Jossey-Bass.

Lodico, M. G., Spaulding, D. T. & Voegtle, K. H. 2006. *Methods in educational research: From theory to practice*. San Francisco: Jossey-Bass.

López, B. J., Santoyo, G. A. R. & Paolacci, J. 2017. The impact of the university-enterprise linkage on scientific research, technological development and innovation in companies in the Mexican state of Aguascalientes. *Dialoos Sobre Educacion,* 8(14):1-14.

Lukenchuk, A. & Kolich, E. 2013. *Paradigms and educational research: Weaving the tapestry*. In Counterpoints, Vol. 436, Paradigms of Research for the 21st Century: Perspectives and examples from practice, 61 -87. Peter Lang AG, from http://www.jstor.org/stable/42981910.

Lundequist, P. & Waxell, A. 2010. Regionalizing mode 2: The adoption of centres of excellence in Swedish research policy. *Geografiska Annaler: Series B, Human Geography,* 92 (3): 263–279.

Ma, W. 2003. *Economic reform and higher education in China. CIDE occasional papers series: Higher education CIDE contributions No. 2.* Los Angeles: Centre for

International & Development Education and UCLA Graduate School of Education & Information Studies.

Mahdi, R. 2015. Evaluation of national science and technology policies in Iran. *Procedia - Social and Behavioural Sciences,* 195:210 - 219.

Maitra, P. 2007. *Higher Education and Global Challenges*. New Delhi: Saurabh Publishing House.

Makrakis, V. & Kostoulas-Makrakis, N. 2016. Bridging the qualitative–quantitative divide: Experiences from conducting a mixed-methods evaluation in the RUCAS programme. *Evaluation and Programme Planning,* 54:144–151.

Malina, M. A., Nørreklit, H. S. O. & Selto, F. H. 2011. Lessons learned: advantages and disadvantages of mixed-method research. *Qualitative Research in Accounting & Management,* 8(1): 59 – 71.

Marin, E., Iftimescu, S., Ion, G., Stîngu, M. & Proteasa, C. 2017. *Academic managers` perspective on research management in higher education institutions across Romania*. 3rd International Conference on Higher Education Advances, HEAd'17 Universitat Politècnica de València, València, Center For Development And Training In Higher Education, University of Bucharest DOI: http://dx.doi.org/10.4995/HEAd17.2017.5544.

Martin, J. S. & Marion, R. 2005. Higher education leadership roles in knowledge processing. *The Learning Organisation,* 12 (2):140-151.

Mashau, T., Mulaudzi, P., Kone, L. & Mutshaeni, H. 2014. Traits of Leadership and Management in Teaching and Learning, Research and Innovation and Community Engagement in Universities of South Africa, *International Journal of Education Science,* 7(3):517-524.

Mason, M. (ed.). 2008. *Complexity Theory and the Philosophy of Education.* UK*:* A John Wiley & Sons.

Marshall, G. 2005. The purpose, design and administration of a questionnaire for data collection. *Radiography,* 11(2):131-136.

Maxwell, J. A. & Mittapalli, K. 2010. Realism as a stance for mixed-methods research. In Tashakkori, A. & Teddlie, C. (Eds.). *Sage Handbook of Mixed-methods in Social and Behavioural Research,* 145-167. California: Sage.

Mazzucato, M. 2018. *Mission-Oriented Research & Innovation in the European Union: A problem-solving approach to fuel innovation-led growth.* Directorate-General for Research and Innovation European Commission.

McCaffery, P. 2010. *The higher education manger's handbook: Effective leadership and management in universities and colleges* (2nd ed.). New York and London: Routledge/ Taylor and Francis Group.

McEvoy, P. & Richards, D. 2006. A critical realist rationale for using a combination of quantitative and qualitative methods. *Journal of Research in Nursing*, 11(1): 66–78.

McInnis, C. Ramsden, P. & Maconachie, D. 2014. *A handbook for executive leadership of research development*. A publication of the Centre for Leadership in Research Development at the University of the Sunshine Coast (USC) in partnership with the Queensland University of Technology (QUT).

Meek, V. L., Teichler, U. & Kearney, M. (Eds.). 2009. *Higher education, research and Innovation: Changing dynamics report on the UNESCO forum on higher education, research and knowledge 2001-2009.* Kassel University, Germany: INCHER.

Méndez, E. & Cruz, M. 2014. Research culture in higher education: The case of a foreign language department in Mexico. *PROFILE Issues in Teachers' Professional Development,* 16(2):135-150.

Mertens, D. M. 2012. Editorial: What comes first? The paradigm or the approach? *Journal of Mixed-methods Research,* XX(X): 1–3.

Mertens, D. M. 2005. *Research methods in education and psychology: Integrating diversity with quantitative and qualitative approaches* (2nd ed.). Thousand Oaks: SAGE.

Middlehurst, R., Goreham, H. & Woodfield, S. 2009. Why research leadership in higher education? Exploring contributions from the UK's leadership foundation for higher education. *Leadership,* 5(30): 311-329.

Ministry of Education [MoE]. 2016. *Research and technology transfer conceptual and governance framework of Ethiopian higher learning institutions*. Draft for circulation, Ministry of Education, Addis Ababa, Ethiopia.

MoE. 2015. *Education Sector development Programme IV (ESDP IV), 2015/16 - 2019/20: Programme Action Plan*, Addis Ababa, Ethiopia.

Mohamedbhai, G. 2012. Research, networking, and capacity building in Africa. *International Higher Education,* 68:21-23.

Mok, K. H. 2012. The quest for innovation and entrepreneurship: the changing role of university in East Asia. *Globalisation, Societies and Education*, 10(3): 317-335.

Moore, S. & Shangraw Jr, R. F. 2011. Managing risk and uncertainty in large-scale university research projects. *Research Management Review,* 18(2):59-78.

Moran, M., Rein, M. & Goodin, R. E. (Eds.). 2006. *The oxford handbook of public policy*. New York: Oxford University Press.

Morgan, D. L. 2014. Pragmatism as a paradigm for social research. *Qualitative Inquiry*, 20(8):1045–1053.

Morgan, D. L. 2007. Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed-methods Research*, 1(1):48-76.

Morrison, K. 2006. *Complexity theory and education*, APERA Conference, 28–30 November 2006, Hong Kong.

Morris, H. & Setser, B. 2015. *Building a culture of innovation in higher education: design and practice for leaders*. 2Revolutions and EDUCAUSE: USA.

Mpehongwa, G. 2013. Academia-industry-government linkages in Tanzania: Trends, challenges and prospects. *Educational Research and Reviews*, 8(21):2093 -2100.

Mugabe, J. O. 2011. Science, technology and innovation in Africa's regional integration: From rhetoric to practice. *ACODE Policy Research Series*, No. 44, 2011. Kampala.

Mulu, N. K. 2017. The links between academic research and economic development in Ethiopia: The case of Addis Ababa University. *European Journal of STEM Education*, 2(2), 05.https://doi.org/10.20897/ejsteme.201705.

Muresan, M. & Gogu, E. 2012. Tertiary education's role in research and innovation. *Procedia - Social and Behavioural Sciences*, 46: 3681-3688.

Musson, D. 2006. *The production of mode 2 knowledge in higher education in South Africa*. DED thesis, Department of Comparative Education, University of South Africa.

Nega, M. 2017. *Research and knowledge transfer at public universities in Ethiopia: Translating vision into action*. A Paper presented on the 35 May Annual International Educational Conference, Higher Education in Ethiopia: Advancing Teaching, Research and Community Outreach Engagement, May 19-20, 2017, College of Education and Behavioural Sciences, Bahir Dar University, Ethiopia.

Nguyen, T. H. 2013. The challenges of developing research resources for leading Vietnamese universities. *Higher Education Management and Policy*, 24/2, http://dx.doi.org/10.1787/hemp-24-5k3w5pdwd7g4.

Nguyen, H. T. L. & Gramberg, B. V. 2017. University strategic research planning: A key to reforming university research in Vietnam. *Studies in Higher Education*, DOI: 10.1080/03075079.2017.1313218.

Nguyen, H. T. L & Meek, V. L. 2016. Key Problems in organising and structuring university research in Vietnam: The lack of an effective research "behaviour formalization" system. *Minerva,* 54(1):45–73.

Nicolae, M. & Vielar, A. 2013**.** Knowledge transfer in Romanian higher education. *Management Dynamics in the Knowledge Economy*, 1(1): 87-99.

Nicolaides, A. 2014. Research and innovation - the drivers of economic development. *African Journal of Hospitality, Tourism and Leisure,* 3 (2):1-16.

Njoku, C., Anyanwu, J. & Kaegon, L. E. 2014. The Roles of Higher Education in Economic Development: Challenges and Prospects of Nigerian Higher Education Institutions. *African Higher Education Review,* 8 (1):22-30.

Nooteboom, B. & Stam, E. (Eds.). 2008. *Micro-foundations For Innovation Policy.* Amsterdam: Amsterdam University Press.

Nowotny, H., Scott, P. & Gibbons, M. 2003. 'Mode 2' Revisited: The New Production of Knowledge. *Minerva,* 41**:**179–194.

Nyerere, J. 2013. Higher education research, science and technology transfer: A Look at the policy strides made in East Africa. *SA-eDUC JOURNAL,* 10(1):1-28.

Organisation for Economic Cooperation and Development [OECD]. 2012. Innovation for development: A discussion of the issues and an overview of work of the OECD Directorate for Science, Technology and Industry.

OECD. 2015. *OECD Reviews of Innovation Policy: Sweden 2016* - Preliminary Version.

OECD Centre for Educational Research and Innovation. 2008. *Innovating to Learn, Learning to Innovate*. In Paris and Washington, D.C.: Organisation for Economic Co-operation and Development.

Oeij, P., Gaspersz, J., van Vuuren, T. & Dhondt, S. 2017. Leadership in innovation projects: An illustration of the reflective practitioner and the relation to organisational learning. *Journal of Innovation and Entrepreneurship,* 6(1):1-20.

Ogbodo, C. M., Efanga, S. I. & Ikpe, U. G. 2013. Knowledge production in higher education: Policies and practices in Nigeria. *International Education Studies,* 6(12): 9-14.

Olsson, A. & Meek, L. 2013. *Effectiveness of research and innovation management at policy and institutional levels in Cambodia, Malaysia, Thailand and Vietnam, Programme on Innovation, Higher Education and Research for Development.* Paris: OECD.

Onwuegbuzie, A. J., & Collins, K. M. T. 2007. A typology of mixed-methods sampling designs in social science research. *The Qualitative Report,* 12(2):281-316.

Onwuegbuzie, A. J. & Johnson, R. B. 2007. The Validity issue in mixed research. *Research in the Schools*, 13(1):48-63.

Onwuegbuzie, A. J., & Leech, N. L. (2006). Linking Research Questions to Mixed-methods Data Analysis Procedures. *The Qualitative Report*, *11*(3): 474-498.

Owen, R., Macnaghten, P. & Stilgoe, J. 2012. Responsible research and innovation: From science in society to science for society, with society. *Science and Public Policy,* 39(6):751-760.

Owusu, F., Kalipeni, E., Awortwi, N. & Kiiru, J. M. M. 2017. Building research capacity for African institutions: Confronting the research leadership gap and lessons from African research leaders, *International Journal of Leadership in Education*, 20(2):220-245.

Oyewole, O. 2010. Africa and the global knowledge domain. In D. Teferra & H. Greijn (Eds.), *Higher education and globalization: Challenges, threats, and opportunities for Afric*. Maastricht: MUNDO.

Plowman, D. A., Solansky, S., Beck, T. E., Baker, L., Kulkarni, M. & Travis, D. V. 2007. The role of leadership in emergent, self-organisation. *The Leadership Quarterly*, 18(4):341-356.

Powers, L. C. & Kerr, G. 2009. Project management and success in academic research. *Real World Systems Research Series* 2009:2. Available at SSRN: http://ssrn.com/abstract=1408032.

Punch, F. K. 2005. *Introduction to social research: Quantitative and qualitative approaches* (2nd ed.). London: SAGE.

Punch, K. F. & Qancea, A. 2014. *Introduction to research methods in education* (2nd ed.). Los Angles / London: SAGE.

Qu, S. Q. & Dumay, J. 2011. The qualitative research interview. *Qualitative Research in Accounting & Management*, 8(3):238-264.

Ranga, M. & Etzkowitz, H. 2013. Triple helix systems: An analytical framework for innovation policy and practice in the knowledge society. *Industry and Higher Education,* 27(40):237-262.

Rapini, M. S., Chiarini, T. & Bittencourt, P. F. 2017. Obstacles to innovation in Brazil: The lack of qualified individuals to implement innovation and establish university–firm interactions. *Industry and Higher Education,* 31(3):168–183.

Republic of Kenya, Ministry of Higher Education, Science and Technology. 2012. *A policy framework for science, technology and innovation: Revitalizing and harnessing science, technology and innovation in Kenya*, Sessional paper no… of 2012.

Research Councils UK. 2007. *Excellence with impact*. http://impacts.rcuk.ac.uk.

Riaz1, A. Tahir, M. M. & Noor, A. 2013. Leadership is vital for project managers to achieve project efficacy. *Research Journal of Recent Sciences,* 2(6):99-102.

Robson, S., Wall, K. & Lofthouse, R. 2013. Raising the profile of innovative teaching in higher education: Reflections on the EquATE project. *International Journal of Teaching and Learning in Higher Education*, 25 (1):92-102.

Rodriguez, V, & Montalvo, C. 2007. Innovation policies from the European Union: Methods for classification**.** *Bulletin of Science, Technology & Society*, 27(6):467-481.

Roll-Hansen, N. 2009. *Why the distinction between basic (theoretical) and applied (practical) research is important in the politics of science*. Centre for the Philosophy of Natural and Social Science Contingency and Dissent in Science Technical Report 04/09. London: the Contingency And Dissent in Science Project Centre for Philosophy of Natural and Social Science The London School of Economics and Political Science.

Saad, M. Guermat, C. & Brodie, L . 2015. National innovation and knowledge performance: the role of higher education teaching and training. *Studies in Higher Education*, 40(7):1194–1209.

Salem, M. I. 2014. The role of universities in building a knowledge-based economy in Saudi Arabia. *International Business & Economics Research Journal*, 13(5):1047-1056.

Saltmarsh, S., Sutherland-Smith, W. & Randell-Moon, H. 2011. 'Inspired and assisted', or 'berated and destroyed'? Research leadership, management, and performativity in troubled times. *Ethics and Education*, 6(3):293–306.

Savrul, M. & Incekara, A. 2015. The effect of R&D Intensity on Innovation perfromance: A country level evaluation. *Procedia - Social and Behavioural Sciences,* 210*:*388-396.

Sawyerr, A. 2004. Challenges facing African Universities: Selected issues. *African Studies Review*, 47(1):1-59.

Schneider, M. & Somers, M. 2006. Organisations as complex adaptive systems: Implications of complexity theory for leadership research. *The Leadership Quarterly*, 17(4): 351-365.

Schultz, D. (Ed). 2004. *Encyclopaedia of public administration and public policy*. New York: Facts On File.

Schwaag-Serger, S., & Grobbelaar, S. 2016. *Realising innovation opportunities in sub-Saharan Africa: Final Report*. Stellenbosch Institute for Advanced Study: Lund University.

Schwachula, A., Seoane, M. V. & Hornidge, A. 2014. *Science, technology and innovation in the context of development: An overview of concepts and corresponding policies*

recommended by international organisations. Working Paper 132, Centre for Development Research, University of Bonn, Germany.

Segnu University. 2018. *Facts and figures*, Segnu University, Ethiopia.

Segnu University. 2011. *Research policy and guidelines*, Segnu University, Ethiopia.

Sergeev, N. 2017. High-priority directions of modernization of university education in innovational society. *International Journal of Educational Management*, 31(1):56-61.

SERI. 2016. *Research and innovation in Switzerland 2016*. Bern: State Secretariat for Education, Research and Innovation.

Shannon-Baker, P. 2016. Making paradigms meaningful in mixed-methods research. *Journal of Mixed-methods Research*, 10(4):319–334.

Shapiro, H. Haahr, J. H. & Bayer, I. 2007. *Background Paper on Innovation and Education*. For the European Commission, DG Education & Culture in the context of a planned Green Paper on Innovation.

Shattock, M. 2003. *Managing Successful Universities.* England: Society for Research into Higher Education & Open University Press.

Sousa, S. B., 2011. The transformation of knowledge production and the academic community. *Educação, Sociedade & Culturas*, (32).

Stentz, J. E., Clark, V. L. P. & Matkin, G. S. 2012. Applying mixed-methods to leadership research. *The leadership quarterly*, 23(6):1173-1183.

Sterling, S. 2004. Higher education, sustainability, and the role of systemic learning. In P. Corcoran & A. Wals (Eds.), *Higher education and the challenges of sustainability: problematic, promise and practice*, 49-70. Dordrecht, Holland: Kluwer.

Swanger, D. 2016. *Innovation in higher education: Can Colleges really change?*

Taghavi, M., Taghavi, H. & Taghavi, M. 2013. Research project leadership stipulation system. *Campus-Wide Information Systems*, 30(4):266-287.

Taherdoost, H. 2016. Validity and reliability of the research instrument; How to test the validation of a questionnaire/survey in a research. *International Journal of Academic Research in Management,* 5(3):28-36.

Tamtik, M. 2016. Institutional Change Through Policy Learning: The case of the European Commission and research policy. *Review of Policy Research,* 33(1):5-21.

Tarnawska, K. & Mavroeidis, V. 2015. Efficiency of the knowledge triangle policy in the EU member states: DEA approach. *Triple Helix,* 2(1):1-22.

Tashakkori, A. 2009. Editorial: Are we there yet? The state of the mixed-methods community. *Journal of Mixed-methods Research,* 3(4):287-291.

Teddlie, C. & A. Tashakkori. 2010. Overview of contemporary issues in mixed-methods research. In Tashakkori, A. & Teddlie, C. (Eds.). *Sage Handbook of Mixed-methods in Social and Behavioural Research*, 1-41. California: Sage.

Teddlie, C. & Yu, F. 2007. Mixed-methods sampling: A typology with examples. *Journal of Mixed-methods Research*, 1(1):77-100.

Teferra, D. & Altbach, P. G. 2004. African higher education: challenges for the 21st century. *Higher Education*, 47(1):21-50.

Thgnu University. 2018. *Facts and figures*, Thgnu University, Ethiopia.

Thgnu University.2017. *Guidelines for research and development:A working document*, Thgnu University, Ethiopia.

Thgnstu University. 2018. *Facts and figures*, Thgnstu University, Ethiopia.

Thgnstu Universsity. 2013. *The research and technology transfer policy*, Thgnstu University, Ethiopia.

Torrance, H. 2012. Triangulation, respondent validation, and democratic participation in mixed-methods research. *Journal of Mixed-methods Research*, XX(X):1–13.

Uhl-Bien, M. & Arena, M. 2017. Complexity leadership: Enabling people and organisations for adaptability. *Organisational Dynamics*, retrieved from http://dx.doi.org/10.1016/ j.orgdyn.2016.12.001.

Uhl-Bien, M., Marion, R. & McKelvey, B. 2007. Complexity leadership theory: Shifting leadership from the industrial age to the knowledge era. *The Leadership Quarterly*, 18(4): 298-318.

Uhl-Bien, M. & Marion, R. 2009. Complexity leadership in bureaucratic forms of organising: A meso model. *The Leadership Quarterly*, 20(4): 631–650.

Venter, A. 2006. *Factors influencing a productive research management environment at two merging higher education institutions in South Africa*. Doctoral thesis, University of Southampton, United Kingdom.

Veugelers, R. & Del Rey, E. 2014. *The contribution of universities to innovation, (regional) growth and employment: European Network on Economics of Education: Analytical Report No. 18*. Prepared for the European Commission.

Walliman, N. 2011. *Your research project: Designing and planning your work* (3rd ed.). New Delhi: SAGE

Wamae, W. 2008. *STI Policy Research and the STI Policy Environment in Africa: A scoping paper for the IPS Programme*. Area of IDRC.

Weaver-Hightower, M. B. 2014. A mixed-methods approach for identifying influence on public policy. *Journal of Mixed-methods Research*, 8(2):115–138.

Wei, L. & Lin, H. 2017. Not a one-size-fits-all methodology: A survey of mixed-methods. *Journal of Advances in Education Research*, 2(2):97 -102.

Whitworth, A. 2012. Invisible success: Problems with the grand technological innovation in higher education. *Computers & Education*, 59(1):145–155.

Wilson-Medhurst, S. 2010. Knowledge production within the innovation system: a case study from the United Kingdom. *Higher Education Management and Policy*, 22(2):1-15.

Woelert, P. & Millar, V. 2013. The 'paradox of interdisciplinary' in Australian research governance. *Higher Education*, 66(6):755-767.

Wondimu, H. 2003. *Ethiopian higher education: Country report*. In Damtew Tefera and P.G Altbach (Eds.), African higher education: An International Reference Handbook, 316-325. Indiana University press.

World Economic Forum. 2016. *China's innovation ecosystem: White paper*. Geneva: Switzerland.

Yizengaw, T. 2004. The Status and challenges of Ethiopian higher education system and its contribution to development. *The Ethiopian Journal of Higher Education,* 1(1): 1-19.

Yizengaw, T. 2005. *Policy development in higher education in Ethiopia and the role of donors and development partners*. Paper presented at the International Expert Meeting-Fromulas that work: Making Higher education Support More effective, 23-24, May 2005, The Hague, The Netherlands.

Yizengaw, T. 2008. *Challenges of higher education in Africa and lessons of experience for the Africa - U.S. higher education collaboration initiative.* A synthesis report based on consultations made between March- April, 2008 and review of literature related to higher education and development in Africa, April, 2008, Washington D.C.

Zhang, Q., Larkin, C. & Lucey, B. M. 2017. The economic impact of higher education institutions in Ireland: Evidence from disaggregated input–output tables. *Studies in Higher Education,* 42(9):1601-1623.

Zhu, C. 2015. Organisational culture and technology-enhanced innovation in higher education. *Technology, Pedagogy and Education*, 24(1): 65-79.

Zhu, C. & Engels, N. 2014. Organisational culture and instructional innovations in higher education. *Educational Management Administration & Leadership*, 42(1):136-158.

APPENDICES

Appendix A: Permission letter to Higher Education Academic and Research Manager at the Ethiopian Ministry of Education

Letters of permission

Request for permission to conduct research at four higher education institutions

Title of the research: The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices

Date: May 30, 2018

Higher Academic and Research Directorate General at Ministry of Education,

Dear_____,

I, Damtew Wolde Berku, am doing research under supervision of HM van der Merwe a professor in the Department of Educational Leadership and Management towards a PhD at the University of South Africa. Four Universities are invited to participate in a study entitled: 'The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices'.

The aim of the study is to to investigate the research and innovation leadership and management at higher education institutions in Ethiopia both at policy and practice level.

Four higher education institutions have been selected because each one represents the generations and Science and technology universities that have been engaging in research. The study will entail collecting primary data using structured questionnaire and semi –structured interview, and analysing research and / or innovation policy, and five years annual reports that are related to research and innovation activities of your university. The benefits of this study are to improve the leadership and management of research and innovation activities of higher education institutions to address their own problems, the problems of the local communities and the nation at large. There is no risk of engaging in this research. And there will be no reimbursement or any incentives for participation in the research.

Feedback procedure will entail through the emails of research participants.

Yours sincerely

Damtew Wolde Berku Signature _____

Name Signature _____

Appendix B: Letter of permission to the vice-president for research and community engagement/technology transfer of each selected research site

Title of the research: The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices

Date: ----------

Dear Dr. _____,

I, Damtew Wolde Berku, am doing research under supervision of Prof HM van der Merwe a professor in the Department of Educational Leadership and Management towards a PhD at the University of South Africa. Your university is invited to participate in a study entitled: 'The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices'.

The aim of the study is to investigate the research and innovation leadership and management practices at higher education institutions in Ethiopia both at policy and practice level.

Your University has been selected because it is one of the second-generation universities that have been engaging in research. The study will entail collecting primary data using a structured questionnaire and semi-structured interviewing, and analysing research and innovation policy, and five years annual reports that are related to research and innovation activities at your university. The benefits of this study are to improve the leadership and management of research and innovation activities of higher education institutions to address their own problems, the problems of the local communities and the nation at large. There is no risk of engaging in this research. There will be no reimbursement or any incentives for participation in the research.

Feedback procedure will entail a summary of the research findings available to all participants.

Yours sincerely

Name: Damtew Wolde Berku Signature _____

Name: Signature _____

Appendix C: Letters of permission for the four zone administrators where the universities are located

Title of the research: The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices

Date: ----------

Dear Mr.--------,

I, Damtew Wolde Berku, am doing research under supervision of Prof HM van der Merwe a professor in the Department of Educational Leadership and Management towards a PhD at the University of South Africa. Four community leaders at zone level are invited to participate in a study entitled: 'The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices'.

The aim of the study is to to investigate the research and innovation leadership and management at higher education institutions in Ethiopia both at policy and practice level.

The community leaders have been selected because they are key stakeholders of _____University in its research and innovation activities and their leadership and management. The study will entail collecting primary data using structured questionnaire and semi –structured interview, and analysing research and / or innovation policy, and five years annual reports that are related to research and innovation activities of your university. The benefits of this study are to improve the leadership and management of research and innovation activities of higher education institutions to address their own problems, the problems of the local communities and the nation at large. There is no risk of engaging in this research. And there will be no reimbursement or any incentives for participation in the research.

Feedback procedure will entail a summary of the research findings available to all participants.

Yours sincerely

Name: Damtew Wolde Berku Signature _____

Name: Signature _____

Appendix D: Letter of consent for interview participants

1. PARTICIPANT INFROMATION SHEET

Date: ----------

Title: The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices

Dear prospective participant**,**

My name is Damtew Wolde Berku, and I am doing research under the supervision of Prof HM van der Merwe, a professor in the Department of Educational leadership and Management towards a PhD at the University of South Africa. I am inviting you to participate in a study entitled: 'The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices'. This study is expected to collect important information that could help to understand the leadership and management of research and innovation policies and practices in higher education institutions to address their own internal problems, the problems of the local communities and the nation.

You are invited because you are one of active the academic researchers in your University. I obtained your contact details from the research director of your University, and _____ participants including you are participating in this research. The study involves audio taping of semi – structured interview. There are different sort of questions that I will ask you. The interview will take 30 minutes. Your participation in this research is voluntary and you can withdraw at any time. The benefit that you will gain from your participation is mental satisfaction as you will provide valuable data from your experience to improve the research and innovation leadership and management at policy and practice levels. As all the data that you are going to provide will be recorded, used and stored anonymously including the name of your university will be replaced by pseudonyms, there is no discomfort and harm upon your participation in this research. Since I myself will code and transcribe your data, there is no possibility of access to the data obtained from you by a third party. When the report of this study is submitted for examination purposes and for research conference presentations and article publications, you will not be identified. After your data have been stored safely in hard and soft copy version for two years, the data will be discarded by burning the hard copies and deleting the soft copies from the computer permanently.

This study has received written approval from the Research Ethics Review Committee of the CEDU ERC, Unisa. A copy of the approval letter can be obtained from the researcher if you so wish. If you would like to be informed of the final research findings, please contact Damtew Wolde Berku on 0913725162 or email: damteww09@gmail.com. Should you have concerns about the way in which the research has been conducted, you may contact Prof HM van der Merwe at e-mail address vdmerhm@unisa.ac.za or cell phone +27834421503.

Thank you for taking time to read this information sheet and for participating in this study.

Researcher's Signature _____

Damtew Wolde Berku

2. CONSENT TO PARTICIPATE IN THIS STUDY

I, _____ (participant name), confirm that the person asking my consent to take part in this research has told me about the nature, procedure, potential benefits and anticipated inconvenience of participation.

I have read (the researcher had explained to me) the purpose of the research and I understood the study as explained in the information sheet. I had sufficient opportunity to ask questions and I am prepared to participate in the study. I understand that my participation is voluntary and that I am free to withdraw at any time without penalty. I am aware that the findings of this study will be processed into a research report, journal publications and/or conference proceedings, but that my participation will be kept confidential unless otherwise specified.

I agree to the recording of the audio taping during face to face interview. I have received a signed copy of the informed consent agreement.

Participant Name & Surname : _____

_____ _____

Participant Signature Date

Researcher's Name & Surname: Damtew Wolde Berku

_____  _____ _____

Researcher's signature Date

Appendix E: Instrument validation form by experts (Adapted from Taherdoost 2016)

Dear Dr. /Professor,

I have developed pool of items based on my theoretical framework and literature review. I am at the stage of testing the content and face validity of a questionnaire, interview, and document analysis instruments that I am going to use for collecting data for my doctoral thesis. My topic is on, 'The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices'. I thank you in advance for your cooperation in checking the content and face validates of my data collection instruments

I will administer the questionnaire and interview to the research and/ or innovation leaders (vice presidents for research and community engagement, research directors, technology transfer directors, research and community engagement coordinators, research and/ or innovation project leaders and managers, and academic researchers) at higher education institutions in Ethiopia, community leaders at zone level and managers of industries around each university. The aim of the study is to understand the leadership and management of research and innovation policies and practices in higher education institutions as this management takes place within a developing society in order to develop a model for effective functioning.

I have developed a from for assessing each item of the instruments that I have newly developed. When you check the items, please use the following criteria and comment freely.

Face validity: check whether the items in the instrument are relevant, reasonable, and clear. In so doing, use 1 for 'Yes' and 2 for 'No' on the left side margin of the each item

Content validity: check whether the items in the instrument are representative and adequate to measure the intended phenomena in the thesis topic. Rate how relevant they think each item is to what I intend to measure. In so doing, use 1 for 'not necessary', 2 for useful but not essential, or 3 for essential on the right side of the margin. And evaluate the items' clarity and conciseness and point out ways of tapping the phenomenon that I have failed to include.

Format: Comment on the logical flow in the instruments.
Instructions: are the instructions in the instruments clear?
Other: please make any additional suggestions and comments.

With kind regards,
Damtew Wolde Berku,
PhD student

Thesis title: The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices

The main research question:

How can higher education institutions lead and manage their research and innovation activities to be in line with national policies?

Sub-research questions:

1. What leadership theories can be used to explain the position of HEIs in the leadership and management of research and innovation for societal development?
2. What is already known about the leadership and management of research and innovation in higher education institutions in order to improve their own teaching, to solve the problems of the local communities, and to produce new knowledge, ideas, and technologies?
3. How do leaders lead and manage research and innovation policies and practices at project, college, and institutional levels to attain research and innovation goals?
4. To what extent do research and innovation goals solve higher education institutions' own problems and the problems of the community and nation?
5. Are the institutional research and innovation policies developed in line with national science, technology and innovation policy, and the framework for higher education research and technology transfer?

STRUCTURED QUESTIONNAIRE

Part I. Items designed to explain the leadership and management of research and innovation policies and practices at higher education institution level

Instructions: The following items are designed to explain the leadership and management of research and innovation policies and practices at university level. Please indicate your degree of agreement or disagreement with each item using the following scale: (1) strongly disagree, (2) disagree, (3) slightly disagree, (4) slightly agree, (5) agree or (6) strongly agree. (**Circle one response for each item with regard to the situations prevailing in the University that you are working at**)

S/N	Items	The six-point rating scale as explained above					
1	The research and innovation policy of my university is developed in line with national policies.	1	2	3	4	5	6
2	The research and innovation policy of the university incorporates important elements from continental and international science, technology and innovation policies.	1	2	3	4	5	6
3	The university research leaders are leading the policy in line with national priority areas.	1	2	3	4	5	6
4	The research leaders are leading the research and innovation policy by developing research strategic plan.	1	2	3	4	5	6
5	The research leaders are managing the intellectual property right of the researchers.	1	2	3	4	5	6
6	The research leaders of my university see the research and innovation policy as a product.	1	2	3	4	5	6
7	The research leaders of my university see the research and innovation policy as continuous learning.	1	2	3	4	5	6
8	The research leaders see the practice of research and innovation policy as learning by producing new knowledge through participation.	1	2	3	4	5	6
9	The leaders see the practice of research and innovation policy as producing new knowledge to solve real world problems through dynamic interaction.	1	2	3	4	5	6
10	The research leaders in my university develop research capacity of the academics.	1	2	3	4	5	6
11	In my university, the research leaders influence their followers by controlling.	1	2	3	4	5	6
12	The research leaders see research leadership as a process.	1	2	3	4	5	6
13	The research leaders exercise research leadership as context specific.	1	2	3	4	5	6
14	The research leaders lead the research activities focusing on innovation by facilitating interaction outside the university.	1	2	3	4	5	6

15	The research leaders are poor in managing the research activities of the university.	1	2	3	4	5	6
16	The research leaders are good at setting direction.	1	2	3	4	5	6
17	The research leaders are good at inspiring and motivation researchers.	1	2	3	4	5	6
18	The leaders are leading the research and innovation activities of the university in line with the need of the local community.	1	2	3	4	5	6
19	The leaders are leading the research and innovation activities of the university in line with the need of the nation.	1	2	3	4	5	6
20	The leaders are leading the research and innovation activities of the university to address their own internal teaching problems.	1	2	3	4	5	6
21	The leaders facilitate dynamic interaction between and among researchers from different disciplines.	1	2	3	4	5	6
22	The leaders inject tension with managerial pressure by providing resources to come up with new and innovative results.	1	2	3	4	5	6
23	The leaders inject tension on the university research system to adjust and bring the required change.	1	2	3	4	5	6
24	The leaders are effective in building research teams that have shared identity.	1	2	3	4	5	6
25	The leaders lead the research teams to find solutions to solve local problems.	1	2	3	4	5	6
26	The leaders are good at collecting information about the weaknesses of their policies and competencies from their stakeholders.	1	2	3	4	5	6
27	The leaders use the information they gathered to fill their gaps in line with the needs of the stakeholders.	1	2	3	4	5	6
28	The leaders accommodate emergent ideas into the university research structure to facilitate innovation.	1	2	3	4	5	6
29	The leaders lead the research and innovation activities of the university to develop new ideas or find innovative solutions, or to develop new product or service for the local context.	1	2	3	4	5	6
30	The research leaders emphasise on basic research with application.	1	2	3	4	5	6
31	The leaders prioritise applied research for real solving problems.	1	2	3	4	5	6
32	The leaders prefer basic research for technology development.	1	2	3	4	5	6
33	The leaders inspire researchers to engage in research-based innovation.	1	2	3	4	5	6
34	The leaders encourage the researchers to adopt technologies from foreign countries.	1	2	3	4	5	6
35	The leaders prefer basic research for developing scientific knowledge.	1	2	3	4	5	6
36	The leaders interconnect research activities to facilitate the production, dissemination, and utilisation of new knowledge or technologies.	1	2	3	4	5	6
37	In the university, an innovation system comprises researchers, the government, the industry, and the local community.	1	2	3	4	5	6
38	There is collaborative leadership in the innovation system of the university.	1	2	3	4	5	6
39	The leaders lead the interrelationship among education, research, and innovation in my university.	1	2	3	4	5	6
40	There is conducive environment for researchers in my university.	1	2	3	4	5	6
41	There is adequate fund for research in my university.	1	2	3	4	5	6
42	There is adequate fund for innovation in my university.	1	2	3	4	5	6
43	The leaders have good networking with other universities locally and internationally.	1	2	3	4	5	6
44	There is strong linkage between my university and the industry for collaborative research or innovation.	1	2	3	4	5	6
45	The leaders prepare researchers that have the potential and calibre from their postgraduate education.	1	2	3	4	5	6
46	The leaders are providing on-going training to improve the capacity of the researchers.	1	2	3	4	5	6
47	Research leadership is given based on research competencies in my university.	1	2	3	4	5	6
48	The research leadership in my university has brought change.	1	2	3	4	5	6
49	The research manager is good at resource mobilization from different sources.	1	2	3	4	5	6
50	The research manager is effective in managing research or innovation projects.	1	2	3	4	5	6
51	The research manager is good at establishing networking and partnership with different organisations.	1	2	3	4	5	6
52	The research manager is excellent in quality control of the research.	1	2	3	4	5	6

53	The research manager is effective in resolving conflicts.	1	2	3	4	5	6
54	The research manager is effective in managing the performance of the researchers.	1	2	3	4	5	6
55	The research manager is tough in funding research projects based of the impact criteria of the university.	1	2	3	4	5	6
56	The research manager is good at in commercialising the research project results.	1	2	3	4	5	6
57	The leaders are poor in preparing the future research or innovation leaders.	1	2	3	4	5	6
58	There is effective support for research leadership and management at college or project level in the university.	1	2	3	4	5	6

59. What are the strengths of research and innovation leadership and management in your university?

60. What are the main weaknesses in the research and innovation leadership and management in your university?

Part II. Items designed to explain the leadership and management of research and innovation policies and practices at college level.

Instructions: The following items are designed to explain the leadership and management of research and innovation policies and practices at college level. Please indicate your degree of agreement or disagreement with each item using the following scale: (1) strongly disagree, (2) disagree, (3) slightly disagree, (4) slightly agree, (5) agree or (6) strongly agree. (**Circle one response for each item with regard to the conditions at college level at your university**)

S/N	Items	The six-point rating scale as explained above					
61	The research leader (coordinator) in my college leads the college research activities in line with the university level policy.	1	2	3	4	5	6
62	The research leader (coordinator) in my college leads the college innovation activities in line with the university level policy.	1	2	3	4	5	6
63	The leader leads the research activities in line with the priority areas of the university.	1	2	3	4	5	6
64	The leader leads the innovation activities in line with the priority areas of the university.	1	2	3	4	5	6
65	The college emphasises on its own research priority areas.	1	2	3	4	5	6
66	The leader is good at inspiring and motivating researchers.	1	2	3	4	5	6
67	The leader is leading the researchers to research their own teaching to address the internal problems of the college.	1	2	3	4	5	6
68	The leader is leading the researchers to research and address the problems of the local communities.	1	2	3	4	5	6
69	The leader is leading the researchers to research and produce new knowledge or technologies to make the country competent in its socio-economic development.	1	2	3	4	5	6
70	The leader is excellent in team building.	1	2	3	4	5	6
71	The leader is excellent in communication.	1	2	3	4	5	6
72	The leader focuses on managing the schedules and budgets of the projects.	1	2	3	4	5	6
73	The leader is good at in discharging his/her managerial responsibilities.	1	2	3	4	5	6
74	The research leader is poor in managing resources.	1	2	3	4	5	6
75	The leader is good at research project management of initiating, planning, implementing, monitoring, and evaluation.	1	2	3	4	5	6
76	The leader is good at managing performance of the researchers.	1	2	3	4	5	6
77	The leader is excellent in conflict management between researchers.	1	2	3	4	5	6
78	The leader is poor in interconnecting education, research, and innovation.	1	2	3	4	5	6
79	The leader is good at resources mobilization.	1	2	3	4	5	6
80	The leader initiates the researchers to undertake problem-solving research.	1	2	3	4	5	6
81	The leader is effective in establishing network among researchers within or outside the college and the university.	1	2	3	4	5	6
82	The leader is effective in managing the qualities of the outcomes of the research or innovation projects.	1	2	3	4	5	6

83	The leader encourages disciplined-based research to produce scientific knowledge.	1	2	3	4	5	6
84	The leader encourages interdisciplinary research to solve real problems.	1	2	3	4	5	6
85	The leader encourages collaborative research with external bodies that promote research-based innovation.	1	2	3	4	5	6
86	The leader is good at managing research-based innovation.	1	2	3	4	5	6
87	The leader is poor in leading research –based innovation.	1	2	3	4	5	6
88	The leader is poor in innovation project management.	1	2	3	4	5	6
89	The leader is poor in innovation project leadership.	1	2	3	4	5	6

90. What are the strengths of research and innovation leadership and management in your college?

91. What are the main weaknesses in the research and innovation leadership and management in your college?

Part III. Items designed to examine the leadership and management of research and innovation policies and practices at research project level

Instructions: The following items are designed to examine the leadership and management of research and innovation projects. Please indicate your degree of agreement or disagreement with each item using the following scale: (1) strongly disagree, (2) disagree, (3) slightly disagree, (4) slightly agree, (5) agree or (6) strongly agree. (**Circle one response for each item in line with the actual practices at your research or innovation project**)

S/N	Items	The six-point rating scale as explained above					
92	The research project leader is excellent in his/her scientific capital.	1	2	3	4	5	6
93	The research project leader is excellent in his/her charisma.	1	2	3	4	5	6
94	The innovation project leader is excellent in his/her scientific capital and charisma.	1	2	3	4	5	6
95	The leader has the quality of a broker between teaching, research, and innovation.	1	2	3	4	5	6
96	The leader is excellent in team building.	1	2	3	4	5	6
97	The leader is excellent in communication.	1	2	3	4	5	6
98	The leader is effective in research project management.	1	2	3	4	5	6
99	The leader is effective in innovation project management.	1	2	3	4	5	6
100	The leader is effective in research project leadership.	1	2	3	4	5	6
101	The leader is effective in innovation project leadership.	1	2	3	4	5	6
102	The leader is good at managing resources.	1	2	3	4	5	6
103	The leader is poor in managing quality of the research project.	1	2	3	4	5	6
104	The leader is poor in managing quality of the innovation project.	1	2	3	4	5	6
105	The leader is good at inspiring and motivating his/her research team.	1	2	3	4	5	6
106	The research leader of our research project has also the quality for innovation leadership.	1	2	3	4	5	6
107	The leader encourages creative researchers.	1	2	3	4	5	6
108	The leader facilitates sufficient resources for innovation.	1	2	3	4	5	6
109	The leader sets big goal, assign difficult tasks, facilitate collaboration and teamwork, create room for interaction and exchange of ideas.	1	2	3	4	5	6
110	The leader manages innovation by establishing partnership and networking to produce new knowledge or adapt to address the challenges of the industry.	1	2	3	4	5	6
112	The leader manages innovation by establishing partnership and networking to produce new knowledge or adapt to address the challenges of the community.	1	2	3	4	5	6
113	The leader manages innovation by establishing partnership and networking to produce new knowledge or adapt to address the challenges of the university itself.	1	2	3	4	5	6
114	The leader is effective in using ICT for research or innovation management.	1	2	3	4	5	6
115	The leader manages research or innovation tasks as repetitive tasks.	1	2	3	4	5	6
116	The leader is good at problem solving.	1	2	3	4	5	6
117	The leader is ineffective in leading innovation projects to develop unique product or service for commercialization.	1	2	3	4	5	6

118	The leader is ineffective in leading innovation projects to develop unique product or service to solve the problems of the local communities.	1	2	3	4	5	6
119	The leader is ineffective in leading innovation projects to develop unique product or service to solve the problem of the country.	1	2	3	4	5	6
120	The leader manages project progress effectively.	1	2	3	4	5	6
121	The leader manages the success of a project in terms of time and budget.	1	2	3	4	5	6
122	The leader manages his team effectively.	1	2	3	4	5	6
123	The leader undertake research project just for generating income.	1	2	3	4	5	6
124	The leader builds research team based on the competencies of the researchers.	1	2	3	4	5	6
125	The leader builds research team based on proximity.	1	2	3	4	5	6
126	There is effective risk-assessment in the research and innovation projects.	1	2	3	4	5	6
127	The project leader is good at conflict resolution.	1	2	3	4	5	6
128	The leader is effective in winning research grants.	1	2	3	4	5	6
129	The leader is poor in managing the performance of the researchers.	1	2	3	4	5	6
130	The leader is poor in managing the quality of the research process and outcomes.	1	2	3	4	5	6

131. What are the strengths of research and innovation leadership and management in your college?

132. What are the main weaknesses in the research and innovation leadership and management in your college?

Part IV. Items designed to examine the contributions of research and innovation goals (practices) of the higher education institutions in solving their own problems, the problems of the local community and their nation

Instructions: The following items are designed to examine the leadership and management of research and innovation goals of the higher education institutions in solving their own problems, the problems of the local community and their nation. Please indicate the extent of research and innovation projects contributions at your higher education institutions with each item using the following scale: (1) no contribution, (2) very low contribution, (3) low contribution, (4) average contribution, (5) high contribution or (6) very high contribution. (**Circle one response for each item in line with the contributions of research and innovation projects of your team at your college and university**)

S/N	Items	The six-point rating scale as explained above					
133	To what extent do you feel that the research activities contribute to address the problems of the local community?	1	2	3	4	5	6
134	To what extent do you feel that the innovation activities of the university contribute to solve the problems of the local community?	1	2	3	4	5	6
135	To what extent do you feel that the research activities of the university address its own internal problems?	1	2	3	4	5	6
136	To what extent do you feel that the innovation activities of the university address its own internal problems?	1	2	3	4	5	6
137	To what extent do you feel that the research projects of the university contribute to fill the knowledge need s of the country?	1	2	3	4	5	6
138	To what extent do you feel that the innovation projects of the university contribute to fill the knowledge or technology needs of the country?	1	2	3	4	5	6
139	To what extent do you feel that innovation projects of the university contribute to technological advancement of the country?	1	2	3	4	5	6
140	To what extent do you feel that the research activities of the university contribute to the knowledge –based economy of the country?	1	2	3	4	5	6
141	To what extent do you feel that the innovation activities of the university contribute to the knowledge-based economy of the country?	1	2	3	4	5	6
142	To what extent do you feel that your research projects contribute to the human capital development of the university?	1	2	3	4	5	6
143	To what extent do you feel that the innovation projects contribute to the human capital development of the university?	1	2	3	4	5	6
144	To what extent do you feel that the research projects of your team contribute to the human capital development of the university?	1	2	3	4	5	6

145	To what extent do you feel that the innovation projects of your contribute to the human capital development of the industry?	1	2	3	4	5	6
146	To what extent do you feel that the research projects of your contribute to the human capital development of the nation at large?	1	2	3	4	5	6
147	To what extent do you feel that the innovation projects of your team contribute to the human capital development of the nation at large?	1	2	3	4	5	6

148. What are the strengths of the contributions of the leadership and management of research and innovation goals to solve local community problems, the problems of the university and the nation as a whole in your university?

149. What are the main weaknesses in the contributions of the leadership and management of research and innovation goals to solve local community problems, the problems of the university and the nation as a whole in your university?

Part V. Demographic information

Please write on the space provided or put check mark (✓) in the box in line with your demographic information.
150. Name of your University _____ College _____ Department _____
151. Gender: male ☐ female ☐
152. Qualification: PhD ☐ MA/BSC/MSC ☐ BA/BED/BSC ☐
153. Academic rank: Lecturer ☐ Assistant professor ☐ ssociate professor ☐ ofessor ☐
154. Responsibility: Research director ☐ Technology transfer director ☐
College level research and community engagement coordinator ☐
Research project leader ☐ Academic researcher ☐
155. Experience in year in the above responsibility _____Total experience as an academic ___
156. Is there anything that you would like to add for me to think about?

I thank you again for your cooperation!

SEMI- STRUCTURED INTERVIEW QUESTIONS

1. **Semi-structured interview for research leaders and managers at the Ministry of Education and Ministry of Science and Technology.**

1.1 Would you please tell me about your roles and responsibilities?

1.2 Do you think that our STI policy is in line with African and international trends?

1.3 How do you lead the STI policy to be integrated into different national sectoral policies, programmes and plans?

1.4 How do you manage the formulation and implementation of the policy across sectors and at the national level?

1.5 Do we have a well-established and functional national innovation system? Who are the main actors in the system? Are higher education institutions parts of the system? Why?

1.6 How do you lead and manage research and innovation activities and their fund at the national level?

1.7 How do you manage the resources (human, material and financial) at the national level?

1.8 What are the priority areas in the national STI policy? How were they selected?

1.9 How do you lead and manage STI policy to address local socio-economic problems, the problems of higher education institutions and the national development agenda of the country?

1.10 What are the main contributions of the research and innovation activities at the national level to:

1.10.1 local communities?

1.10.2 higher education institutions

1.10.3 the nation as a whole?

1.10.4 the international community?

1.11 What are the success criteria for the development and implementation of the research and/or innovation projects at the national level?

1.12 What are the main challenges or problems in leading and managing research and innovation activities in particular and STI policy in general?

1.13 Is there anything left that you would like to share to me?

2. Semi-structured interview questions for vice president for research and community engagement, research director, technology transfer director of a university

2.1 Would you please tell me about your roles and responsibilities?

2.2 Do you think that the research and/or innovation policy of the university is in line with national policies, programmes and plans? Why?

2.3 What are the priority areas of the policy? How were they selected? Are they in line with national priorities?

2.4 Does the university have a research strategic plan? Why?

2.5 How do you lead the research and innovation policy and practice of the university?

2.6 How do you manage the research and innovation policy and practice of the university?

2.7 How do you lead and manage the research and innovation activities of the different colleges and projects?

2.8 How do you manage the resources (human, material and financial) at a project, college and university level?

2.9 Is basic or applied research that has priority in your university research activity? Why?

2.10 Is discipline-based, interdisciplinary or collaborative research that has been given priority in your university research activity? Why?

2.11 How do you lead and manage the relationships among education, research and innovation in the university?

2.12 Is there an established and functional innovation system in the university? Why?

2.13 How do you lead the linkages among the government, industry and the university? Are the communities parts of the linkages? How do you manage the linkages?

2.14 What are the contributions of the linkages so far for:

2.14.1 the university?

2.14.2 industry?

2.14.3 the government?

2.14.4 the community?

2.15 Do you think the linkages address the problems of each stakeholder? Why?

2.16 What are the contributions of the research and/ or innovation activities of the university to:

2.16.1 the local communities?

2.16.2 The university itself?

2.16.3 The national socio-economic development?

2.16.4 The international community?

2.17 What are the main successes of you in leading and managing the research and innovation policy and practices of the university?

2.18 What are the main challenges or problems you face while leading and managing research and innovation activities of the university?

2.19 Is there something that you would like to tell me at the end?

3. **Semi-structured interview for research coordinators at the college level.**

3.1 Would you please tell me about your roles and responsibilities?

3.2 How do you lead the research and innovation practices in your college in line with the university research policy?

3.3 What are the priority areas of the college?

3.4 How do you manage resources (human, material and financial) at college and project levels?

3.5 How do you lead the research and/or innovation projects of the college?

3.6 How do you manage the research and/or innovation projects of the college?

3.7 How do you manage the quality of the research and/ or innovation projects of the college?

3.8 How do you manage the performance of the project leaders and the researchers at the college level?

3.9 How do you lead and manage the activities of the research and/or innovation projects?

3.10 What are the criteria for funding the research and/ or innovation projects at the college level?

3.11 What are the success criteria of the implementation of the projects? Why?

3.12 What are the contributions of the research and/ or innovation projects of the college to:

3.12.1 the local communities?

3.12.2 The college and university?

3.12.3 The nation at large?

3.12.4 The international community?

3.13 What are the main successes in the leadership and management of research and /or innovation activities and projects at the college level?

3.14 What are the main weaknesses in the leadership and management of research and /or innovation activities and projects at the college level?

3.15 Is there anything that you would like to tell me?

4. Semi-structured interview for principal researchers at the project level

4.1 Would you please tell me about your roles and responsibilities?

4.2 How do you choose a research theme? Why?

4.3 How do you build you a research team? Why?

4.4 How do you lead your research team?

4.5 How do you manage your research team?

4.6 How do you lead and manage research-based innovation?

4.7 How do lead and manage the research and innovation project development and implementation?

4.8 How do you manage the resources in the project?

4.9 How do you manage the quality of the project?

4.10 How do you manage the performance of each member of the project team?

4.11 What personal qualities and behaviours do you have as a research or innovation leader?

4.12 What are the competencies that you have as a research leader or innovation?

4.13 What are the success criteria of your project implementation?

4.14 What are the main contributions of your team and you to:

4.14.1 the local communities?

4.14.2 college and university?

4.14.3 the nation?

4.14.4 international community?

4.14.5 the leader and the researchers themselves?

4.15 What are your successes in the leadership and management of research and /or innovation projects?

4.16 What are your main challenges or problems in the leadership and management of research and /or innovation projects?

4.17 Is there anything that you would like to tell me in the end?

5 Semi-structured interview for co- researchers at the project level

5.1 Would you please tell me about your roles and responsibilities in the research and/ or innovation project?

5.2 How did you join the project team?

5.3 How does the research and /or innovation leader build a research team?

5.4 How does the leader manage conflicts within the team?

5.5 How does the leader manage and lead research and/or innovation project?

5.6 How does the leader manage the resources in the project?

5.7 How does the leader manage the quality of the project and its outcome?

5.8 How does the leader manage the performance of each team member of the project?

5.9 What are the success criteria for the implementation of the project?

5.10 What are the contributions of the projects in your team to:

5.10.1 the local communities?

5.10.2 the colleges and the university?

5.10.3 the nation?

5.10.4 the international community?

5.11 What are the personal qualities of the leader of the research and/or innovation project in your team?

5.12 What are the competencies of the leader in your project?

5.13 What are the strengths and weaknesses of the leader in leading and managing research and/or innovation projects?

5.14 In the end, is there anything that you would like to tell me?

6 Semi-structured interview for community leaders at the zone level

6.1 Would you please tell me about your roles and responsibilities in leading and managing the community at the zone level?

6.2 What are the main problems of the local communities in your zone?

6.3 How have you tried to address the problems?

6.4 Who are your partners in addressing the problems of the local communities?

6.5 Do you think that the university in your zone has played its role in addressing the problems of the local communities? How?

6.6 What are the main contributions of the university in addressing the problems of the local community?

6.7 Do you have collaborative leadership in research and innovation activities with the university and the industries in the zone? Why?

6.8 How do you describe the research and innovation performance of the university to address:

6.8.1 its own internal problems?

6.8.2 the problems of the local communities, and

6.8.3 the problem of national development?

6.9 What are the main successes that you have achieved while working in university research and innovation projects?

6.10 What are the main problems observed while working together in the research and innovation activities of the university?

6.11 Is there anything that is very important that you would like to tell me that I should not miss what we have discussed so far?

7 Semi-structured interview for industry managers around each university

7.1 Can you tell me about your roles and responsibilities in the industry?

7.2 What are the main problems in your industry?

7.3 How have you tried to address the problems?

7.4 Who are your partners in addressing the problems of your industry?

7.5 Do you think that the university in your locality working together with the industry to address the problems of the industry?

7.6 What are the main contributions of the university in addressing the problems of your industry?

7.7 Do you have collaborative leadership in research and innovation activities with the university and the local community or government leaders? Why?

7.8 How do you describe the research and innovation performance of the university to address:

7.8.1 its own internal problems?

7.8.2 the problems of the local industries, and

7.8.3 the problems of national development?

7.9 What are the main successes that you have achieved while working in university research and innovation projects?

7.10 What are the main problems observed while working together in the research and innovation activities of the university?

7.11 Is there anything that is very important that you would like to tell me that I should not miss what we have discussed so far?

Guiding questions and checklist for document analysis (new to be pilot tested and refined)

Questions for qualitative data collection from policy documents of the higher education institutions:

1.1.1 How do the research and/ or innovation policies of the higher education institutions incorporate the vision, mission and objectives of national policies?

1.1.2 How do the research and innovation policies of the higher education institutions priority areas of the country?

1.1.3 How are the priority areas of the institutions presented in line with the national priorities?

1.1.4 How the policies of the institutions are integrate into the concepts of innovation, research, science, technology, knowledge-based economy/society?

1.1.5 Do the policies of the higher education institutions incorporate the leadership and management of research and/or innovation activities of the higher education institutions?

1.1.6 How the policies of the institutions are including the funding, implementation, monitoring and evaluation mechanisms in line with the national ones?

1.1.7 How the policies are include funding criteria in line with national ones?

Checklist for collecting quantitative data for five years annual reports of each university

S/N	Items	Plan versus contributions of the university in the last five year									
		2012/13		2013/14		2014 /15		2015/16		2016/17	
		N	%	N	%	N	%	N	%	N	%
1	Number of research projects planned to be completed										
2	Number of research projects completed										
3	Number of technologies planned to be transferred										
4	Number of technologies transferred										
5	Number of articles planned to be published										
6	Number of articles published										
7	Number of collaborations and partnerships planned										
8	Number of collaborations and partnerships achieved										
9	Number of maters students completed										
10	Number of PhD students completed										
11	Budget allocated and utilised for research and innovation from the annual budget of a university										
12	Number of research projects commercialised										
13	Number of research projects patented										

Appendix F: Validated structured questionnaire

Dear respondent,

This questionnaire forms part of my doctoral research entitled: 'The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices' for the degree PhD at the University of South Africa. You have been selected by a systematic sampling strategy from the population of researchers. Hence, I invite you to take part in this survey.

The aim of this study is to investigate the research and innovation leadership and management at higher education institutions in Ethiopia both at policy and practice level. The findings of the study may benefit the higher education institutions, the local communities, the industries and the nation at large.

You are kindly requested to complete this survey questionnaire, comprising five paragraphs as honestly and frankly as possible and according to your personal views and experience. No foreseeable risks are associated with the completion of the questionnaire as all information obtained from the questionnaire will be used for research purposes only and will remain confidential. The questionnaire will take approximately 30 minutes to complete. You are not required to indicate your name so that your anonymity will be ensured; however, indication of your age, gender, occupation position etcetera will contribute to a more comprehensive analysis. Your participation in this survey is voluntary and you have the right to omit any question if so desired, or to withdraw from answering this survey without penalty at any stage. After the completion of the study, an electronic summary of the findings of the research will be made available to you on request.

Permission to undertake this survey has been granted by the Ethics Committee of the College of Education, UNISA. If you have any research-related enquiries, they can be addressed directly to my supervisor or me. My contact details are: 0913725162 e-mail: damteww09@gmail.com and my supervisor can be reached at +27834421503, Department of Educational Leadership and Management, College of Education, UNISA, e-mail: vdmerhm@unisa.ac.za. By completing the questionnaire, you imply that you have agreed to participate in this research. Please return the completed questionnaire to me before June 14, 2018.

I thank you for your cooperation!

Key terms used in this survey:

- Research is a scientific way of producing new knowledge or idea.
- Innovation is the application of the new knowledge and idea produced or technology transferred from the research activities of a university.
- Research and innovation leaders at university level refer to vice president for research and community engagement/ technology transfer, research director, community engagement director and technology transfer director.
- Research and innovation leader at college level refers to research and community engagement coordinator.
- Research and innovation leader at project level refers to principal investigator.
- Project can be research or innovation that has specific objective, budget and time period to be completed.

Part I. Items designed to explain the leadership and management of research and innovation policies and practices at higher education institution level

Instructions: The following items are designed to explain the leadership and management of research and innovation policies and practices at university level. Please indicate your degree of agreement or disagreement with each item using the following scale: (1) strongly disagree, (2) disagree, (3) slightly disagree, (4) slightly agree, (5) agree or (6) strongly agree. (**Circle one response for each item with regard to the situations prevailing in the University that you are working at**)

S/N	Items	The six-point rating scale as explained above					
	A. Regarding administrative leadership at university level						
1	The research policy of the university is developed in line with national education and STI policies.	1	2	3	4	5	6
2	The research policy of the university incorporates important elements from national, continental and international science, technology and innovation policies.	1	2	3	4	5	6
3	The university research leaders are managing the policy in line with national priority areas.	1	2	3	4	5	6
4	The research leaders are managing the research policy by developing research strategic plans.	1	2	3	4	5	6
5	The research leaders of the university see the research policy as a finished document.	1	2	3	4	5	6
6	The research leaders influence their followers by controlling their day-to-day activities using the structure of the university.	1	2	3	4	5	6
7	The research leaders are good at developing the research capacity of the academics.	1	2	3	4	5	6
8	The research leaders are good at resource mobilization from different sources.	1	2	3	4	5	6
9	The research leaders are effective in managing research projects.	1	2	3	4	5	6
10	The research leaders are effective in managing innovation projects.	1	2	3	4	5	6
11	The research leaders are good at quality control of the research activities.	1	2	3	4	5	6
12	The research leaders are effective in resolving conflicts.	1	2	3	4	5	6
13	The research leaders are effective in managing the performance of the researchers.	1	2	3	4	5	6
14	The research leaders are good at commercialising the research project results.	1	2	3	4	5	6
15	The leaders are effective in incorporating learning, creativity and adaptability while managing research and innovation activities of the university.	1	2	3	4	5	6
16	The research leaders are good at establishing network and partnership with different organisations.	1	2	3	4	5	6
	B. Regarding adaptive leadership at university level		1				
1	The research leaders see the practice of research policy as learning by producing new knowledge through participation to address real problem.	1	2	3	4	5	6
2	The leaders see the practice of research policy as producing new knowledge to solve real world problems through dynamic interaction.	1	2	3	4	5	6
3	The research leaders of the university see the research policy as continuous learning.	1	2	3	4	5	6
4	The research leaders see research leadership as a process.	1	2	3	4	5	6
5	The research leaders exercise research leadership as context specific.	1	2	3	4	5	6
6	The research leaders lead the research activities focusing on innovation by facilitating interaction outside the university.	1	2	3	4	5	6
7	There is collaborative leadership in the innovation system of the university.	1	2	3	4	5	6
8	The research leaders are good at setting direction.	1	2	3	4	5	6
9	The leaders are leading the research and innovation activities of the university in line with the needs of the local community.	1	2	3	4	5	6
10	The leaders are leading the research and innovation activities of the university in line with the needs of the nation.	1	2	3	4	5	6
11	The leaders are leading the research and innovation activities of the university to address their own internal teaching problems.	1	2	3	4	5	6
12	The leaders lead the research teams to find solutions to solve local problems.	1	2	3	4	5	6
13	The leaders are good at collecting information about the weaknesses of their policies and competencies from their stakeholders.	1	2	3	4	5	6
14	The leaders use the information they gathered to fill their gaps in line with the needs of the stakeholders.	1	2	3	4	5	6
15	The leaders accommodate emergent ideas into the university research structure to facilitate innovation.	1	2	3	4	5	6
16	The leaders lead the research and innovation activities of the university to develop new ideas and find innovative solutions for the local context.	1	2	3	4	5	6
17	The research leaders emphasise leading basic research within a context of application.	1	2	3	4	5	6

18	The leaders prioritise applied research for real problem solving.	1	2	3	4	5	6
19	The leaders focus on action based on learning and creativity.	1	2	3	4	5	6
20	The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the university.	1	2	3	4	5	6
C. Regarding enabling leadership at university level							
1	The leaders inspire researchers to engage in research-based innovation.	1	2	3	4	5	6
2	The leaders encourage the researchers to adopt technologies from foreign countries.	1	2	3	4	5	6
3	The leaders are effective in building research teams having different skills with shared identity.	1	2	3	4	5	6
4	The leaders interconnect research activities to facilitate the production, dissemination, and utilisation of new knowledge or technologies.	1	2	3	4	5	6
5	The leaders promote interactive relationship among education, research, and innovation.	1	2	3	4	5	6
6	There is an environment conducive to undertake research and innovation activities in the university.	1	2	3	4	5	6
7	There are adequate funds for research undertakings in the university.	1	2	3	4	5	6
8	There are adequate funds for innovation projects in the university.	1	2	3	4	5	6
9	There is strong linkage between the university and industry for collaborative research and innovation.	1	2	3	4	5	6
10	The leaders facilitate dynamic interaction between and among researchers from different disciplines.	1	2	3	4	5	6
11	The leaders motivate the researchers to engage passionately in the research task by providing resources to come up with new and innovative results.	1	2	3	4	5	6
12	The leaders put managerial pressure on the university research system to adjust and bring about the required change.	1	2	3	4	5	6
13	The leaders are good at using the structure of the university to address challenges to research and innovation activities.	1	2	3	4	5	6
14	The leaders are good at establishing functional networks across stakeholders that engage in research and innovation activities	1	2	3	4	5	6
15	There is functional innovation system that comprises researchers, the government, industry and the local community.	1	2	3	4	5	6

What are the strengths in research and innovation leadership and management at your university?

What are the main weaknesses in the research and innovation leadership and management at your university?

Part II. Items designed to explain the leadership and management of research and innovation policies and practices at college level.

Instructions: The following items are designed to explain the leadership and management of research and innovation policies and practices at college level. Please indicate your degree of agreement or disagreement with each item using the following scale: (1) strongly disagree, (2) disagree, (3) slightly disagree, (4) slightly agree, (5) agree or (6) strongly agree. (**Circle one response for each item with regard to the conditions at college level at your university**)

S/N	Items	The six-point rating scale as explained above					
	A. Regarding administrative leadership at college level						
1	The research leader (coordinator) of the college manages the college research activities in line with the university research policy.	1	2	3	4	5	6
2	The research leader of the college manages the college innovation activities in line with the university research policy.	1	2	3	4	5	6
3	The leader is good at communication with the researchers.	1	2	3	4	5	6
4	The leader focuses on managing the schedules and budgets of the projects.	1	2	3	4	5	6
5	The leader is good at delegating managerial responsibilities for improved performance.	1	2	3	4	5	6
6	The research leader is good at research project management.	1	2	3	4	5	6
7	The research leader is good at managing the performance of the researchers.	1	2	3	4	5	6
8	The research leader is good at resources mobilization.	1	2	3	4	5	6
9	The research leader is good at resolving conflict among researchers.	1	2	3	4	5	6
10	The research leader is effective in managing the qualities of applicability outcomes of the research projects.	1	2	3	4	5	6
11	The research leader is good at managing research-based innovation.	1	2	3	4	5	6
12	The research leader is struggling in innovation project management.	1	2	3	4	5	6

13	The leader is good at incorporating learning, creativity and adaptability while managing research and innovation activities of the college.	1	2	3	4	5	6
	B. Regarding adaptive leadership at college level						
1	The college puts more value on areas of research applicable to the internal development of the college.	1	2	3	4	5	6
2	The leader is leading the researchers to research their own teaching to address the internal problems of the college.	1	2	3	4	5	6
3	The leader is leading the researchers to research and address the problems of the local communities.	1	2	3	4	5	6
4	The leader is leading the researchers to research and produce new knowledge for the socio-economic development of the country.	1	2	3	4	5	6
5	The research leader is struggling with innovation project leadership.	1	2	3	4	5	6
6	The leader focuses on action based learning and creativity.	1	2	3	4	5	6
7	The leaders are good at facilitating dynamic interaction among the key stakeholders for research and innovation activities of the college.	1	2	3	4	5	6
	C. Regarding enabling leadership at college level						
1	The research leader motivates the researchers to undertake problem-solving research.	1	2	3	4	5	6
2	The leader is good at team building and has different skills.	1	2	3	4	5	6
3	The leader is good at inspiring the researchers.	1	2	3	4	5	6
4	The research leader encourages disciplined-based research to produce improved discipline –based knowledge.	1	2	3	4	5	6
5	The research leader encourages interdisciplinary research to solve real problems.	1	2	3	4	5	6
6	The research leader encourages collaborative research with external bodies that promote research-based innovation.	1	2	3	4	5	6
7	The leader is good at establishing functional networks across stakeholders that engage in research and innovation activities.	1	2	3	4	5	6
8	The leader is good at using the structure of the college to address challenges to research and innovation activities.	1	2	3	4	5	6

What are the main strengths in research and innovation leadership and management at your college?

What are the main weaknesses in the research and innovation leadership and management at your college?

Part III. Items designed to examine the leadership and management of research and innovation activities at project level

Instructions: The following items are designed to examine the leadership and management of research and innovation projects. Please indicate your degree of agreement or disagreement with each item using the following scale: (1) strongly disagree, (2) disagree, (3) slightly disagree, (4) slightly agree, (5) agree or (6) strongly agree. (**Circle one response for each item in line with the actual practices at your research or innovation project**)

S/N	Items **A. Regarding administrative leadership at project level**	The six-point rating scale as explained above					
1	The project leader (principal investigator) sets realistic and functional objective(s) to a project in collaboration with the project stakeholders.	1	2	3	4	5	6
2	The project leader is good at communication with the researchers.	1	2	3	4	5	6
3	The project leader is effective in research project management.	1	2	3	4	5	6
4	The project leader is good at managing resources.	1	2	3	4	5	6
5	The project leader is struggling to manage the quality of the research project in terms of producing new and relevant knowledge.	1	2	3	4	5	6
6	The project leader is effective in innovation project management.	1	2	3	4	5	6
7	The project leader is a good problem solver.	1	2	3	4	5	6
8	The project leader manages project progress effectively.	1	2	3	4	5	6
9	The project leader manages the success of the project in terms of time and budget.	1	2	3	4	5	6
10	The project leader manages his or her team effectively.	1	2	3	4	5	6
11	There is effective risk-assessment in the research and innovation projects.	1	2	3	4	5	6

12	The project leader is good at conflict resolution.	1	2	3	4	5	6
13	The project leader is effective in obtaining research grants.	1	2	3	4	5	6
14	The project leader is good at incorporating learning, creativity and adaptability while managing research or innovation project.	1	2	3	4	5	6
	B. Regarding adaptive leadership at project level						
1	The project leader is effective in research project leadership.	1	2	3	4	5	6
2	The project leader is effective in leading innovation projects to develop unique products and services for commercialization.	1	2	3	4	5	6
3	The project leader is effective in leading innovation projects to develop unique products and services to solve the problems of the local communities.	1	2	3	4	5	6
4	The project leader is effective in leading innovation projects to develop unique products and services to solve the problem of the country.	1	2	3	4	5	6
5	The project leader assigns difficult tasks and facilitates collaboration.	1	2	3	4	5	6
6	The project leader facilitates teamwork, and creates room for interaction and exchange of ideas.	1	2	3	4	5	6
7	The project leader builds research teams based on the competencies of the researchers.	1	2	3	4	5	6
8	The project leader focuses on action based on learning and creativity.	1	2	3	4	5	6
9	The project leader leads researchers to produce new knowledge to address the challenges of the industry.	1	2	3	4	5	6
10	The project leader leads researchers to produce new knowledge to address the challenges of the local community.	1	2	3	4	5	6
11	The project leader leads researchers to produce new knowledge to address the challenges of the university itself.	1	2	3	4	5	6
	C. Regarding enabling leadership at project level						
1	The project leader is good at inspiring and motivating his/her research team.	1	2	3	4	5	6
2	The project leader is able to promote good quality research and innovation.	1	2	3	4	5	6
3	The project leader encourages creative researchers.	1	2	3	4	5	6
4	The project leader is effective in using ICT for research and innovation management.	1	2	3	4	5	6
5	The project leader has the quality of a broker to create linkage between teaching, research, and innovation.	1	2	3	4	5	6
6	The project leader is very good at team building.	1	2	3	4	5	6
7	The project leader injects tension into his/her research team to come up with innovative ideas.	1	2	3	4	5	6
8	The project leader is good at using the structure of the college to address challenges to research and innovation activities.	1	2	3	4	5	6

What are the strengths in research and innovation leadership and management at your college?

What are the main weaknesses in the research and innovation leadership and management at your college?

Part IV. Items designed to examine the contributions of research and innovation goals (practices) of the higher education institutions in solving their own problems, the problems of the local community and their nation

Instructions: The following items are designed to examine the leadership and management of research and innovation goals of the higher education institutions in solving their own problems, the problems of the local community and their nation. Please indicate the extent of research and innovation projects contributions at your higher education institutions with each item using the following scale: (1) no contribution, (2) very low contribution, (3) low contribution, (4) average contribution, (5) high contribution or (6) very high contribution. (**Circle one response for each item in line with the contributions of research and innovation projects of your team at your college and university**)

S/N	Items	The six-point rating scale as explained above					
1	To what extent do you feel that the research projects you have engaged in so far have contributed to address the problems of the local community?	1	2	3	4	5	6
2	To what extent do you feel that the innovation projects you have engaged in so far have contributed to solve the problems of the local community?	1	2	3	4	5	6

3	To what extent do you feel that the research projects you have engaged in so far have contributed to address the university's own internal problems?	1	2	3	4	5	6
4	To what extent do you feel that the innovation projects you have engaged in so far have contributed to address the university's own internal problems?	1	2	3	4	5	6
5	To what extent do you feel that the research projects you have engaged in have contributed to fill the knowledge or technology needs of the country?	1	2	3	4	5	6
6	To what extent do you feel that the innovation projects you have engaged in so far have contributed to the technological advancement of the country?	1	2	3	4	5	6
7	To what extent do you feel that the research projects you have engaged in so far have contributed to the knowledge –based economy of the country?	1	2	3	4	5	6
8	To what extent do you feel that the innovation projects you have engaged in so far have contributed to the knowledge-based economy of the country?	1	2	3	4	5	6
9	To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the university?	1	2	3	4	5	6
10	To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the university?	1	2	3	4	5	6
11	To what extent do you feel that the innovation projects you have engaged in so far have contributed to the human capital development of the industry?	1	2	3	4	5	6
12	To what extent do you feel that the research projects you have engaged in so far have contributed to the human capital development of the nation at large?	1	2	3	4	5	6
13	To what extent do you feel that the innovation projects of your team have contributed to the human capital development of the nation at large?	1	2	3	4	5	6

What are the strengths of the contributions of the leadership and management of research and innovation goals to solve local community problems, the problems of the university and the nation as a whole in your university?

What are the main weaknesses in the contributions of the leadership and management of research and innovation goals to solve local community problems, the problems of the university and the nation as a whole in your university?

Part IV. Demographic information

Please write on the space provided and put a check mark (✓) in the box in line with your demographic information.

1. Name of your University _____ College _____ Department _____

2. Gender: male ☐ female ☐

3. Qualification: PhD ☐ MA/MEd/MSC ☐

4. Academic rank: Lecturer ☐ Assistant professor ☐ Associate professor ☐ rofessor ☐

5. Responsibility: Research director ☐ Technology transfer director ☐

Community engagement director ☐ College level research and community engagement coordinator ☐

Project leader ☐ Academic researcher ☐

6. Do you have training related to the responsibility in question 5? Yes ☐ No ☐

7. Experience in years in the responsibility rank indicated in question 5 _____ and total years of work experience _____.

8. Is there anything that you would like to suggest with regard to leadership and management of research and innovation in public higher education institutions in Ethiopia?

I thank you again for your cooperation!

Appendix G: Semi-structured individual interview questions

1. **Semi-structured individual interview questions for research leaders and managers at the Ethiopian Ministry of Education and Ministry of Science and Technology.**

1.1 What are your roles and responsibilities?

1.2 Do you think that the Ethiopian Science, Technology and Innovation (STI) policy is in line with African and international trends?

1.3 How do you lead the STI policy to be integrated into different national sectoral policies, programmes and plans?

1.4 How do you manage the formulation and implementation of the policy across sectors and at the national level?

1.5 How well-established and functional are the national innovation system? Who are the main actors in the system? To what extent are higher education institutions parts of the system?

1.6 How do you manage research and innovation activities and their funding at the national level?

1.7 How do you manage the resources (human, material and financial) at the national level?

1.8 What are the priority areas in the national STI policy? How were they determined?

1.9 How do you lead and manage STI policy to address local socio-economic problems, the problems of higher education institutions and the national development agenda of the country?

1.10 What are the main contributions of the research and innovation activities at the national level to:

1.10.1 local communities?

1.10.2 higher education institutions?

1.10.3 the industry?

1.10.4 the nation as a whole?

1.11 What are the success criteria for the development and implementation of research and/or innovation projects at the national level?

1.12 What are the main challenges or problems in leading and managing research and innovation activities in particular and STI policy in general?

1.13 Is there anything left that you would like to share to with regard to STI policy and the leadership and management of research and innovation activities at higher education institutions and national levels?

2 Semi-structured individual interview questions for the vice president for research and community service, the research director, or the technology transfer director of a university

2.1 What are your roles and responsibilities?

2.2 To what extent is the research and innovation policy of the university are in line with national policies, programmes and plans? Motivate.

2.3 What are the priority areas of the policy? How were they determined? Are they in line with national priorities?

2.4 Explain the university's research strategic plan? Why?

2.5 How do you lead and manage the research policy implementation of the university in the context of the local communities, the university itself and the nation at large?

2.6 How do you lead and manage the planning, implementation and utilisation of research and innovation projects of the university?

2.7 How do you manage the resources (human, material and financial) at a project, college and university level?

2.8 How do you manage the progress of different research and innovation projects of the university?

2.9 Which one is a priority at your university, basic or applied research? Motivate

2.10 Is discipline–based, interdisciplinary, or collaborative research that has been given priority in your university research activity? Why?

2.11 What are the criteria for funding the research and innovation projects?

2.12 What are the success criteria for the implementation of research and innovation projects? Explain

2.13 How do you lead and manage the relationships among education, research and innovation in the university?

2.14 Is there an established and functional innovation system in the university? Explain

2.15 How do you lead the linkage among the government, the industry and the university? Are the communities parts of the linkage? How do you lead the linkage?

2.16 What are the contributions of the research and innovation activities of the university to:

2.16.1 the local communities?

2.16.2 The university itself?

2.16.3 The industry?

2.16.4 The national socio-economic development?

2.17 What are the conditions that you facilitate for the researchers and project leaders to engage in developing, implementing and applying research or innovation projects successfully?

2.18 Do you have the habit of accommodating learning, creativity and adaptability in the research and innovation management of the university? Explain

2.19 Is there a room to accommodate emerging ideas that result from the interactions of research coordinators, researchers, project leaders and stakeholders that engage in the research and innovation activities of the university? Motivate

2.20 What are the main challenges and problems you have observed while leading and managing research and innovation activities of the university?

2.21 Is there something that you would like to tell me with regard to the leadership and management of research and innovation at your university?

3. **Semi-structured individual interview questions for research coordinators at the college level.**

3.1 What are your roles and responsibilities?

3.2 How do you lead the research and innovation practices in your college in line with the university research policy?

3.3 What are the priority areas of research at the college?

3.4 How do you manage the planning, production and utilisation of new knowledge or idea from your research and innovation projects?

3.5 How do you lead the research and innovation projects of the college in the context of the local communities, the college itself and the nation?

3.6 Is discipline-based, interdisciplinary, or collaborative research that has been given priority in your research projects? Why?

3.7 How do you manage resources (human, material and financial) at college and project levels?

3.8 How do you manage the quality of the research and innovation projects of the college?

3.9 How do you manage the performance of the project leaders and the researchers at the college level?

3.10 How do you manage the progress of research and innovation projects of the college?

3.11 What are the contributions of the research and innovation projects of the college to:

3.11.1 the local communities?

3.11.2 The college and university?

3.11.3 The industry?

3.11.4 The nation at large?

3.12 Do you have the habit of accommodating learning, creativity and adaptability while managing the research and innovation activities of the college? Explain

3.13 Is there a room to accommodate emerging ideas that result from the interactions of research coordinators, researchers, project leaders and stakeholders that engage in the research and innovation activities of the college?

3.14 What are the conditions that you facilitate for the researchers and project leaders to engage in research and/or innovation projects successfully?

3.15 What are the main strengths in the leadership and management of research and innovation activities and projects at college level?

3.16 What are the main weaknesses in the leadership and management of research and innovation activities and projects at the college level?

3.17 Is there anything that you would like to tell me with regard to the leadership and management of research and innovation at your college level?

4. **Semi-structured individual interview questions for the project leader.**

4.1 What are your roles and responsibilities?

4.2 How do you choose a research theme?

4.3 How do you build your research team?

4.4 How do you manage research and innovation projects in the context of the local communities, the university and the nation?

4.5 Is discipline-based, interdisciplinary or collaborative research that has been given priority in your research projects? Why?

4.6 How do you manage the progress of the research or innovation projects?

4.7 How do you manage the resources of the project?

4.8 How do you manage the quality of the project?

4.9 How do you manage the performance of each member of the project team?

4.10 What are the conditions that you facilitate for the researchers to engage in research and/ or innovation projects successfully?

4.11 What qualities do you pursue as a research or innovation leader?

4.12 What are the competencies you consider important as research and innovation leader?

4.13 What are the criteria that you use to measure the success of your project development, implementation and outcomes?

4.14 What are your and your team's research and innovation contributions to:

4.14.1 the local communities?

4.14.2 college and university?

4.14.3 the nation?

4.15 Do you have the habit of accommodating learning, creativity and adaptability while managing the research and innovation activities of your projects? Explain

4.16 Is there a room to accommodate emerging ideas that result from the interactions of research coordinators, researchers, and stakeholders that engage in the research and innovation activities of your projects?

4.17 What are your strengths in the leadership and management of research and innovation projects?

4.18 What are your main challenges or problems in the leadership and management of research and innovation projects?

4.19 Is there anything that you would like to tell me with regard to the leadership and management of research and innovation projects?

5 **Semi-structured individual interview questions for co-investigators**

5.1 What are your roles and responsibilities in the research and/ or innovation project?

5.2 How did you join the project team?

5.3 How does the research and /or innovation leader build a research team?

5.4 How does the leader manage conflicts within the team?

5.5 How does the leader manage the planning, implementation and application of the research project of your team in the context of the local communities, the university and the nation?

5.6 How does the leader lead research and innovation projects in the context of the local communities, the university and the nation?

5.7 How does the leader manage resources in the project?

5.8 How does the leader manage the quality of the project and its outcome?

5.9 How does the leader manage the performance of each team member of the project?

5.10 How does the leader manage the progress of the research or innovation project?

5.11 What are the success criteria for the implementation of the research or innovation project?

5.12 What are the contributions of the projects in your team to:

5.12.1 the local communities

5.12.2 the colleges and the university

5.12.3 the nation

5.13 What are the personal qualities of the leader of the research and innovation project in your team?

5.14 What are the competencies of the leader in your project?

5.15 What are the conditions that are facilitated for the researchers to engage in research and/ or innovation projects effectively?

5.16 Is there a room to accommodate emerging ideas that result from your interaction with the researchers within and outside your research and /or innovation projects? Explain

5.17 Is there a habit of accommodating learning, creativity and adaptability in the management of your research or innovation projects? Explain

5.18 What are the strengths and weaknesses of the leader in leading and managing research and innovation projects?

5.19 In the end, is there anything that you would like to tell about the leadership and management of research and innovation at the project or college or University level?

6 **Semi-structured individual interview questions for community leaders at the zone level**

6.1 What are your roles and responsibilities in leading and managing the community at the zone level?

6.2 What are the main problems of the local communities in your zone?

6.3 How do you address the problems?

6.4 Who are your partners in addressing the problems of the local communities?

6.5 To what extent has the university in your zone addressed the problems of the local communities? Motivate.

6.6 What are the main contributions of the university in addressing the problems of the local community?

6.7 What is the nature the collaborative leadership in research and innovation activities with the university and the industries in the zone? Why?

6.8 How do you describe the research and innovation performance of the university to address:

6.8.1 its own internal problems?

6.8.2 the problems of the local communities, and

6.8.3 the problem of national development?

6.9 What are the main successes that you have achieved while working as a team member in the research and innovation projects of the university?

6.10 What are the main problems observed while working as a team member in the research and innovation activities of the university?

6.11 Is there anything that is very important that you would like to tell me that I should not miss about the leadership and management of research and innovation at the university in your zone?

7 Semi-structured individual interview questions for industry managers around each university

7.1 What are your roles and responsibilities in the industry?

7.2 What are the main problems in your industry?

7.3 How do you address the problems?

7.4 Who are your partners in addressing the problems of your industry?

7.5 To what extent do the university in your area collaborate with the industry to address the problems?

7.6 What are the main contributions of the university in addressing the problems of your industry?

7.7 What are the nature collaborative leadership in research and innovation activities with the university and the local community or government leaders? Why?

7.8 To what extent does the research and innovation performance of the university address:

7.8.1 its own internal problems?

7.8.2 the problems of the local industries, and

7.8.3 the problems of national development?

7.9 What are the main successes that you have achieved while participating as a team member in the university research and innovation projects?

7.10 What are the main problems observed while working as a team member in the research and innovation activities of the university?

7.11 Is there anything that is very important that you would like to tell me that I should not miss about the leadership and management of research and innovation at the university in your area?

Appendix H: Guiding questions and checklist for document analysis

Questions for qualitative data collection from policy documents of the higher education institutions:

1. Are the visions, missions, objectives and priority areas of the research and innovation policies of the universities formulated in line with the visions, missions, and objectives of the national higher education research and technology transfer framework and, and STI policy?
2. Are the priority areas of the universities developed in line with the priority areas of the two national policy documents?
3. Do the research and innovation policy documents of the universities include the research and innovation leadership and management discussed in the two national policy documents?

Checklist for collecting quantitative data for five year- period of 2012 to 2017 annual reports of each university

S/N	Items	Plan versus contributions of the university in the last five year									
		2012/13		2013/14		2014 /15		2015/16		2016/17	
		N	%	N	%	N	%	N	%	N	%
1	Number of research projects planned to be completed										
2	Number of research projects completed										
3	Number of technologies planned to be transferred										
4	Number of technologies transferred										
5	Number of articles planned to be published										
6	Number of articles published										
7	Number of collaborations and partnerships planned										
8	Number of collaborations and partnerships achieved										
9	Budget allocated for research and innovation from the annual budget of a university										
10	Budget of research and innovation utilised at each university per year										
11	Number of Master students completed										
12	Number of PhD students completed										

Appendix I: Ethics clearance certificate

UNISA university of south africa

UNISA COLLEGE OF EDUCATION ETHICS REVIEW COMMITTEE

Date: 2018/05/16

Ref: 2018/05/16/58546596/11/MC
Name: Mr DW Berku
Student: 58546596

Dear Mr Berku

Decision: Ethics Approval from 2018/05/16 to 2023/05/16

Researcher(s): Name: Mr DW Berku
E-mail address: 58546596@mylife.unisa.ac.za
Telephone: +251 91 372 5162

Supervisor(s): Name: Prof HM van der Merwe
E-mail address: vdmerhm@unisa.ac.za
Telephone: +27 83 442 1503

Title of research:

The leadership and management of research and innovation in public higher education institutions in Ethiopia: Policies and practices

Qualification: PhD in Educational Leadership and Management

Thank you for the application for research ethics clearance by the UNISA College of Education Ethics Review Committee for the above mentioned research. Ethics approval is granted for the period 2018/05/16 to 2023/05/16.

*The **low risk** application was reviewed by the Ethics Review Committee on 2018/05/16 in compliance with the UNISA Policy on Research Ethics and the Standard Operating Procedure on Research Ethics Risk Assessment.*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the UNISA College of Education Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing.
5. The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study. Adherence to the following South African legislation is important, if applicable: Protection of Personal Information Act, no 4 of 2013; Children's act no 38 of 2005 and the National Health Act, no 61 of 2003.
6. Only de-identified research data may be used for secondary research purposes in future on condition that the research objectives are similar to those of the original research. Secondary use of identifiable human research data requires additional ethics clearance.
7. No field work activities may continue after the expiry date **2023/05/16**. Submission of a completed research ethics progress report will constitute an application for renewal of Ethics Research Committee approval.

Note:
The reference number **2018/05/16/58546596/11/MC** *should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.*

Kind regards,

Dr M Claassens
CHAIRPERSON: CEDU RERC
mcdtc@netactive.co.za

Prof V McKay
EXECUTIVE DEAN
Mckayvi@unisa.ac.za

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za