A MODEL FOR ASSISTING SOFTWARE PROJECT MANAGERS TO TREAT PROJECT TEAMS AS KEY STAKEHOLDERS: A CASE STUDY OF THE SOUTH AFRICAN SOFTWARE INDUSTRY

by

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Submitted in accordance with the requirements for

the degree of

DOCTOR OF PHILOSOPHY

in the subject of

COMPUTER SCIENCE

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROFESSOR ERNEST MNKANDLA

September 2020

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13 October 2020
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ACKNOWLEDGEMENTS

- To God Almighty: Thank You for the strength and sound mind during the taxing times of this study.
- To my supervisor, Professor Ernest Mnkandla: Sir, I could not have wished for a better supervisor than you. I appreciate your wise advice and gentle guidance during this journey.
- To my mother and late father: You did everything possible to give us education under difficult circumstances; your labour was not in vain.
- To my immediate dear family (oNokwindla): I hope this work will inspire you.
- Finally, I would like to thank everyone who directly or indirectly contributed to this research: my language editors (Dr Laura Budler Kleinhans and Mr Sean Harper); the software professionals who participated in this study; and my friends and colleagues. This study would not have been possible without your valuable contributions.

ABSTRACT

Projects in the Information and Communication Technology (ICT) industry have diverse project stakeholder groups. Project teams (PTs) are typically a key class of role-players. Despite the empirical evidence of the pivotal role played by PTs, project managers (PMs) and authors of project management literature, to a certain extent; have failed to pay attention to the needs and concerns of this stakeholder group. It has thus not been accorded key stakeholder status, as it ought to. The literature has shown that project stakeholders who have enjoyed the attention of PMs and project management literature are those that are considered to wield more economic muscle.

The limitations of the current stakeholder management tools and models, as revealed by the stakeholder management literature, have constrained them from addressing the neglect of software project teams. It is based on this gap that the study proposed and developed a model and a project management intelligence (PM*Int*) tool aimed at assisting software PMs to pay necessary attention to the concerns and needs of project teams, thus treating them as key stakeholders. To get a contextual understanding of the neglect of the PTs, an 'as is' environmental analysis was carried out. One of the important findings of the environmental analysis was the inconsistent and varying application of processes for the gathering of views and concerns of PTs by project managers. In order to address this problem, the model incorporates the project management office as a custodian and guardian of project management processes, including the gathering of project teams' views and concerns.

Following their development, both the model and PM*Int* tool were refined and evaluated using a two-phase expert-based Delphi method. Thereafter, both artefacts were further validated through an evidence-based process. The model was evaluated and validated in accordance with ICT model assessment criteria. The interview data analysis results of the two processes from the participants indicated that a majority of them embraced both artefacts, even though some participants pointed out inaccuracies from the tool's output.

The model is intended to give a stakeholder voice to one of the, if not the most, 'forgotten' stakeholder group in the ICT industry, because the continued disregard for their interests is not sustainable and produces negative project outcomes.

Keywords

Model; ICT project teams; Project managers; Software projects; Project management intelligence tool; Key stakeholders; Project stakeholders; Standardised project management; Validation

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ICT	Information and Communication Technology
PT	Project team
PM	Project manager
CSFs	Critical success factors
PM*Int*	Project management intelligence
DSR	Design science research
DSRM	Design science research methodology
Unisa	University of South Africa
PMO	Project management office
PMI	Project Management Institute
CEO	Chief Executive Officer
IT	Information Technology
BI	Business Intelligence
IS	Information Systems
SDLC	Systems development life cycle
UML	Unified Modelling Language
JSON	JavaScript Object Notation
POS	Part-of-speech
APIs	Application Programming Interface
NLP	Natural Language Processing

GLOSSARY

A model	Abstraction or simplification of a real or conceptual artefact
Actor-Network Theory	A theory, which considers networks (associations or relations) as processes which shape and reshape relationships amongst individuals, organisations and entities
Critical success factors	Determinants which are considered vital for the successful completion of a project
Evaluation	A measurement process to determine the extent to which an artefact meets set assessment criterion or criteria; the process is opinion-based
Project stakeholders	People, groups or organisations who may impact, be impacted by, or identify themselves to be affected by a project action, decision or outcome
Key project stakeholder	A project stakeholder who provides essential resources or possesses power or influence over the project because of the unique position over the project
Project management intelligence tool	A project management tool, which assists in creating knowledge from available business and project information through a systematic process which involves collection, analysis, communication and management that will enable better project decisions to meet project needs
Project success criteria	Measurement standards or assessment criteria (e.g. time, cost, quality, project team satisfaction) against which project outcome is assessed
ICT project team	A team which consists of ICT professionals who are directly involved in the development of software solutions within a project, including software developers, software testers, system analysts, software architects and database designers.
Stakeholder management	A management process of stakeholders by a project management team with the aim of enabling the stakeholders to contribute positively to project success
Standardised project management	A standardised set of project management tools, practices, processes and skill sets.

Validation	A process of determining through experimentation that a concept or construct is performing and producing results as expected; the process is results-based

PUBLICATIONS FROM THE STUDY

Academic Journals

Hans, R. T., and Mnkandla, E. 2021. A model for assisting ICT project managers to treat project teams as key stakeholders: What do experts say? *Procedia Computer Science, 181,* 1105-1113.

Hans, R. T., and Mnkandla, E. (In press). The South African software industry lacking project critical success factors: A project team perspective. *International Journal of Forensic Software Engineering.*

Hans, R. T., and Mnkandla, E. 2019a. A framework for improving the recognition of project teams as key stakeholders in Information and Communication Technology projects. *International Journal of Project Organisation and Management*, *11*(3), 199–226.

International Conferences

Hans, R. T., and Mnkandla, E. 2021. Assessment of a model using a framework for the validation of Information System artefacts. *International Conference on Interdisciplinary Research in Technology & Management (IRTM)*, 202–207.

Hans, R. T., and Mnkandla, E. 2019b. To What Extent Do South African Software Organizations Lack Project Success Factors? *2019 IEEE International Conference on Contemporary Computing and Informatics (IC3I)*, 211–216.

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CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter presents the motivation, the research background and the purpose of this research study. The important role played by software project teams (PTs) in the achievement of project goals and the simultaneous neglect of software project interests by project managers (PMs) are discussed and related to existing literature. The chapter outlines the research problem, the research questions, the research objectives and the research contribution of this study. Furthermore, this chapter provides a summary on methodologies used by the study. Lastly, the chapter concludes with summary on what the chapter is about.

1.2 Background of the research study

Information and Communication Technology (ICT) Projects are used by organisations as a means of meeting business objectives and optimising business operations (Albert, Balve & Spang, 2017; Berssaneti and Carvalho, 2015; Millhollan and Kaarst-Brown, 2016); essentially, projects are business undertakings, which are intended to realise business goals (Hans and Mnkandla, 2013; Thakurta, 2015). ICT projects have various stakeholders, broadly defined as *'individuals, groups, or organizations who may affect, be affected by, or perceive themselves to be affected by a decision, activity, or outcome of a project'* (Project Management Institute (PMI), 2013: 589).

One of the key stakeholder groups of any ICT project is a project team made up of individuals who work interdependently to achieve set project goals (Hoch and Dulebohn, 2013). As projects in this field are intensive with respect to human resources, it is no secret that PTs are not only fundamental ingredients in projects (Faraj and Sambamurthy, 2006) but are also themselves key stakeholders in these projects (Albert *et al.,* 2017; McLeod *et al.*, 2012). Walt Disney, (in Lam, McNeeley & Bhargava, 2015:7), agrees with this view and states that, *'You can dream, create, design and build the most wonderful place in the world… but it requires people to make the dream a reality'.*

Furthermore, Davis (2014) posits that stakeholders, PTs in the case of ICT projects (Andrias, Matook & Vidgen, 2018; Hoch and Dulebohn, 2013), play a vital role in the successful completion of project. Additionally, the satisfaction of stakeholders, PTs included, is one of the criteria used to determine project success (Millhollan and

Kaarst-Brown, 2016). This implies that project managers are expected to address project teams' needs.

According to Grimble and Wellard (1997), a number of initiatives (projects) fail because PMs don't pay adequate consideration to the necessities and interests of stakeholders. Similarly, Coakes and Elliman (1999) posit that stakeholders should be considered and consulted regarding project issues of interest to them, and also be allowed and encouraged to play a participative or responsible role in matters, which concern them.

A project manager has the responsibility of managing and maintaining relationships with all stakeholders, both primary and secondary (Meng and Boyd, 2017). The key aspects of consideration for internal stakeholder relationship management include: (i) good communication between a PM and team members, as well as amongst team members; (ii) building trust between a PM and PT members, and amongst team members; (iii) the ability of a project manager to listen carefully and respond collaboratively, rather than listening to tell (Helin, Jensen & Sandström, 2013; Sloan, 2009), to team members' needs and concerns (Meng and Boyd, 2017).

Moreover, Hoang, Deegan and Rochford (2013) postulate that a PM's mandate is not only to deliver technical solutions, but also to satisfy stakeholder expectations through efficient communication strategies. The same authors further claim that project stakeholder satisfaction is highly dependent on sound project management leadership from a project manager. The satisfaction of a PT member is based on meeting expectations (Basten, Stavrou & Pankratz, 2016), because each PT member's expectations are influenced by individual needs and interests (McLeod, Doolin & MacDonell, 2012), as depicted in Figure 1.1.

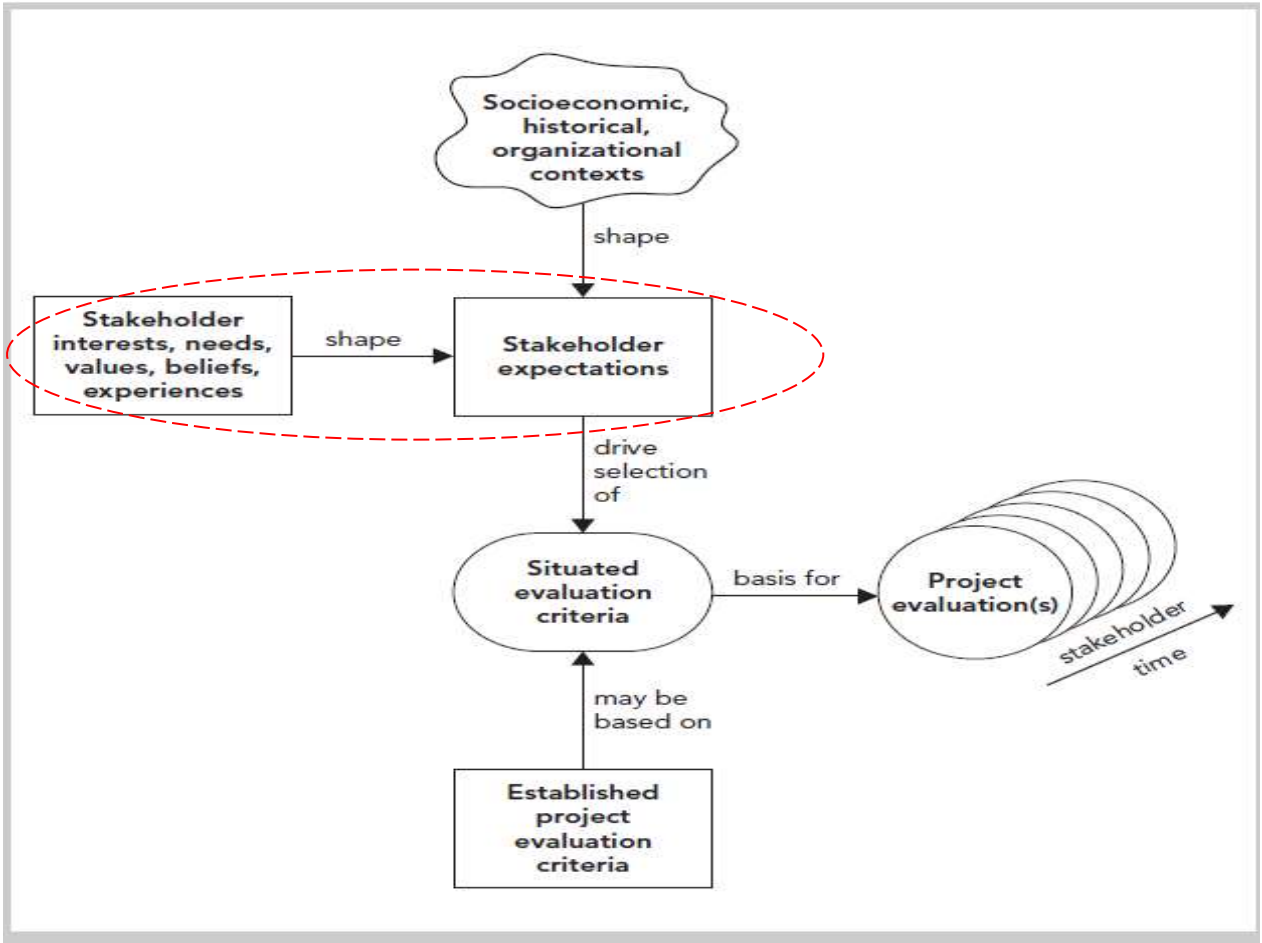


Figure 1.1 - A perspective-based framework for evaluating project success (Source: McLeod, Doolin & MacDonell, 2012)

Therefore, the preceding discussion points to the need for effective project stakeholder management for the successful achievement of ICT project objectives (Sutterfield, Friday-Stroud & Sheivers-Blackwell, 2006). Over the years, various stakeholder management frameworks and models have been developed with the sole purpose of aiding PMs to manage project stakeholders better. Two of the prominent frameworks and models are the Stakeholder Circle methodology (Bourne and Walker, 2005; Walker, Bourne & Shelley, 2008), which is based on the work of (Mitchell, Agle & Wood, 1997), and Social Network Analysis (Yang, 2014), which considers the significance of stakeholder networks (relationships among project stakeholders) for a project.

However, Jensen and Sandström (2011), as well as Missonier and Loufrani-Fedida (2014), posit that current stakeholder management models have limitations in that they fail to help PMs identify all project stakeholders and their project interests. Based on

these limitations, Missonier and Loufrani-Fedida (2014) propose a new stakeholder analysis framework and model, which is based on Actor-Network Theory. However, Davis (2017) argues that Missonier and Loufrani-Fedida (2014) model was not designed in the context of project success, but on a failed project context (i.e. Their model is based on a single case study project which failed). These limitations could contribute to insufficient attention being given to PTs' interests by PMs, and result in project teams being treated as non-key stakeholders. In light of this and the lack of relevant research aimed at assisting project managers in this regard, there is a need for a tool to address these gaps.

1.3 Problem statement

Verma (1996, cited in Hans and Mnkandla, 2013) states that:

> *One of the toughest challenges in managing a project in the 21st century, is to manage the people involved in delivering the project successfully.*

Development Review Management (1997) supports this claim and further states that many projects (about 65%) fail because project managers do not pay sufficient attention to issues related to project team members. Moreover, poor communication amongst some key stakeholders, including project teams, and PMs, contributes to project failure (Hans and Mnkandla, 2019a; Ebad, 2016). In support of this claim, Mnkandla (2013) states that a project where there is no proper communication it is bound to fail. If there is poor communication between a PM and project teams, it is therefore unlikely that the needs of project team members can be part of the issues to be addressed by a project manager. Furthermore, project managers constantly take decisions, which may lack consideration of the consequences on team members. Additionally, if there is poor communication, how would a project manager know if some important team members are not happy with some issues in the project and may be considering leaving the project or the organisation? Such real-time and informative data is essential to a PM in order to make thoughtful decisions on issues that affect project teams and project operations (Hedgebeth, 2007). Lack of such critical information results in insufficient attention paid to project team members' issues and concerns in a project, thereby causing a project to fail.

Team members are key stakeholders in a project, as discussed in Section1.2, and therefore paying attention to details that pertain to team members is important. Continuous stakeholder analysis, with an eye to meeting the expectations of same, is crucial in project management. Schwalbe (2015:512) supports this view by stating that the importance of a project manager taking time to identify, understand and manage relationships with key stakeholders (PTs included) cannot be overemphasised.

Furthermore, research on factors that influence project success has been largely conducted around issues like executive support, user involvement, clear business objectives, etc. but little or no attention has been paid to the importance of PMs paying necessary attention to their PT members. In support of the need for exploring other project critical success factors (CSFs), Christenson (2007) states that project CSFs mentioned in literature are necessary but not enough '*to explain project success*'. The preceding discussion has therefore led to this research study's research questions, as expressed in the next section.

1.4 Research questions

The research questions for this study are:

1. *How can a model supported by a project management intelligence (*PM*Int) tool assist ICT project managers to pay necessary attention to project team issues and thus treat them as key project stakeholders?*
2. *Does the use of the proposed model supported by a* PM*Int tool improve the attention given to the needs and interests of project teams as key stakeholders by project managers?*

1.5 Purpose of this research study

The purpose of this research study is to develop a model, which is aimed at assisting project managers to pay necessary attention to the needs and concerns of project teams, thus treating them as key stakeholders by addressing their concerns and needs. It is aimed at providing support to ICT PMs to pay necessary attention to the needs and interests of PT members, which will improve relationships between the PM and individual PT members. The model makes use of an interactive PM*Int* tool (in-depth discussion on the PM*Int* tool in Section 2.5.1 of Chapter 2 of this study) to mine

opinions of project team members about their issues of concern and interest, which should enable a project manager to pay them the necessary attention.

1.6 Research objectives

Based on the research questions given in Section 1.4, the following research objectives were developed:

1. To design and develop a model aimed at assisting ICT project managers to pay the necessary attention to project teams, and thus treat them as one of the key stakeholder groups.
2. To design and develop a PM*Int* tool to support the model proposed by this study.

Objectives 1 and 2 are linked to research Question 1 of this research study.

3. To refine the model as well as the PM*Int* tool.
4. To measure the effectiveness of the designed model and the PM*Int* tool using the Delphi experts as well as a real-life project.

Objectives 2, 3 and 4 are linked to research Question 2 of this study.

1.7 Research methodology

Any scientific research follows one of the four major philosophical paradigms, which are positivism, constructivism, transformative paradigm and pragmatism (Creswell, 2014:34). Positivism paradigm is closely linked to controlled experiments, even though there are survey and case studies conducted by positivists (Easterbrook, Singer, Storey & Damian, 2008). Quantitative measures in studying and understanding the behaviour of subjects of interest is important to the positivism paradigm. On the other hand, constructivism paradigm is linked largely to qualitative research (Creswell, 2014:38), with less emphasis on proving or refuting theories (Easterbrook *et al.*, 2008; Vosloo, 2014). According to the transformative paradigm one cannot separate politics and research, and therefore the study of lives of the oppressed groups should be the focal point of research (Creswell, 2014:41; Easterbrook *et al.,* 2008). Unlike the other three paradigms, pragmatism is not restricted to any belief, and therefore any suitable method to obtain required knowledge is considered suitable (Creswell, 2014:43). This study therefore follows the pragmatic philosophical paradigm, because it uses mixed

methods in addressing its research problem, as discussed in Section 3.2. Chapter 3 of this study provides a detailed discussion of the four main paradigms.

As was mentioned in Section 1.5 of this thesis, the primary aim of this study is to develop a model to assist ICT PMs to pay sufficient attention to project teams. The Design science research (DSR) methodology was used to develop the study's model, because the DSR methodology is meant to create such artefacts aimed at addressing human problems (Ostrowski, Helfert & Xie, 2012; Peffers, Tuunanen, Rothenberger & Chatterjee, 2007). The DSR methodology involves four process steps, which are: awareness of problem, suggestion, development and conclusion (Vaishnavi, Kuechler & Petter, 2019). The methodology is open to the use of the case-study approach during its different steps and phases, especially during the evaluation phase (Mettler, Eurich & Winter, 2014). As a result, a multiple-case study approach was used, where five ICT projects, each with a project manager and five PT members were selected for participation.

As a form of ensuring a contextual picture of the research problem in South Africa, an 'as is' environmental analysis was carried out during the "awareness of problem" step. The development and the evaluation phases of the DSR methodology entail iteration, where the solution is improved and evaluated iteratively. To achieve this, the Delphi methodology was utilised and this involved two Delphi stages, as explained in Chapter 3. The panel of experts that participated in the refinement and evaluation of the model during the two stages of the Delphi process were drawn from the same five ICT projects, which were mentioned in the previous paragraph, as well as five academics. Following the refinement and evaluation process of the model and the PM*Int* tool, the two artefacts were validated on a real-life project environment using one of the five projects which were selected to participate in the 'as is' environmental analysis.

The DSR methodology was again used for designing and delivering the PM*Int* tool, since the tool is also an artefact. The input received from the 'as is' environmental analysis process served as valuable guidance on how the tool ought to function. The PM*Int* tool is a web application and this facilitated the improvement and evaluation of the tool. Once more, a two-stage Delphi methodology with the panel of experts mentioned in the previous paragraph was used during the enhancement and evaluation steps of the PM*Int* tool.

The primary data used in this study was gathered during the ‘as is’ environmental analysis process, during the two stages of the Delphi process and during validation process of the two artefacts. Face-to-face semi-structured interviews were used to gather data during the ‘as is’ environmental analysis stage, while telephonic semi-structured interviews were used to gather data during the two data gathering stages of the Delphi methodology as well as the feedback data following the validation process. This was because the South African lockdown caused by the Covid-19 pandemic made the conducting of in-person interviews illegal. The collected data was coded and analysed using the ATLAS.ti (Friese, 2012:1) tool in the case of qualitative data, and R for statistical analysis was used for analysing quantitative data. The detailed discussion of the research methodology followed by this study is presented in Chapter 3.

Before the collection of data, permission was sought from University of South Africa (Unisa)’s ethics committee to collect data from the participants, and it was granted. Table 1.1 summarises the link between the research questions, the objectives and the research methodologies used to address the research questions of this study.

Table 1.1 – Summary link between the research questions, the objectives and the research methodologies

Research Questions	Research Objectives	Methodology	Deliverables
How can a model supported by a project management intelligence (PM*Int*) tool assist ICT project managers to pay necessary attention to project team issues and thus treat them as key project stakeholders?	To design and develop a model aimed at assisting ICT PMs to pay necessary attention to PTs, and thus treat them as one of the key stakeholder groups	Literature review; Design science research Methodology; Case study approach – using 'as is' environment analysis results	A model developed in Chapter 4
How can a model supported by a project management intelligence (PM*Int*) tool assist ICT project managers to pay necessary attention to project team issues and thus treat them as key project stakeholders?	To design and develop a PM*Int* tool to support the model proposed by this study	Literature review; Design science research Methodology; Case study approach – using 'as is' environment analysis results	The PM*Int* tool developed in Chapter 5
Does the use of the proposed model supported by a tool such as the PM*Int* tool improve the attention given to the needs and interests of PTs as key stakeholders by PMs?	To refine both the model and the PM*Int* tool	DSR methodology; Case study approach; Delphi methodology	A refined model and the PM*Int* tool. The results of Delphi method
Does the use of the proposed model supported by a tool such as the PM*Int* tool improve the attention given to the needs and interests of PTs as key stakeholders by PMs?	To measure the effectiveness of the designed model and the PM*Int* tool when applied in project environment	DSR methodology; Case study approach (validate the artefacts in a real-life project environment); Delphi methodology	The results of Delphi method – the evaluation process results. The results of the validation process.

1.8 Motivation of this research study

The importance of human resources in the Information and Communication Technology (ICT) sector is immense, a statement supported by Smith (2008:20):

> *Quality services, innovative and critical thinking, effective working all come in significant part out of the combined effort of an organisation's human resources (HR), not from technology, processes, or financial structures.*

Faraj and Sambamurthy (2006) as well as Popaitoon and Siengthai (2014) concur with these sentiments by stating that the achievement of ICT project objectives is almost solely dependent on project teams (PTs). Furthermore, PTs play a critical role in aiding project management performance (Bryde, 2003; Mir and Pinnington, 2014; Pee, Kankanhalli, Tan & Tham, 2014; Lindsjørn, Sjøberg, Dingsøyr, Bergersen & Dybå, 2016) because the development of ICT applications and tools is dependent on PTs, as they provide knowledge and skills to projects (Sloan, 2009).

The project teams that are of interest in this research study are those teams that are directly involved in the software development projects: such teams include software developers, software quality engineers, system analysts, software architects and database designers, as also identified by Pankratz and Basten (2013). According to Yuan, Zhang, Chen, Vogel and Chu (2009) as well as Hoch and Dulebohn (2013) project teams in ICT are mainly characterised by the following: (i) team members working on parallel projects or non-routine activities (membership of a team is temporary); (ii) high interdependency within and amongst teams; (iii) high collaboration amongst teams and/or team members; (iv) teams dealing with complexity and ambiguity; and (v) teams consisting of knowledgeable team members with multidisciplinary skillsets. The abovementioned ICT project teams' characteristics differentiate ICT teams from teams in other sectors.

Regardless of the proven critical role played by ICT PTs in projects, project teams have become overlooked and neglected key project stakeholders, because project managers ignored their needs (Bourne, 2011; Hans and Mnkandla, 2019a; Pecherskaya, Kamaletdinov, Zhabin & Grishina, 2015; Tadinen, 2005; Turner, Heumann and Keegan, 2008). However, there seems to be no justifiable reason for the neglect of PTs by PMs, as discussed in the next chapter of this study. In fact, the

neglect of PTs' needs by PMs has created a number of challenges and problems in projects, including a high failure rate of ICT projects (Tham, Pee, Kankanhalli & Tan, 2008), because PT members feel more inclined to leave projects and their organisations (Pee *et al.,* 2014), due to their concerns remaining unaddressed. In support of this assertion, Ertürk and Vurgun (2015) claim that when team members perceive that their concerns and needs are addressed, and who consequently feel supported by the organisation, they are unlikely to leave the organisation. Furthermore, the satisfactory address of project members' needs and concerns has a critical influence on project success (Müller and Turner, 2007). However, the continuous neglect of PTs' needs and concerns by PMs indicates that PMs have not taken heed of this, as well as the stern warning from Coakes and Elliman (1999:5) that: *'managers ignore internal and external stakeholders who can affect the success of a development at their peril'*.

ICT project teams have not only experienced marginalisation at the hands of PMs, but also their project interests have found little coverage, if any, in the project management literature. However, other key project stakeholders' interests have experienced wide coverage, and some of these stakeholders which have received more attention in literature include customers from studies by Dibbern, Goles, Hirschheim and Jayatilaka (2004), Hätönen and Eriksson (2009), as well as Basten and Pankratz (2015); suppliers from studies by Mao, Lee and Deng (2008) and Savolainen, Ahonen and Richardson (2012); project managers from studies by Müller and Turner (2007), Pankratz and Loebbecke (2011), as well as Pankratz and Basten (2019); top management (sponsors) interests covered by Doherty and King (2001), Young and Jordan (2008), Dong, Neufeld and Higgins (2009); and users' interests covered by Abelein, Sharp and Paech (2013).

Furthermore, there is a lack of empirical research studies for helping PMs to treat PTs as key project stakeholders by addressing their project interests and expectations. The existing literature has fallen short in helping PMs to correctly identify stakeholders and provide appropriate strategies for stakeholder management (McManus, 2004). Confirming this assertion, Basten *et al.* (2016) state that there has been a lack of research work on approaches for meeting software projects stakeholders' expectations on the process side, while on the other hand there has been a prevalent

focus by researchers on strategies for addressing stakeholder expectations on project products.

PTs' expectations are aligned with the process side (project management processes), whereas expectations of many other stakeholders, such as customers, users and project managers, to a certain extent, are linked to project products. It would therefore appear that the claim of PTs to being treated as key stakeholders is more rhetorical than realistic in practice, an observation also made by (Hans and Mnkandla, 2019a).

The lack of empirical research aimed at assisting PMs to pay due attention to both the needs and concerns of PTs, as presented in the preceding paragraphs of this section, has prompted this study. The purpose is to fill this gap by developing a model aimed at assisting PMs to pay the necessary attention to PT's needs, and treat them as key stakeholder groups by addressing their concerns and needs. The proposed model makes use of a sentiment analysis tool to mine opinions of project team members about issues of concern on the project.

1.9 Significance of this research study

Winter, Smith, Morris and Cicmil (2006) state that research directed at theory in practice and theory for practice in project management is important for the advancement of project management. The significance of this research study therefore is to advance both theory in practice and theory for practice of project management by developing a model intended to improve the attention given to PTs by PMs and aid PMs to treat PTs as one of the key stakeholder groups of ICT projects. This research study therefore seeks to contribute to project management in the following ways:

- The first contribution relates to reducing the paucity of research studies (lack of empirical studies gap) aimed at assisting PMs to pay the necessary attention to PTs' needs and concerns.
- The second contribution is the proposed model, intended to assist PMs to pay the needed attention to the interests and concerns of PTs, and consequently treat PTs as a key stakeholder group, as they ought to be (Hans and Mnkandla, 2018a; Hans and Mnkandla, 2019a). The model involves revised thinking

concerning how PTs are to be treated as key project stakeholders, thus responding to Eskerod, Huemann and Ringhofer's (2016) call for new ways of managing project stakeholders. Therefore, the proposed model contributes to theory in practice.

- The PM*Int* tool designed by this study is the third contribution of this research project. The Covid-19 pandemic has ushered in new working conditions, where remote working of ICT project teams has become a reality than ever before. Therefore, the need for a project manager to monitor the feelings and concerns of team members under these conditions has become imperative. The PM*Int* tool provides project managers with these informal discernment capabilities, which should enable them to anticipate likely future behaviours of their team members better.
- The fourth contribution is a practical one, because the processes discussed in the model are adoptable by companies to ensure that software project teams are managed as key stakeholder groups for the delivery of successful projects, an argument which was also advanced by Hoang, Deegan and Rochford (2013) for a model developed in their research study.

The following chapters constitute the remainder of the study:

Chapter 2: Literature review: This chapter reviews what the literature says with regard to stakeholder management; the important role played by ICT project teams as key stakeholders in project success; ICT PTs as neglected stakeholders; the problems caused by the neglect of project teams in ICT; the weaknesses of some of the stakeholder management tools; the need for better management of PTs; the need for project management intelligence tools; project team engagement; project team morale; and the importance of the project management office (PMO). The chapter concludes with a proposal for a model to assist project managers to pay the necessary attention to the needs and interests of project teams.

Chapter 3: Research design and methodology: In this chapter, the research design and the methodologies used are discussed. The three data collection stages, as well as the data collection instruments used, are presented. The sampling method and the sample size used in the study are articulated. Processes for evaluating, refining and

validating the model and the PM*Int* tool developed by this study are set out. Data analysis techniques followed are presented and discussed.

Chapter 4: A model for assisting software project managers to treat project teams as key stakeholders: This chapter develops the model proposed by this study. It starts by presenting the results of the 'as is' environmental analysis that have an influence on the design and the functionality of the model. The model is then developed based on the outcome of the 'as is' environmental assessment, as well as the literature review.

Chapter 5: The design and development of the PM*Int* tool: The development of the project management intelligence (PM*Int*) tool is presented in this chapter. The chapter begins with the origin of the tool and states the main contributors to its current prototype state. The architecture of the PM*Int* tool, which includes the input data sources, the application layer and the user interface layer, are discussed in detail. The chapter concludes with a section detailing the technologies used to develop the system and the reasons behind their selection.

Chapter 6: Research results: This chapter presents the results pertaining to the 'as is' environmental analysis conducted in this study, the refinement and evaluation process of the model and the PM*Int* tool as well as the validation process of the model and the PM*Int* tool. The chapter starts with a presentation of the analysis of the data collected during the 'as is' environmental study and concludes with the analysis results of the validation process of both the model and the PM*Int* tool.

Chapter 7: Discussion of the research results, conclusion and recommendations: The results from the analysis of the primary data are synthesised in order to obtain better understanding of: (i) the prevailing conditions in the ICT industry concerning the level of attention PTs receive from PMs. Where necessary, recommendations are presented for each finding of the study. (ii) the results of the refinement and evaluation process of the model and the PM*Int* tool. (iii) the results of the validation process of the model and the PM*Int* tool. The chapter also provides answers to the research questions of the study based on the synthesis of the data analysis results. Finally, the conclusions and limitations of the study are presented.

1.10 Summary

Based on the perpetual neglect of software PTs by PMs this chapter argued for a model, which is aimed at assisting software PMs to pay necessary attention to the needs and concerns of PTs, and such behaviour would demonstrate that PTs are regarded as key stakeholders. The model makes use of an interactive PM*Int* tool to mine opinions of PT members in order to establish their issues of project concern and interest, which should be addressed by a PM.

This chapter also outlined the study's problem statement, research questions, research objectives and purpose. Furthermore, research methodologies to be used in order to achieve the purpose of this research study were presented. The motivation for this research and its significance were also discussed. Finally, the chapter provided an overview of the content of the chapters of this study.

The next chapter, Chapter 2, reviews and synthesizes research work, which is relevant to this research work.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter reviews and synthesises the literature, which is relevant to this study. Section 2.2 presents a discussion on stakeholder theory including stakeholder needs, important role played by different project stakeholders, as well as stakeholder management models and frameworks. Section 2.3 discusses the critical role played by software PTs in project success, while Section 2.4 presents an argument on software PTs as neglected key stakeholders. Section 2.5 discusses the need for better management of software PTs. The research gap that this study aims to address is discussed in Section 2.6, while Section 2.7 provides a summary to this chapter.

2.2 Stakeholder theory

According to Donaldson and Preston (1995) stakeholder theory may be categorised under three related but distinct theories, namely, descriptive or empirical theory, instrumental theory and normative theory. A descriptive theory simply explains the existence of stakeholders for an organization or a project, while an instrumental theory shows that organizations / projects (project managers) that regard stakeholders formulate effective strategies (Donaldson and Preston, 1995). A normative theory describes why organizations / projects (project managers) are expected to consider their stakeholders. Freeman and McVea (2001) claim that corporate planning, systems theory, corporate social responsibility and organizational theory are the building blocks of stakeholder theory. On the other hand, Aaltonen and Kujala (2010) and Rajablu, Hamdi, Marthandan and Wan Yusoff (2017) state that the stakeholder concept is rooted in organisational management and ethics and thus adding ethics as one of the foundation pillars of stakeholder theory.

Corporate planning considered stakeholders as having potential to impede an organization's objectives, and therefore management should discern stakeholders' needs in order to limit their possible damaging actions and at the same time find ways to maximize one stakeholder group, shareholders. This approach of stakeholder management is called management *of* stakeholders, and various scholars, such as Aagaard, Eskerod, Huemann and Ringhofer (2016), Freeman, Harrison and Wicks (2007), Huemann, Eskerod and Ringhofer (2016) and Silvius (2017) have cautioned project managers on its use as they consider it to marginalise some stakeholders. A

number of researchers, which include Aagaard *et al.* (2016), Silvius (2017) and Di Maddaloni and Davis (2017) advocate for the management *for* stakeholders approach, which is more inclusive in addressing all stakeholders' needs.

Systems theory stresses the importance of external connections, which are part of any organization (Freeman and McVea, 2001) or project by extension, because projects are regarded as temporary organisations (Hans and Mnkandla, 2013; Lindner and Wald, 2011). Organizations as well as projects are 'open systems' by nature, meaning that they are affected by the environment within which they operate (Eskerod and Larsen, 2018; Schwalbe, 2015:87). This indicates interconnectivity and interdependency between a project and its stakeholders. Therefore, the success of a project is dependent on the positive contribution of its stakeholders, as discussed in Section 2.2.2.

Freeman and McVea (2001) assert that organizational theory has similar roots as the systems theory. It is therefore not surprising that organizational theories attempt to describe organizations' or projects existence taking into account their external environment, and thus underscoring the important role played by stakeholders in an organization's/project's operation and existence.

Aaltonen and Kujala (2010) credit Cleland (1986) for introducing the stakeholder concept to project management. Aaltonen and Kujala (2010) claim that stakeholder theory field is relatively new in the field of project management. Stakeholders are broadly defined as '*people, groups, or organizations that could impact or be impacted by the project*' (Project Management Institute (PMI), 2017:540). Internal and external stakeholders are generally two broad categories of stakeholders (Aaltonen, 2011). Employees, labour unions and management teams are some of the internal stakeholders, while customers, suppliers and government constitute external stakeholders (Kerzner, 2009:231). However, internal stakeholder definitions given by certain scholars in the field of stakeholder management have been so narrow that some stakeholders may be excluded (Aaltonen and Kujala, 2010), while other definitions are too vague (Davis, 2014).

2.2.1 The balancing act of competing needs

Project management is about balancing competing demands presented by the project constraint, such as cost, time, scope and quality, as well as satisfying needs and expectations of various project stakeholders (Aaltonen and Kujala, 2010; Aapaoja and Haapasalo, 2014; Aga, Noorderhaven and Vallejo, 2016; Chang, Chih, Chew & Pisarski, 2013). In order to address the needs and expectations of stakeholders, project managers are expected to employ stakeholder management, which is aimed at understanding the needs of stakeholders for a project manager to make informative decisions and create a conducive environment for stakeholders to continue to support a project. The stakeholder theory points out that the prerequisite for effective management of stakeholders is understanding of their needs and behaviour (Aaltonen and Kujala, 2010). As such, better stakeholder management is one of the key performance areas for a PM in project management (Turkulainen, Aaltonen & Lohikoski, 2016). Stakeholder management in software projects points to the necessity for good stakeholder relationships, inclusive empowerment and collaborative efforts (McManus, 2004).

2.2.2 The importance of all project stakeholders

Eskerod *et al.* (2016) emphasise the important role played by stakeholders in various ways, financially and non-financially. Project success and project value-creation are targets achieved jointly by various project stakeholders, and thus the need for active engagement of all stakeholders by a project manager is highlighted (Chang *et al.,* 2013; Davis, 2014). In software projects, the quality and success of the final product is almost entirely dependent on the actions of stakeholders (McManus, 2004). For the realisation of these targets, a good working relationship between PM and stakeholders is imperative (Chang *et al.,* 2013; Hans and Mnkandla, 2018a; Hoang, Deegan & Rochford, 2013; Meng and Boyd, 2017). The value of the project lies not only in the functional product (in the case of a client), or in returns on investment (for the company carrying out the project and/or the client), but also about the experience (in the case of project teams) of carrying out the project (Chang *et al.,* 2013).

Due to the contributory role of project stakeholders to a project, project managers are expected to manage stakeholders judiciously. Even though various researchers (such as the ones mentioned in the preceding discussion) have demonstrated the

indispensable role of stakeholders in projects, projects have been failing due poor project stakeholder management, or even lack thereof (Aaltonen, 2011; Chang *et al.,* 2013), amongst other things. This is also taking place against the backdrop of numerous research work demonstrating how stakeholders should be managed effectively and efficiently (Aaltonen and Kujala, 2010). The stakeholder group, which seems to have been consistently on the receiving end of poor project management, is the ICT project team.

Inadvertently, or intentionally at times, project managers have been paying more attention to stakeholders who they perceive to possess more economic power or interest in the project (Turner et al., 2008)(Aaltonen and Kujala, 2010; Eskerod *et al.*, 2016; Eskerod, Huemann & Savage, 2016; Turner *et al.*, 2008), while overlooking other stakeholders who PMs perceive to be having less power, including project team members, in the case of software projects (Hans and Mnkandla, 2019a). Such treatment by project managers seems to disregard the value creation contribution of PTs mentioned in the preceding paragraphs. Moreover, the power possessed by project teams should not be a determinant of their treatment by project managers (Aagaard, Eskerod, Huemann & Ringhofer, 2016). The software project teams have not been neglected by PMs only, but researchers have also focused primarily on project stakeholders that are considered to be powerful economically (Aaltonen and Kujala, 2010; Di Maddaloni and Davis, 2017). This claim is also confirmed by Scott-Young and Samson (2008) who posit that few research studies have turned their attention to project teams and their management. The next section presents a discussion on stakeholder management theories, models and frameworks.

2.2.3 Stakeholder management theories, models and frameworks

The purpose behind stakeholder management is to develop a structured approach that assists managers to respond to business challenges, change and opportunities, as prior frameworks to stakeholder management framework were incapable of providing such assistance (Freeman and McVea, 2001). The same authors purport that the stakeholder management framework has its roots on many management fields, but more so on clinical studies of management practitioners.

The discussions at the beginning of Section 2.2 and the one presented in Subsection 2.2.2 emphasize a critical role played by project stakeholders in terms of project success and the need to cultivate an interdependent relationship between a project and its stakeholders. In order for a healthy relationship to exist between a project and its stakeholders, stakeholders ought to be managed circumspectly because ineffective management of stakeholder poses a big threat to project success, as stated by Mazur and Pisarski, (2015). At the heart of project stakeholder management is the ability of PMs to understand and address the needs and concerns of various stakeholders in order for them to contribute positively to project success. Stakeholder management tools and techniques are meant to assist a PM realise this aim and also help a PM manage the relationships amongst project stakeholders effectively (Hans and Mnkandla, 2019a; Mazur and Pisarski, (2015). The purpose of the tools and techniques is to help PMs identify various stakeholders, together with their project interests, categorise them, analyse their impact on a project and come up with strategies to manage them (Aapaoja and Haapasalo, 2014). Yang (2014) declares stakeholder management tools to belong to two main categories, which are empiricism and rationalism. Under empiricism, stakeholder analysis is carried out considering *only a representative* of stakeholders that is regarded to be representing the expectations and interests of other stakeholders in the group (Yang, 2014). The Stakeholder Circle methodology created by Bourne (2005), is an example of a tool belonging to the empiricism category.

The rationalist approach, on the other hand, engages nearly *almost all* the stakeholders in a group of stakeholders, not only a few of them (Crane and Livesey, 2017; Yang, 2014). The rationalism approach is based on the understanding that there are three types of project stakeholders, which are described by using three line-circles through the graph theory (Yang, 2014). The first circle represents stakeholders who are well known to the PT, while the second circle represents all stakeholders who less well known to the PT. The third circle denotes all stakeholders not known to the PT, but known to the stakeholders in both the first and the second circles (Yang, 2014). Based on this understanding then, the interests of all stakeholders in a project may be identified, as long as the interrelationships amongst the groups of stakeholders in the three circles are well established. However, due to ethical behavioural constraints,

some stakeholders may feel reluctant to offer information about other stakeholders, as doing so may violate the anonymity rights of these stakeholders (Yang, 2014). The Stakeholder Circle methodology and Social Network Analysis are the two prominent stakeholder management analysis tools, and the other approaches of analysis are based on them (Hans and Mnkandla, 2019a; Yang, 2014).

According to Yang (2014), the Stakeholder Circle methodology, also known as stakeholder salience framework (Aaltonen and Kujala, 2010; Aapaoja and Haapasalo, 2014) developed by Bourne (2005) is based on the work of Mitchell *et al.* (1997). The tool classifies stakeholders and analyses their impact on a project, or their level of significance to the project, based on three stakeholder attributes, namely, power, urgency and legitimacy (Yang, 2014). The number of attributes a stakeholder possesses determines the level of attention given by a PM and the degree of priority afforded to needs by a PM (Aapaoja and Haapasalo, 2014).

The Power attribute refers to a power relationship between stakeholders, say A and B, where A can make B perform a certain action which B would not otherwise do (Aaltonen and Kujala, 2010). According to Mitchell *et al.* (1997), there are three forms of power: *coercive,* which is based on force; *utilitarian,* which is rooted in incentives; and *normative*, which is based on sway or influence. Stakeholder may exercise any of the three types of power in a project when 'fighting' for their stake.

Urgency refers to the degree to which the action or claim of a stakeholder necessitates expeditious attention from a PM (Aapaoja and Haapasalo, 2014; Mitchell *et al.,* 1997). It is based on issues of time sensitivity (how quick the stakeholder requires the PM's response) and criticality (how important is the stake to the stakeholder) (Aapaoja and Haapasalo, 2014). For example, a delay in response by the PM to the issue raised by a PT member may see the team member quitting the project and resulting in undesirable outcomes for the project.

The legitimacy attribute refers to the understanding that the behaviour of a stakeholder is needed, normal and in accordance to the social justice system (Mitchell *et al.,* 1997). The Stakeholder Circle methodology may mislead a PM into incorrectly estimating the importance of a PT member in a project, resulting in a PT member being classified as having little or no power, which may have undesired consequences for a project.

Furthermore, Hans and Mnkandla (2019a) purport that the Stakeholder Circle methodology marginalises some stakeholders (focuses on a few stakeholders considered as representing other stakeholders in the group), subsequently neglecting the needs of the marginalised stakeholders, as discussed in Section 2.4 of this study. The marginalisation of PTs by the Stakeholder Circle methodology directly flies in the face of recommendations by Eskerod *et al.* (2016) for equivalent treatment of all stakeholders, regardless of whether they possess the Power, Legitimacy and Urgency attributes. Other researchers, such as Crane and Livesey (2017) have also levelled some criticism at the Stakeholder Circle methodology on the grounds that it treats stakeholders' interests as uniform.

Social Network Analysis is founded on Social Network Theory, which in turn is based on sociology and anthropology (Mitchell *et al.,* 1997; Yang, 2014). The Social Network Theory is premised on the fact that people are connected to each other, and this chain of connection establishes a network of interrelationships (Yang, 2014). The relationships amongst the stakeholders are the focal points in the Social Network Analysis. According to Timur and Getz (2008), Social Network Analysis involves the following steps: identification of stakeholders in the network using a snowball approach, assessment of significant stakeholder relationships, visualisation of the networks using a software package, analysis of the data of the network and presentation of analysis results.

As discussed earlier in this section, the Social Network Analysis approach is based on the understanding that project stakeholders are of three types, explained by using '*three in-line cycles in the graphic theory*' (Yang, 2014:841). The stakeholders in the first circle are people well known to the project team. The second circle consists of stakeholders who are known to the stakeholders in the first circle, but not well known to the team. The last circle are stakeholders not known to the team but well acquainted to the stakeholders in the first two circles. This approach is more suitable in identifying 'hidden' or 'invisible' project stakeholders with concealed power (Hans and Mnkandla, 2019a; Yang, 2014) who are not PT members, because team members are not 'hidden' or 'invisible' stakeholders, as they are at the forefront of delivering project output. Furthermore, a project manager is expected to have a direct relationship with each project team member in order to understand the needs and concerns of individual

team members and be able to provide team members with necessary support (Lee, 2004; Walter and Zimmermann, 2016). Yang (2014:847) concludes that '*no one single method for stakeholder analysis is perfect*'. As each method has strengths and limitations, their application should be undertaken with caution. The weaknesses of the two approaches, Social Network Analysis approach and The Stakeholder Circle methodology, have been also extensively analysed by Hans and Mnkandla (2019a) in terms of their failure to assist PMs to accord PTs an appropriate stakeholder status.

2.3 Software project teams are critical stakeholders

Walt Disney, as quoted by Development Review Management (1997:179), states:

> *You can dream, create, design and build the most wonderful place in the world … but it requires people to make the dream a reality.*

In support of this notion, Bourne and Walker (2005:650) state that software PTs are a '*considerable asset, contributing knowledge, insights and support … supporting its execution*'. Both statements point to the critical role played by software project teams in the development of software solutions. Very few, if any, can dispute the important role played by software teams in the success of a project (André, Baldoquín and Acuña, 2011; Hans and Mnkandla, 2018a; Hans and Mnkandla, 2019a). In support of this assertion, Davis (2014) states that stakeholders, including PTs in the case of ICT projects (Hoch and Dulebohn, 2013; Andrias *et al.,* 2018) are vital to project success. This statement indicates the important role of stakeholders, particularly software project teams, in projects. There has been a steady increase in the use of teams in projects in the recent past (Hoch and Dulebohn, 2013; Rezania and Lingham, 2009), pointing to the critical role performed by PTs.

Stakeholders who do not possess the Power (economic and/or coercive power), Legitimacy and Urgency attributes are not regarded as important stakeholders (Aapaoja and Haapasalo, 2014; Yang, 2014). These attributes are used to classify stakeholders in terms of who gets the full attention of a PM and who does not (Eskerod *et al.*, 2016). A software team member does possess power, in the sense that they can always withhold labour (Aapaoja and Haapasalo, 2014; Drucker, 2002; Hans and Mnkandla, 2019a). Moreover, according to Hans and Mnkandla (2019a) software PTs *have* a legitimate claim in a project because of their active participation and functional

roles in the project, as well as their contractual relationship with the organisation and project by extension (Aaltonen and Kujala, 2010). The urgency attribute of a PT member is dependent on the important role played by the team member at any given time and project phase. Therefore, depending on the role of the project team member, individual action may call for either immediate or delayed attention from a PM (Hans and Mnkandla, 2019a). Aapaoja and Haapasalo (2014) classify stakeholders under the following four categories:

a) *Keep as key players* – stakeholders with roles to play in the project;

b) *Keep informed* – stakeholders, whose actions have less impact on the project;

c) *Keep satisfied* – those who have the power to stop a project but have no personal interest in the project; and

d) *Keep to minimal effort* – those stakeholders lacking saliency.

Since software PTs have important roles in a project, they are categorised as key players, thus indicating that they are key and critical stakeholders, which affirmation is supported by McManus (2004) who says that software teams are key stakeholders because they stand to lose or benefit from a project.

2.4 The software project teams as neglected key stakeholders

Studies by Bourne (2011) and Hans and Mnkandla (2018b), established that PTs have become forgotten key stakeholders, and as such are not treated as key stakeholders by PMs. They are not embraced as project stakeholders and this is contrary to the recommendation made by Eskerod *et al.* (2016) for total stakeholder inclusivity in the process of dealing with stakeholders. A recent study by Hans and Mnkandla (2018a) also confirmed this observation in the South African ICT sector. Hans and Mnkandla (2019a) bemoan the neglect of software PTs by PMs, and state that this happens even though the critical role played by software PTs in project success has been proven by several research studies, including work by Aapaoja and Haapasalo (2014), Davis (2014), Lindsjørn *et al.* (2016) as well as Popaitoon and Siengthai (2014).

According to Hans and Mnkandla (2018a), there are some who justify and legitimise the side-lining and neglect of PTs by PMs, citing several 'reasons' for such action. The following have been advanced as 'justifiable reasons' for the neglect of PTs by PMs:

- Project managers regard PTs' concerns as 'distractive' (Bourne, 2011);
- PTs' interests are 'incompatible' with projects' needs (Aaltonen, 2011);
- Concerns of PT members are the responsibility of human resources department (Woods and Abdon, 2011).
- Some PMs consider PT members' loyalty to a project and an organisation as 'permanent' (Shen, 2011).
- Project managers could be paying little attention to PT members because they view them as having little or no economic and coercive powers, unlike other stakeholders such as clients, suppliers and project sponsors, as mentioned by Aaltonen (2011).
- According to Turner *et al.* (2008), the work of the project-based organisations necessitates that PMs chase financial targets and pay more attention to clients' needs than caring for the needs of PTs.
- There is no consensus amongst the researchers on the definition of project stakeholder (Eskerod *et al.*, 2016), and therefore some definitions may be too narrow (Aaltonen and Kujala, 2010) and others too ambiguous (Davis, 2014), such that they could be excluding some stakeholders, such as project teams. Therefore, PMs could justify their exclusion of PTs in the list of stakeholders that should receive their attention on the lack of consensus as to who should and should not be regarded as a stakeholder.
- Projects operate on limited resources and therefore concerns of other stakeholders might not be addressed (Aaltonen and Kujala, 2010; Di Maddaloni and Davis, 2017).

However, some of the reasons given as a justification for side-lining of software project teams by project managers are considered to be flawed by various researchers. Aga *et al.* (2016) state that the concerns and views of PTs cannot be regarded as 'distractive' because PMs who address PT members' concerns create a conducive project environment for PTs to perform. In support of this claim, Kissi, Dainty and Tuuli (2013) argue that the level of commitment of PTs to their work is partly determined by

the perceived level of support from a PM. Since every project stakeholder has expectations to be met by the project, one of the major PT expectations is that working on a project should assist in contributing to their growth of their skills (Millhollan and Kaarst-Brown, 2016) and therefore viewing their needs as 'incompatible' with the needs of the projects will be an error. A study by Kaliprasad (2006) also indicates that 87% of CEOs that were surveyed expressed the importance of addressing employees' issues.

The management of human resources during a project is the responsibility of a project manager, a team builder (Belout and Gauvreau, 2004; Radujković and Sjekavica, 2017), as indicated by the project management framework developed by PMI, and thus this function may not be outsourced to the human resource department. PMs are better positioned to address PT's issues, as they have close working relationship with team members (Hans and Mnkandla, 2018a). A PT's loyalty can never be perpetual, but is based on a *'reciprocal exchange relationship*' (Allen, Armstrong, Reid & Riemenschneider*,* 2008:556) which is aimed at benefitting all concerned (Eskerod *et al.*, 2016). Moreover, well-managed PT members commit, and become loyal, to an organisation (Kaliprasad, 2006). The view that PT members have little or no economic and/or coercive powers is not correct (Aapaoja and Haapasalo, 2014; Hans and Mnkandla, 2018a; Woods and Abdon, 2011) because they may not do possess the other types of power, but they have enormous labour power. The labour power in a form of skills and ability that the teams have is such that there is no automated machine which can match it (Kerr, 1989) and as long as that has not happened, software project teams should be valued and honoured (Mnkandla, 2008).

According to Hans and Mnkandla (2018a; 2019a) the continued unfortunate neglect of software PTs by PMs has had an indirect contribution to the ongoing poor project success rate in the software sector. The aforementioned researchers further argue that the neglect has resulted in other challenges for projects in this sector, such as unpleasant work environments, some key PT members quitting projects and attention given to other stakeholders at the expense of project teams. These assertions are also supported by Lee (2004), Mainardes, Alves and Raposo (2012), Parker and Skitmore (2005) as well as Pee *et al.* (2014). It is in the best interests of a project that a project manager should seek to balance the interests of *all* stakeholders and *not ignore others*

(Mainardes *et al.,* 2012). Projects cannot be regarded as successful in the absence of PT members' 'development and satisfaction' (Scott-Young and Samson, 2008:750).

2.4.1 The problems caused by the neglect of software PTs

Hans and Mnkandla (2019a) argue extensively about many ramifications, which emanate from PTs neglect, and these include low morale of PTs, high turnover of project team members and project failure due to project teams' low morale and high turnover of PTs. The scourge of employee turnover is unlikely to improve soon (Lee, Hom, Eberly & Li*,* 2018), unless project managers approach this phenomenon with new ideas of how to retain team members. The high turnover of project teams is a result of a number of factors, with PTs' dissatisfaction with the work environment and project managers' lack of attention to the needs of project teams being among them (Lee, 2004). The work environment (climate) under which PTs operate will determine whether PT members stay or leave (Kaliprasad, 2006). Kaliprasad (2006) posits that listening to and engaging PTs in decision-making processes are important factors in creating a conducive work environment, as well as retaining team members in a project. This claim is also supported by Lee *et al.* (2018), Ertürk and Vurgun (2015) as well as Walter and Zimmermann (2016) who state that employees who are highly engaged (listened and cared for) are less inclined to leave.

High turnover by PTs contributes to project failure (Lee, 2004; Pee *et al.,* 2014; Tham *et al.,* 2008), causes financial loss to organisations and depresses the remaining team members (Lee *et al.,* 2018). Unexpected departure of project team members from a project is one of the contributing factors to project failure in the IT sector, as mentioned by Pankratz and Basten (2013). Disregarding project teams' needs and views may engender unhappiness in the workplace and lead to key PT members leaving a project or the organisation (Turner *et al.*, 2008), resulting in a failed project.

2.5 The need for better management of software project teams

The critical role of PTs in the success of software projects, as presented in Section 2.3, and the inclusion of stakeholder management as a knowledge area in the knowledge management framework by the Project Management Institute (2013) indicates that PMs should develop the requisite skillset to manage PTs efficiently and judiciously, especially given that better PT management is a prerequisite for project

success (Scott-Young and Samson, 2008). The lack of certain team management skills, as established by a study conducted by Hans and Rwelamila (2012) compounds the challenges around project team management even further. Moreover, the challenges in managing PTs are compounded by the uniqueness of software PTs, the uniqueness of software projects, the individuality of project team members (Rezania and Lingham, 2009), the differences in organisations and their cultures, as well as the fast-paced and dynamic nature of the information technology environment. The ever-changing software technologies used in software projects exacerbate the challenge for project managers of successfully managing software PTs (Hans and Mnkandla, 2013; Hans and Mnkandla, 2019a).

Tarim (2015) concurs with the sentiments and states that management of teams is one of the difficult tasks in project management. In the midst of all these challenges, PMs are expected to engage and properly address the needs and expectations of various project stakeholders (Ghapanchi and Aurum, 2011; Kaliprasad, 2006), software PTs included. A project manager's decision should indicate that he/she is motivated by the desire to address PTs' needs and is taking their interests seriously (McManus, 2004; Weaver, 2012), and this will provide a sense of belonging and care for project team members. A study conducted by Paradise (2008) shows that almost half of the organisations which engage their employees do not train their managers on how to engage employees. It is no surprise, then, that most PMs pay little attention to the needs of their PTs. According to Hans and Mnkandla (2018b), the training of PMs around stakeholder management, which includes stakeholder engagement, is a must for organisations, if some of the project management ills are to be curbed.

On the basis of the aforementioned challenges, the expected leadership and management role from project managers, as well as the critical role played by software project teams in delivering successful projects, Aaltonen (2011), Hans and Mnkandla (2018a) and Weaver (2012) are calling for improved management of these key project stakeholders. Drucker (2002) urges PMs to manage PT members as 'partners' or 'associates' and not as subordinates, because PT members are knowledge workers. Project teams are to be persuaded (Henderson, 2004) instead of being instructed while looking to satisfy their needs and expectations as one would do with 'partners' and 'associates' (Drucker, 2002). Furthermore, given the scarcity of project knowledge

workers and the mobility of these resources in the ICT sector (Ghapanchi and Aurum, 2011), South African organisations in particular are faced with the daunting task of retaining these resources (Bagraim, 2010).

It is therefore important that organisations should seek ways of addressing this critical challenge, amongst others. In the process of managing PTs, project managers should make fact-based decisions regarding PT members and this requires correct and quality information on individual PT members. Therefore, there have been calls for the use of project management intelligence tools, such as PM*Int* tool (Hans and Mnkandla, 2013, 2017) which is discussed in the next subsection.

2.5.1 The PM*Int* tool

The best way to drive and facilitate better decision-making processes is by providing fact-based and relevant information timeously at the point of decision-making. Hedgebeth (2007) supports this view, and states that managers need real-time 'actionable data' and information in order to make informed decisions on various issues that pertain to, for example, employees, business operations and expansion. Organisations are constantly required to gather project-related data and turn it into knowledge and intelligence. The need for project management intelligence tools has been extensively argued for by Hans and Mnkandla (2013, 2014, 2016), and the authors contend that such tools will enable project managers to attain project intelligence equivalent to that provided by business intelligence (BI) tools to business managers, in order to deal with the range of project management challenges presented in Section 2.5. The authors maintain that 'extending' BI tools to software projects is 'natural', given that projects are business constructs. Hans and Mnkandla (2013:3) define *Project Management Intelligence* (PM*Int*) as: *'The art and science of creating knowledge from available business and project information through the systematic process which involves collection, analysis, communication and management, which will enable better project decisions to meet project requirements'*. From this definition, it is evident that project management intelligence is to project management what business intelligence is to business.

The main aim of the PM*Int* tool is to perform sentiment analysis using text mining techniques on both structured and unstructured data pertaining to individual PT

members (Hans and Mnkandla, 2016). The PM*Int* tool provides a PM with information, which enables a project manager to be aware of the needs of PTs and to be alert of potential relationships and conflicts. Therefore, such information enables a project manager to build intelligence about one of the organisation's intangible assets, namely, project teams (Green, 2008). The tool enables a project manager to 'read' a project team member's intended move, as advised by Weaver (2012). The PM*Int* tool is a data-driven decision support system. As is the case with other BI systems, PM*Int* tool utilises data gathering, data storage, data analysis and knowledge management in its processes, the outputs of which are used in decision-making processes (Liyang, Zhiwei, Zhangjun & Li, 2011). This study's model makes use of the PM*Int* tool in the process of establishing the interests and concerns of individual PT members. The methodology used in developing the tool is presented in Chapter 3, while the design and development of the PM*Int* tool is discussed in Chapter 5 of the research study. The PM*Int* tool promotes and encourages, amongst other things, engagement between PM and PTs, as discussed in the following subsection. According to Kaliprasad (2006), effective human resource management involves four key issues: interaction (engagement) with individual employees, employee motivation as well as vision and learning. The first two issues are discussed in Subsections 2.5.2 and 2.5.3 respectively.

2.5.2 Project team engagement

The Project Management Institute (2013:559) defines stakeholder engagement as '*a component of the project management plan that identifies the strategies and actions required to promote productive involvement of stakeholders in decision-making and execution*'. This definition is in line with the one given by Sloan (2009), who further states that there is no universal agreement regarding what stakeholder engagement is and what characterises effective stakeholder engagement. The definition also indicates the need to have project teams participate in the decision-making process, a strategy which is key in retaining PT members in South Africa (Kaliprasad, 2006). However, it is generally agreed that the main objective of stakeholder engagement is to have better knowledge of stakeholders' expectations and interests (Eskerod and Huemann, 2014; Sloan, 2009). Further, there is no debate about the importance of stakeholder engagement to an organisation's success (Paradise, 2008). Effective communication and engagement with stakeholders is critical to receiving ongoing

support and commitment of PTs for the success of a project (Bourne, 2006). McManus (2004) states that stakeholder engagement reduces the risk of unwanted negative response from stakeholders.

Many project managers are not engaging stakeholders genuinely, but rather with the aim of informing the stakeholders of their predetermined decision on the issue at hand (Deetz (1995) cited in (Helin, Jensen & Sandström, 2013)). Helin, Jensen and Sandström (2013) consider this type of engagement with stakeholders as information oriented, aimed at informing, instructing and controlling stakeholders, instead of negotiating and having a dialogue with them. In contrast, bona fide engagement is communication oriented, characterised by each party being open to be persuaded by the other party in the process of negotiation. This style of engagement and collaboration engenders productive and committed project teams as stakeholders (Henderson, 2004; Weaver, 2012). Sloan (2009) presents two different stakeholder engagement models, namely, the *control model of stakeholder engagement,* based on the understanding that PTs pose risks for organisations/projects, and the *collaborative model,* predicated on PTs as being a source of opportunities for organisations and their projects. Sloan (2009) argues for the latter model, where PTs are viewed as presenting opportunities rather than threats to projects. Properly engaging project teams requires this paradigm shift. Furthermore, engaging PTs triggers the need for a mutual beneficial partnership between a project manager and the project (Eskerod *et al.*, 2016; Sloan, 2009). Without engaging and interacting (not just instructing PTs) with software PTs, then there is no team to speak of (Rezania and Lingham, 2009) and there is no way of fully understanding the needs and concerns of PTs and attending to them (Eskerod *et al.*, 2016).

According to Lee *et al.* (2018), the employees of the 21st century value continuous engagement with their managers. When PTs are engaged, it is a sign of their PM paying attention to their needs. Usually projects fail because project managers have failed to meet the project team's expectations by not addressing their needs (Stevenson and Starkweather, 2010). Some benefits which accrue from PT engagement include increased productivity, better teamwork and team morale, as well as reduction in PT members' turnover (Paradise, 2008). Engaging project teams is not a one-way communication, where a project manager just instructs (authoritative style)

team members what to do, but is a bilateral communication, involving dialogue and collaboration. Weaver (2012) acknowledges that it is a challenge to change mind-sets of PMs to behave like this.

2.5.3 The importance of raising project team morale

The software development sector is known for not considering motivation and high team morale as a key factor in productivity (Linberg, 1999). Factors which motivate project team members in software environments differ (McManus, 2004). The neglect of team motivation by software PMs is the downfall of the software sector (Linberg,1999), even though it is a known fact that PT satisfaction has a positive impact on project success (Müller and Turner, 2007). Improved team morale is one of the advantages brought about by formal use of project management in managing organisational projects (Schwalbe, 2014:32). Good project management has a positive influence on team members' morale, as well as the project success. This is because project managers need human intellectual capital to deliver successful projects (André *et al.*, 2011; Fuller, Valacich & George, 2008:185; Hans and Mnkandla, 2018a, 2019a; Sloan, 2009).

Continuously establishing the current needs of each team member is important in enabling a project manager to motivate team members to perform at the best of their abilities (Brewer and Dittman, 2018:187). This is in part due to realising that a lack of finding a balance between the needs of the organisation and employees (project team members) may lead to undesirable consequences (Hans, Chuene & Lepota, 2012). Jacques, Garger and Thomas (2008), agree with this claim and state that the delivery of a successful project is dependent on carefully balancing the needs of all project stakeholders. Furthermore, effective management of employees has a positive impact on their desire to stay (Kaliprasad, 2006), while poor management of project teams presents a major risk of not finishing the project on schedule should, for example, an important team member leaving the organisation. To enable a project manager to delicately balance between the needs of the organisation and team members, correct information about the needs of project teams must be readily obtainable to the PM. The timely availability of such information is in fact critical to the success of a project (Graham and Englund, 2004:169).

The motivation of stakeholders for their contribution can vary considerably; for example, the customer would prefer requirements changes that maximise benefits, the project manager wants to efficiently and effectively deliver the project with the suitable resources, and the analyst would like to complete his or her work on time and within budget.

2.5.4 The need for a strategic project management office

Consistently completing projects successfully while having all business units applying the same project management practices has proven to be a challenge for a number of organisations (Bolles and Hubbard, 2008). Organisations use project management offices (PMOs) to attend to the aforementioned challenges (Bolles and Hubbard, 2008). It is almost, if not completely, impossible to achieve consistent application of project management practices without the use of a project management office (Hans and Mnkandla, 2018b) because a PMO improves efficiency and project success (Ebad, 2016). A PMO, as a custodian of project management practices in an organisation, is responsible for standardising and enforcing project management practices across the enterprise (Hans and Mnkandla, 2018b, 2019a; PMI, 2013) and also provides the supporting and controlling role for projects (Too and Weaver, 2014). The absence of a PMO in an organisation is likely to lead to lack of standardisation of project management practices and standards, resulting in non-compliance with these practices, as observed by the recent study carried out by Hans and Mnkandla (2018b).

Projects fail because PMOs are missing in action (Ebad, 2016). Ebad (2016) further states that the non-existence of PMOs in organisations in developing countries has contributed to the poor performance of projects in the ICT industry. A PMO helps to make project management more effective, promotes consistency in the application of project management and forges standardisation of project management practices (Desmond, 2015). Moreover, projects critical success factors are dependent on standardised project management practices (Brown and Eisenhardt, 1997; Cooke-Davies, 2002; Milosevic and Patanakul, 2005).

The establishment of a PMO is one of the key ingredients of project management performance and maturity for an organisation that is serious about realising and maximising its project investments (Eve, 2007). For organisations to indicate to all concerned that project management is the ‘way of running projects’ and that those

who run projects should ‘sing from the same hymn sheet’, then a PMO is a vehicle to drive that message across and an agent for implementing the project management culture (Aubry, Müller, Hobbs & Blomquist, 2010; Desmond, 2015; Eve, 2007). While striving to maintain consistent application of project management practices, PMOs should guard against over-standardising project management methodologies, processes and tools, where a ‘one size fits all’ approach is used (Aubry *et al.,* 2010:774) in managing projects in different units of the organisation. Furthermore, PMs should not see themselves as slaves of standardised project management practices but rather as experts who are expected to be consistent in their adherence to such organisational practices (Milosevic and Patanakul, 2005). According to Sobek, Liker and Ward (1998), Toyota was able to strike a balance between standardisation and flexibility.

2.6 Research gap

The discussion in Section 2.4 and Subsection 2.4.1 of this chapter delved into the neglect of ICT project teams at the hands of project managers and the resultant challenges thereof. The discussion in these sections is in line with the findings of recent research work by Hans and Mnkandla (2018a; 2019a) which established that the needs and expectations of ICT PTs in South Africa are neglected, as indicated by prior studies carried out elsewhere in the world. Subsection 2.2.3 pointed out how the existing stakeholder management tools have failed in assisting project managers to pay needed attention to software project teams’ issues and also afford them the key stakeholder treatment they deserve. The tools have further fallen short in enabling PMs to treat ICT PTs as critical project resources, as argued in Section 2.3.

It is on this basis that this study advocates for the development of a model aimed at addressing the problem of the neglect of the needs and expectations of ICT project teams by project managers. Several studies, such as Aaltonen (2011), Ertürk and Vurgun (2015), Hans and Mnkandla (2019a), as well as Too and Weaver (2014) have called for better management of project teams in the ICT sector through paying attention to the needs and issues of PTs. Unless project managers actively address project-related interests of their project teams, the phenomena of high failure rate of ICT projects and high turnover rate of PT members are likely to linger for the foreseeable future. Success of ICT projects is dependent on how well project

managers address project team-related issues (da Cunha, da Silva, de Moura and Vasconcellos, 2016).

2.7 Summary

The key role played by project teams in assisting project managers to meet project goals is unquestionable and undisputable. Intentionally or not, project managers have been paying less attention to the needs of PTs, while the concerns of other project stakeholders, such as clients, have received more attention (Turner *et al.*, 2008). The stakeholders who have caught the eyes and ears of PMs are considered to be those who possess more economic interests and power (Aaltonen and Kujala, 2010; Eskerod *et al.*, 2016; Eskerod, Huemann, & Savage, 2016) than project team members (Hans and Mnkandla, 2019a). This is in spite of the important part that project teams play in software projects. Their needs and concerns have not attracted the attention of PMs as they ought to (Hans and Mnkandla, 2019a). The marginalisation of PTs by project managers contradicts the calls made by various researchers, including Eskerod *et al.* (2016), as well as Hans and Mnkandla (2019a), for equitable treatment of all key project stakeholders, regardless of their individual attributes of power, legitimacy and urgency. Furthermore, the poor attention given to PTs by PMs has led to numerous problems, including lack of trust of PMs by project teams (Hans and Mnkandla, 2019a), unhealthy project manager to project team relationships (Hans and Mnkandla, 2019a; Shen, 2011), lack of care and social support of PT members (Turner *et al.*, 2008), unconducive work environment leading to high turnover of PT members, which in turn results in the failure of ICT projects (Hans and Mnkandla, 2018a; 2019a).

It is on the basis of the abovementioned challenges and continuous side-lining of project teams, both by PMs and project management researchers, that this study proposes a model aimed at aiding project managers to pay the necessary attention to the needs and concerns of PTs and thus treat them as one of the key project stakeholder groups. The proposed model is presented and discussed in Chapter 4, while its validation with regard to assisting PMs to pay better attention to the needs and concerns of PTs is addressed in Chapter 6 of this thesis. The next chapter outlines the research methodology followed in this research study.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter discusses the research design as well as the research methodology followed in this research study to accomplish its purpose. The main aim of this chapter is to develop and discuss a blueprint, which was followed in addressing the research objectives of this research study. The chapter discusses and describes unit of analysis, research design, and then the research methodology of the study. The chapter has dedicated sections which discuss the processes followed in collecting data in three stages, namely, 'as is' environmental analysis, refinement and evaluation of the model and the PM*Int* tool as well as the validation of the both the artefacts. The chapter concludes by a section on ethical considerations that the author had to pay necessary attention to. The next section discusses different research paradigms and the one adopted in this study.

3.2 Philosophical research paradigms

There are four main philosophical stances or paradigms or worldview in research, and these are positivism, constructivism, transformative/critical theory and pragmatism (Creswell, 2014:36; Easterbrook *et al.,* 2008). According to Easterbrook *et al.* (2008), the research approach that one adopts in obtaining answers to ones' research question(s) is informed by the philosophical position that one takes because it guides one's research reasoning (Neuman, 2006:103). The quantitative and qualitative approaches are deeply rooted in the four paradigms (Vosloo, 2014). Moreover, methodological research outcomes of the four paradigms are different (Mertens, 2010). Positivists believe in the traditional system of research, which is sometimes referred to as scientific research or empirical science, which is rooted in the belief that for every effect there is a cause which needs to be identified (Creswell, 2014:36). Quantitative measures in studying and understanding the behaviour of subjects of interest is important to the positivism paradigm. Easterbrook *et al.* (2008) posit that positivists favour methods that start with accurate theories, where hypotheses can be deduced, tested and verified separately. Positivism is therefore closely linked to controlled experiments, even though there are survey and case studies conducted by positivists (Easterbrook *et al.,* 2008).

Constructivism, also known as interpretivism, is seen as being linked largely to qualitative research (Creswell, 2014:38), with less emphasis on proving or refuting theories, but paying more attention to understanding human behaviour and interpreting actions and attach meanings to the actions (Easterbrook *et al.*, 2008; Vosloo, 2014). According constructivists meanings to behaviours and actions of human beings cannot be discovered through quantitative research only, but entails human language interpretation which is afforded by qualitative research (Vosloo, 2014). Therefore, researchers in the constructivist paradigm consider research methods, which enable the collection of information-rich data.

The transformative researchers regard the positivists' views as marginalising, and less accommodative to certain societal groups, such as oppressed and marginalised people (Creswell, 2014:41). The central tenet of the transformative paradigm is that one cannot separate politics and research, and therefore the study of lives of the oppressed groups should be the focal point of research (Creswell, 2014:41; Easterbrook *et al.,* 2008).

When it comes to pragmatism, Creswell (2014:43) claims that researchers in this paradigm are not dedicated to any form of philosophy, but rather choose any method that will best provide a solution to the problem under investigation, in a similar way that researchers apply mixed methods in solving research problems. Easterbrook *et al.* (2008) agree with this claim, and indicate that pragmatism is not bound to any belief. Unlike the other three paradigms, pragmatists use any suitable method to obtain required knowledge. It is a research belief that is based on understanding that the world needs to be understood on its entirety, not from one perspective only. According to Livesey (2011c:4) cited in (Vosloo, 2014), pragmatists make use of in-depth interviews to gather rich, valid and reliable data.

A philosophical stance that one has chosen is not meant to convince others to change their positions, but should instead provide reasons why particular research methodologies and methods have been chosen. Not knowing the paradigm in which one's research is situated increases the chances of one operating under unacceptable assumptions (Mertens, 2010). This research study leans toward the pragmatism paradigm, because it incorporates mixed research methodologies. The choice of

selected methodologies was based on their suitability in providing ideal and desired solutions for the problems that needed to be addressed. This study made use of the following research approaches, the Design science research methodology and case-study approach as well as the Delphi methodology, as discussed in Subsections 3.5.1, 3.5.2 and 3.5.4 respectively.

3.3 Unit of analysis

Babbie, Mouton and Vorster (2009:85) and (Neuman, 2006:58) state that *unit of analysis* refers to the 'things' which one's study is investigating or studying. In this study the 'things' under investigation are project managers and the project teams who are targeted for the use of this study's model, which is aimed at bringing about a particular outcome (impact) by assisting ICT PMs to pay much-needed attention to the interests of PTs.

The PMs and PTs are the focal points of analysis – they are investigated to determine how the use of the model can assist project managers give necessary attention to the interests of PTs, and thus treat them as key project stakeholders.

3.4 Research design

A study's research methodology should be informed by the study's research design (the type of study) which in turn is determined by the research problem or research question(s) of the research study (Babbie *et al.*, 2009:75). Leedy and Ormrod (2005:105) concur with this view and state:

> *We urge you to make the choice (of which research approach to use) based on the research problem you want to address.*

The research problem and the question of this research study, as stated in Chapter 1 of this study, are:

- Problem statement:
  The neglect of the needs and interests of project teams by project managers has resulted in high failure rates of ICT projects, as PT members feel more inclined to leave projects and their organisations, due to the neglect of their needs.

- Research questions:
    1. *How can a model supported by a project management intelligence (*PM*Int) tool assist ICT project managers to pay necessary attention to project team issues and thus treat them as key project stakeholders?*
    2. *Does the use of the proposed model supported by a* PM*Int tool improve the attention given to the needs and interests of project teams as key stakeholders by project managers?*

These research questions require explanatory answers (Yin, 2009:56). The first research question is aimed at determining how PMs can be assisted to pay the necessary attention to the needs and interests of PTs. The second question is aimed at probing further and providing an explanatory answer as to whether the use of the proposed model of this study did achieve desired objectives.

The type of research approach followed by the study is a model-building research strategy. Babbie and Mouton (2001:229) say such a study should be aimed at developing new models to explicate certain phenomena. This research study develops and evaluates a model intended to assist ICT PMs to pay the necessary level of attention to PTs. The model makes use of an interactive PM*Int* tool to mine opinions of project team members about issues of concern on the project that should enable a project manager to pay the necessary attention.

In the process of providing answers to the research questions, both exploratory and explanatory approaches were used in order to gain better understanding, insight and comprehension of the results brought about by the use of such a model. In other words, the broader purpose of this study is to explore and explain. This study requires an exploratory approach because the use of the proposed model is a fairly new phenomenon in project management. Babbie *et al.* (2009:79) and Neuman (2006:33), who explain that exploratory research is suitable for examining new phenomenon, support the classification of this research as exploratory. In establishing answers to the second question of the study, an explanatory approach needs to be utilised. This assertion is also supported by Joia (2002), who states that the explanatory approach is meant to answer how the intervention works. The preceding discussion indicates that the broad methodological approach for this study is a qualitative one (Babbie *et*

al., 2009:48; Olivier, 2013:112). This claim is supported by Müller and Klein (2019), who say that qualitative studies are best suited to address the how research type of questions.

3.5 Research methodology

The previous section discussed the research design followed by this study. This section discusses the research methodologies used in this study.

3.5.1 Design science research methodology

The Design science research methodology is about creating artefacts aimed at solving human problems, unlike other fields of science, such as natural and social sciences, which attempt to understand, describe, and make sense of the real world (Ostrowski *et al.,* 2012; Peffers *et al.,* 2007). According to Azasoo and Boateng (2015) as well as Mettler *et al.* (2014), the artefacts produced by the DSR methodology may be classified into one of the following categories: constructs (e.g. a specification language in Computer Science), models (e.g. software engineering competency model), methods/methodologies (e.g. Agile), instantiations (e.g. any system for business intelligence) and theories (e.g. theory of website design). When new knowledge is required to design and develop the needed artefact, then research in the form of DSR methodology comes in to close the knowledge gap (Vaishnavi *et al.,* 2019). Ostrowski *et al.* (2012) concur with this view, explaining that DSR produces knowledge where other solutions fail. Engineering fields have embraced the DSR methodology as an important approach, because of its ability to produce relevant problem-oriented solutions (Peffers *et al.,* 2007). Vaishnavi *et al.* (2019) consider the DSR methodology to be similar to Action research methodology, with the difference between the two based on the timeframe required by each methodology to yield results, with action research taking longer.

According to Peffers *et al.* (2007), Design science research methodology has found applications in various scientific fields, including Computer Science, Software Engineering and Information Systems (IS), with the DSR methodology introduced in the latter field in the early 1990s. However, Gregor and Hevner (2013) suggest that the DSR methodology has been with the IS discipline since the field's inception. There is no doubt that both the Computer Science and Information Systems fields have seen

an increase in usage of the DSR methodology (Ostrowski *et al.,* 2012). There are various studies in these fields that have been carried out using DSR methodology, and these include research work by Ostrowski *et al.* (2012), Kao, Yu, Masud, Wu, Chen and Wu (2016), Fernandes, Barbosa, Pinto, Araújo and Machado (2019) and Omar, Trigunarsyah and Wong (2009).

A general model of the DSR methodology consists of the following steps (Mettler *et al.,* 2014; Vaishnavi *et al.,* 2019): (i) *Awareness of problem,* which entails discovery of a research problem. The problem, which prompted the research, must be well investigated and analysed before embarking on subsequent steps of the DSR methodology. The articulation of the criteria to be used to evaluate the solution, which the research is intended to produce is part of this step. (ii) *Definition of the objectives of the solution*, where the intentions of the solution are clearly stipulated, so that there are no ambiguities about what the solution needs to accomplish; (iii) *Design and development of the artefact,* which involves the design (with creativity) (Vaishnavi *et al.,* 2019) and implementation of the solution, following a clear and traceable approach using appropriate techniques; (iv) *Demonstration and evaluation of the artefact in a suitable context*, which includes finding a suitable contextual environment to evaluate the suitability of the solution in solving the identified problem. The solution may be evaluated using various methods, including case studies, experiments or prototyping. The artefact must be evaluated using the evaluation criteria that were developed in the first step. The evaluation results might necessitate that the *definition of the objectives of the solution* or/and the *design and development of the artefact* phases be restarted, and this shows that the phases of DSR process are interdependent. Table 3.1 indicates how were the DSR methodology steps applied by this study, while Figure 3.1 presents a diagrammatic summary of how this study adapted and used DSR methodology.

Given the preceding discussion and the purpose of this study, which is to develop a model (an artefact) for assisting project managers to treat project teams as key stakeholders, then the DSR became the methodology of choice. Another further nudge for the use of the DSR methodology is its demonstration and evaluation step, which made provision for the model as well as the PM*Int* tool to be evaluated and improved.

Moreover, the *'Awareness of the problem'* step of the DSR methodology enabled the use of the empirical data analysis results of the 'as is' environmental analysis process as an input to the development of the model. These results ensured that the design and the development of both artefacts of the study were not only influenced by relevant literature, but by also empirical data from software project management environments. The Delphi methodology was used during the evaluation of the model and the PM*Int* tool as discussed in Subsection 3.5.5. Mettler *et al.* (2014) claim that the evaluation step in DSR methodology entails testing the solution against stated requirements and determining its impact in real life situations. In the process of developing and refining the Stakeholder Cycle model, Bourne (2005) used similar iterative research techniques. In developing and evaluating the model and the PM*Int* tool a case study approach was used. The justification for the use of the case study approach is discussed in the next subsection.

Table 3.1 – The application of the DSR methodology steps in this research study

DSR methodology steps	The application of the DSR methodology step in this study
1. *Awareness of problem,* which entails discovery of a research problem. The articulation of the criteria to be used to evaluate the solution.	This study's problem statement in Section 1.3. The 'as is' environmental analysis (Subsection 3.5.3) was used to further discover the problem in the South African context and the results of the analysis informed the design process of what problems the model needed to address. The process of the evaluation of the model and the PM*Int* tool is discussed in Subsection 3.5.5.
2. *Definition of the objectives of the solution.*	The study's research objectives in Section 1.6.
3. *Design and development of the artefact.*	The model and the PM*Int* tool are designed and developed in Chapter 4 and Chapter 5 respectively.
4. *Demonstration and evaluation of the artefact in a suitable context.*	The evaluation and refinement of the model and the PM*Int* tool are discussed in Subsection 3.5.5.

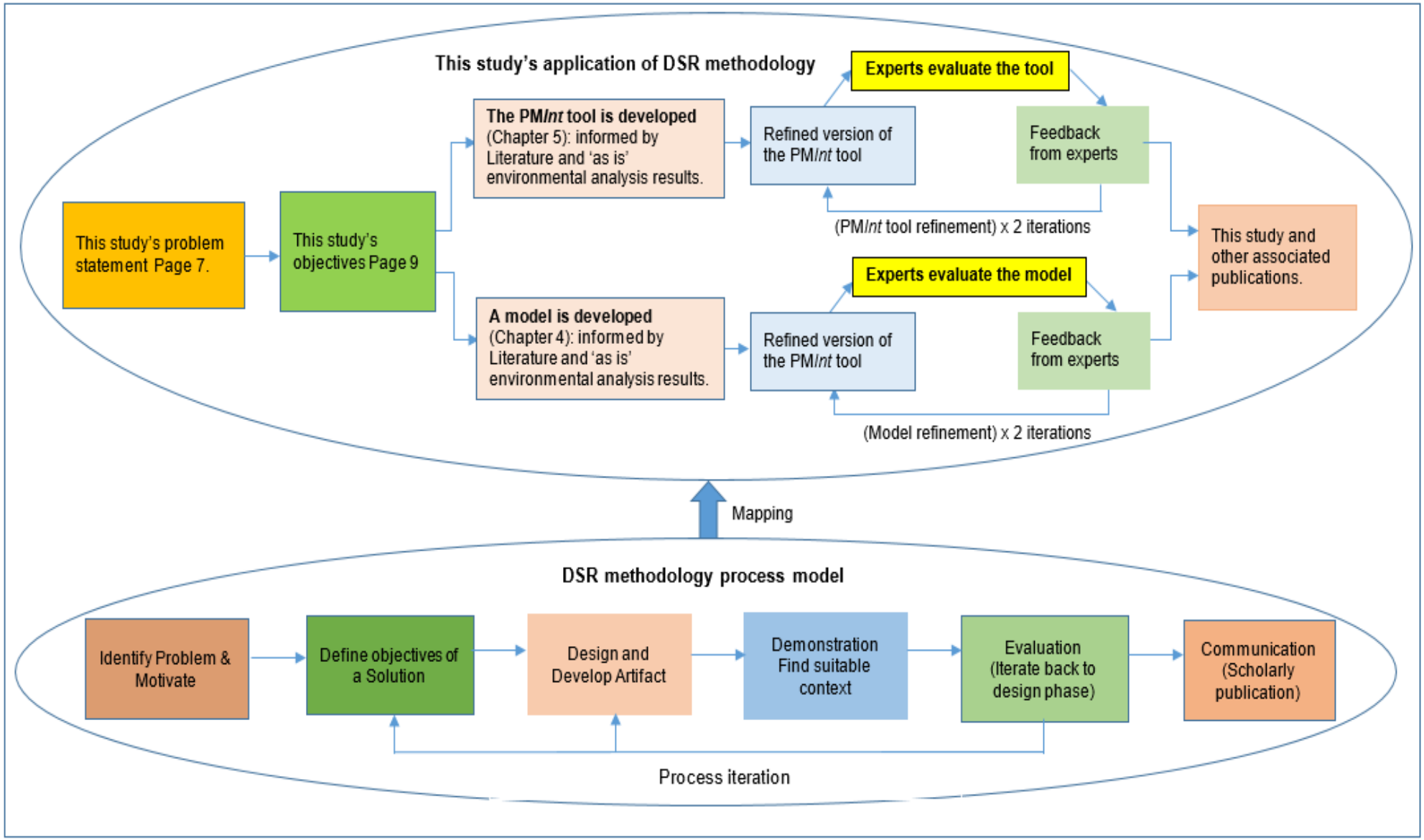


Figure 3.1 – The application of the DSR methodology process model by this study (Adapted from Mettler *et al.*, 2014)

3.5.2 The use of the case study approach

In a situation where the phenomenon under study there is little or no knowledge or information about it due to insufficient empirical research, Eisenhardt (1989) proposes the use of a case study research approach. The case study research affords one to explore the subject under study, while gathering extensive information of the unit under consideration (Neuman, 2006:203; Olivier, 2013:10). Furthermore, Babbie *et al.* (2009:280-281) state that in case study approach the focus is on a unit of study and less on the representation of the sampled target population. Yin (2009:147) gives four conditions under which the use of a case study approach should be considered, and one of these conditions is that the boundaries between the context and the phenomenon under study are fuzzy (not clear). That is, one cannot consider (study) the phenomenon without taking into account the context of the phenomenon. Moreover, case studies are much more suited to answering '*why*' and '*how*' types of research questions (Aaltonen, 2011; Joia, 2002).

A research study may use a single case or a multiple case study design (Babbie *et al.*, 2009:282-283; Yin, 2017:151). Olivier (2013:99) states that, in a situation where a phenomenon under study is a new one, a single case is sufficient. However, Babbie *et al.* (2009:282) and Easterbrook *et al.* (2008) recommend the use of multiple cases if one requires convergence (usage of multiple sources of evidence) and replication (number of occurrences of phenomenon increasing the findings' reliability). Another reason for the use of multiple cases is to enable the researcher to perform a comparative analysis (Joia, 2002).

This study met these criteria for the use of a case study research approach based on the following:

- It was indicated that the phenomenon under study, which is the use of a model to assist project managers to treat project teams as key stakeholders is fairly new subject matter in project management. Therefore, this allowed for the use of a case study research.
- The phenomenon considered by the study and its context, which is ICT project management environment are inseparable. That is, to better assist project managers to manage PTs as key stakeholders, one needs to be fully cognisant

of the prevailing work conditions. This also made a case for the use of the case study approach.

- As the first research question of the study is a 'how' type of a question, then this also pointed to the use of a case study methodology.
- Since the use of the multiple sources of evidence improves the validity and reliability of a study's findings, the researcher chose multiple cases as discussed in Subsection 3.5.3.1. This also allowed cross-case analysis as explained in Subsection 3.5.3.4.

This study is not unique in using a case study research methodology in developing a model to be used in project stakeholder management. Studies, such as Bourne and Walker (2005), Coakes and Elliman (1999) as well as Missonier and Loufrani-Fedida (2014) employed case study approach in developing their models.

The primary research data used in this study was collected over four stages, namely, through an 'as is' environmental analysis, during the refinement and evaluation processes (the two Delphi phases) of both the model and the PM*Int* tool and during the validation process of the two artefacts. The following discussion is about data collection during the 'as is' environmental analysis stage.

3.5.3 The 'as is' environmental analysis stage

According to Coakes and Elliman (1999) the decisions taken by a project manager are a reflection of whether stakeholders' interests form part of decision-making process or not. It is therefore important to establish the current status quo with regard to the decision-making process by the South African ICT project managers to enable fair assessment of this study's proposed model after its application. A pre-test measure was undertaken to establish the current 'as is' environmental conditions of decision-making in the ICT South African project management environment. This analysis is aimed at obtaining a better understanding as to how information, if any, which reflects concerns and views of project team members is obtained and used in the decisions, which affect project team members. The data analysis results also served as an important input in the design, development and implementation of the initial version of the model and the PM*Int* tool. This input ensured strong outcome-oriented and objective-oriented focused design for the model and the tool, the results of which

would therefore be much more valid and useful (Babbie *et al.*, 2009:348). The need to establish a better understanding of the current status quo finds support from Krebs and Holley (2006), who state that any improvement in the current situation should be preceded by understanding the current picture.

The following subsections discuss the sampling technique used for selecting participants of the study, sample design and sample size of participants, data collection instrument used, piloting of data collection instrument and data analysis applied to the data collected during this stage.

3.5.3.1 Sampling technique, sample design and sample size

According to Neuman (2006:10) and (Olivier, 2013:98) case study research is less concerned with representative sampling than survey research. What matters is the relevance of the selected case in addressing the research question. (Babbie *et al.*, 2009:283) state that the sampling methods used for qualitative case-based studies are purposive.

Purposive and opportunistic sampling were chosen in this study because they enable the researcher to purposefully identify cases, which can be used to participate in this research study. The following were the criteria used in identifying the cases:

1. Willingness to participate in this research study,
2. The case (project) or replication, as referred to by Easterbrook *et al.* (2008) identified must be in ICT; and
3. The case (project) should have five or more project team members, excluding the project manager. This number was chosen to ensure that the team had a *sizeable number of team members* with *diverse concerns (needs) and views* on the project and thus demanding the project manager's attention when making decisions on the project.

As discussed in the previous paragraph, research carried out using case studies is not about the case's representativeness of the larger population, but rather the relevance of the case in addressing the research question. Therefore, the issue of a representative sample size does not really matter. The number of cases (projects) used in this research study is five, targeting one project manager and five team members from each project. The five project teams, were aptly named Team A, Team

B, Team C, Team D and Team E. The number of cases chosen here is in line with the recommendation made by Eisenhardt (1989) who states that the cases should be chosen based on the purpose of the study, while Hine and Carson (2007:67) state that the question of how many cases to use is left with the researcher. The decision of using as many cases as possible is to ensure replication and convergence.

3.5.3.2 Pilot study of the data collection instrument

There is a need to address unclear, awkward and ambiguous questions in the data collection instrument to be used in an interview. A pilot study is meant to address exactly these issues (Bless, Higson-Smith & Kagee, 2006:135; Cooper and Schindler, 2011:431; Olivier, 2013:84). The pilot test should be conducted with the sample from the target population and the participants do not need to be selected statistically (Cooper and Schindler, 2011:86; Olivier, 2013:84). The interview questions asked during the data collection of this stage were pilot tested using one ICT project from the targeted population.

3.5.3.3 Data collection

It was important to establish the status quo with regard to how the needs and interests of PTs were being considered by PMs in the South African ICT project management environment in order to enable fair assessment of this study's model after its use. Therefore, a pre-test measure was undertaken to establish the current 'as is' environmental conditions of the treatment of PTs by PMs in the South African ICT sector. The data collected during this stage also served as an important input in the design, development and implementation of the model of this study. The use of the collected data ensured a strong outcome-oriented and objective-oriented focused design for the model whose results guarantee more validity and usefulness (Babbie *et al.*, 2009:328).

The data was collected from the five project managers and their five project team members, which came from five different ICT projects, selected as mentioned in Subsection 3.5.3.1. Participants (PMs and PT members) were asked questions which required them to provide information concerning how project team members' needs, views and concerns were considered, if at all, by PMs, especially in any decision-making processes which affected PTs. The interview questions attempted to elicit information on the following topics:

- A process of communicating project team members' views and comments or concerns to the project manager.
- If the information provided to the previous topic indicates that there was a process in place, then the explanation of the process of considering such views in the decision-making process.
- How interactive is the process (if there is one) of sourcing such views and concerns?
    - The effectiveness of the process, if there is one, in terms of sourcing the project team members' needs, views and concerns and assisting project managers to reach appropriate decisions.

During this stage, data was collected using semi-structured interviews (in-depth interviews) because these encourage participants to share as much information as possible (Cooper and Schindler, 2011:362). To establish an answer to the first research question of this study, participants were expected to provide more information. Over and above recording respondents' answers textually, a digital voice recorder was used as a backup. A number of authors, including Leedy and Ormrod (2005:139) and Neuman (2006:82) have written extensively on how interviews should be conducted and their advice were followed when carrying out the interviews in this study.

3.5.3.4 Data analysis

The analysis was aimed at obtaining a better understanding as to how information was obtained, if it was, that reflects concerns, views and needs of project team members and then used, if at all, in project decisions by PMs. After the data was collected, the researcher used the recorded interviews to verify that the answers that were manually recorded were a true reflection of what was said in an interview. The data collected during interviews, as outlined in Subsection 3.5.3.3, was in the semi-structured form.

ATLAS.ti, as a tool that facilitates qualitative data analysis (Friese, 2012:1), was used for both data coding and data analysis in this research study. For each interview, a semi-pre-coded interview questionnaire was used to facilitate the data coding process. That is, closed-ended questions had responses, which were pre-coded on the questionnaire, while responses to open-ended questions were coded once an

interview was completed. For example, **INFORMATION_USAGE** was used as a code for the answer to the question aimed at establishing whether information collected from PTs was used in the decision-making process by PMs (see Appendix B for the list of questions). Post-coding was used to highlight answers to open-ended questions, such as the probing questions (e.g. 'explain what type of information is gathered?'). For example, **INFORMATION_TYPE** was used to code the answer to this preceding question. Table 3.2 presents the other codes that were used for data classification in this study.

Table 3.2 – Codes used for data classification of 'as is' environmental analysis interviews

Type of questions	Code	Code description
Close ended		
	PROCESS_EXISTS	The code was intended to record responses to the question on whether processes existed to collect opinions and needs of PTs.
	INFORMATION_USAGE	The code was used to record answers on how the information was used in the decisions by a PM.
Open ended		
	SUGGESTED_IMPROVEMENTS	This code was used to record answers regarding suggested improvements on the process used to gather team members' views.
	HOW_WAS_INFO_SOURCED	This code was used for answers regarding how the opinions and needs of project teams were gathered, if such processes existed.
	INFORMATION_TYPE	Code was used for the answers to the question aimed at determining the type of information collected from PTs.
	INFO_USAGE_AWARENESS	This code was intended to record answers concerning whether a team member was aware of the usage of the collected information in decision-making processes by a PM.
	IDEAL_PROCESS	This code was aimed at recording responses to the question that was meant for determining an ideal process, if any, for collecting opinions of project teams.

Related codes were then classified into a class, and from these classes, themes were developed, enabling patterns from the participants' answers to be established. As a result, data could be organised and interpreted as easily as possible. Coding of data provided a systematic way of reducing a huge amount of data into manageable pieces of data and this assisted the researcher in interpreting the data with the aim of finding answers for the research questions. Once coding and categorisation of data was completed, then identification of patterns in the data became the next task. Pattern identification helped the researcher in interpreting the data, taking into account the context of each case (project). In the process of data interpretation, the research questions of this research study were answered using an inductive approach.

As a method for increasing validity (all forms of validity) of this research study, the following data analysis techniques were performed during or immediately after data analysis:

(i) Within-case pattern matching was performed by establishing existing patterns, which are emerging in each case (project). This type of analysis assists in drawing conclusions regarding the case being analysed.

(ii) Within-case patterns, which have been established in (i), were scrutinised to establish cross-case patterns and to compare patterns of different cases. Furthermore, the cross-case patterns were used as a way of crosschecking the data analysis results to establish internal consistency of the findings.

(iii) The researcher linked, as much as possible, the findings of this research study with findings of related previous studies.

Figure 3.2 summarises the process followed during the stage under discussion, starting from data collection to drawing conclusions from the analysed data. As mentioned in this section, the results of the analysed data of this stage had an impact on the design of this study's model as well as the PM*Int* tool. After the development of both the model and the tool, they were then refined and evaluated using Delphi method, as discussed in the next section.

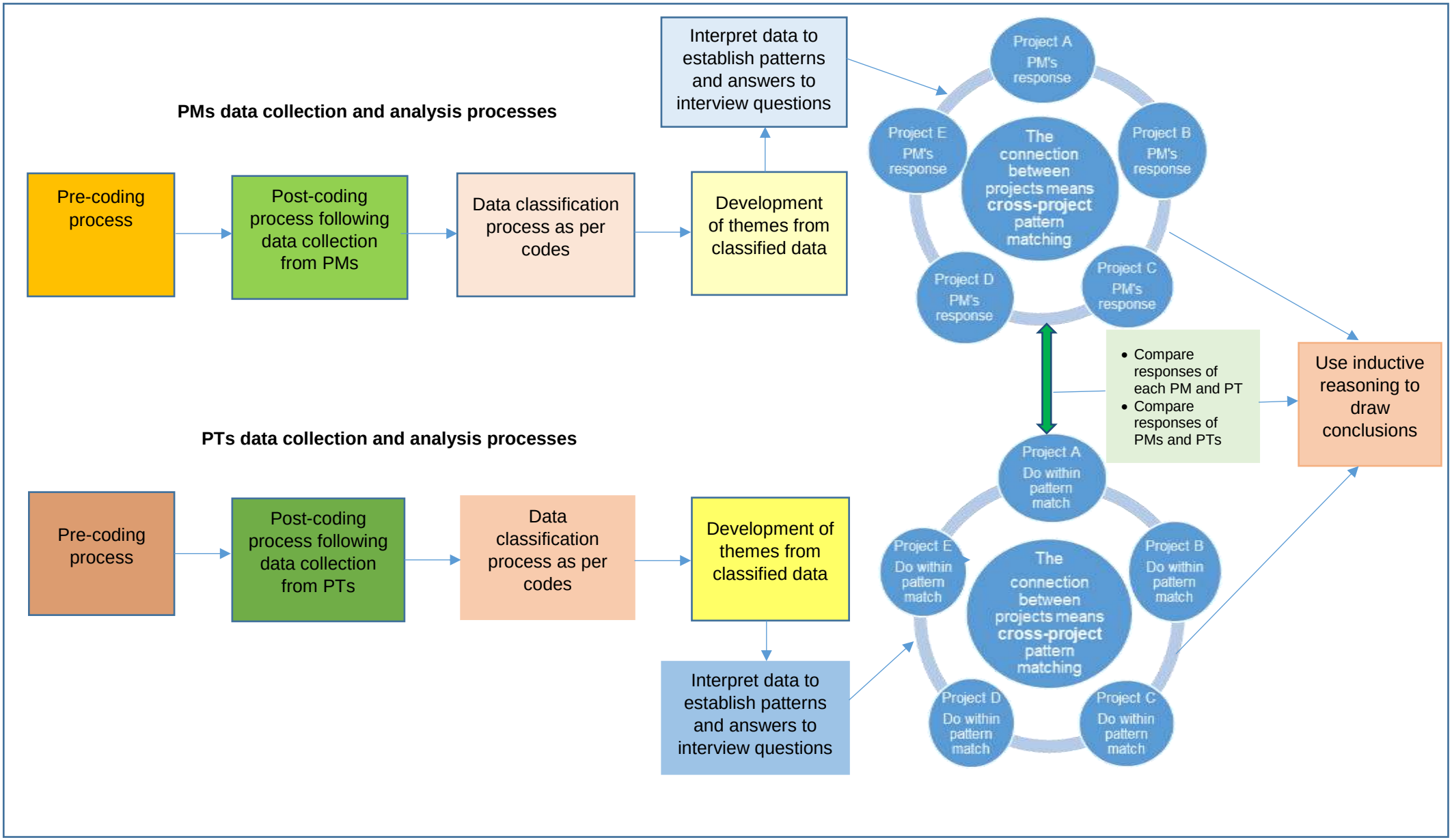


Figure 3.2 – Data collection and data analysis processes followed during 'as is' environmental analysis stage

3.5.4 The model and the PM*Int* tool development, refinement and evaluation using the Delphi method

The empirical results of the data analysis of the data collected during 'as is' environmental analysis phase alongside relevant literature formed important input to the design and the development of both the model and the PM*Int* tool, as shown in Figure 3.3. Some of the relevant literature, which played an important part in the design and development of the model is the research work of Bonke (2000), Bourne and Walker (2008), Achterkamp and Vos (2008), Coakes and Elliman (1999), Aapaoja and Haapasalo (2014), Yang (2014) and Sutterfield *et al.* (2006). Once the initial model and the PM*Int* tool were developed, then the evaluation and validation processes were initiated with the aim of refining the artefacts and establishing their usefulness.

The question on how ICT models should be evaluated and validated has been a challenge for many in the ICT sector (Khazanchi, 1996). As an attempt to address the challenge, Khazanchi (1996) proposes a set of criteria to be used for the evaluation and validation of ICT models. The list of criteria that were used to evaluate and validate this study's model are: *Plausible* (Plausibility), *Feasible* (Feasibility), *Effective* (Effectiveness), *Pragmatic*, *Empirical* and *Inter-subjectively certifiable*. Some of these criteria were used to evaluate the model during the two-stage Delphi method discussed in this subsection, while others were used during the validation process, which are discussed in Subsection 3.5.5. Section 6.3 articulates how each criterion was applied in the evaluation and validation of the model in this study.

Following their development, the model and the PM*Int* tool were refined and evaluated using the Delphi method, through iterative feedback stages. The use of the Delphi method is appropriate in IS, where consensus on opinions, judgements and ideas of qualified experts on a specific subject or issue is needed (Hoermann, Schermann & Aust, 2012; Okoli and Pawlowski, 2004; Yousuf, 2007). As for this study, it was important to obtain consensus on the opinions and judgements of ICT experts in project management regarding the usefulness and applicability of the model developed here. In support of the need to use experts in this regard, Grobbelaar (2006) says judgement of a group of experts is superior to an individual one. The method has been applied in a number of research areas in IS, and these include issue identification and framework development (Okoli and Pawlowski, 2004), framework evaluation (Bacon and Fitzgerald, 2001) and creation of models (Yousuf, 2007). Figure 3.3

summarises how the model was refined and evaluated during this stage, using data collected from the experts.

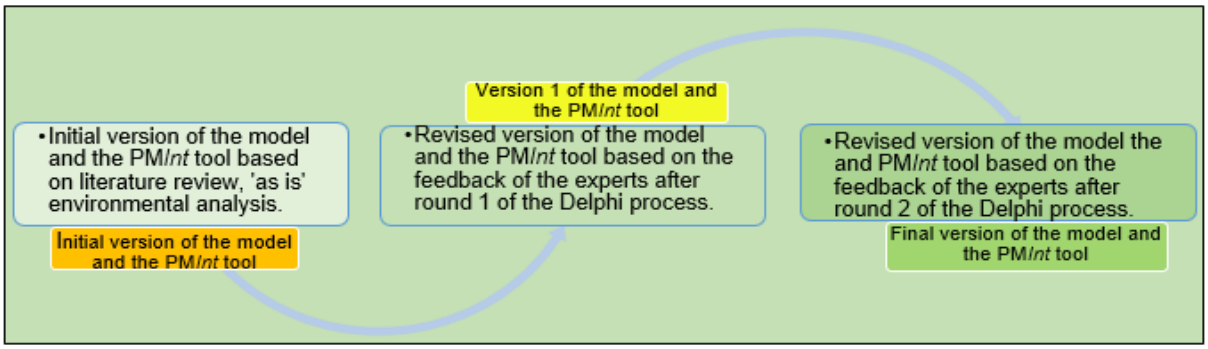


Figure 3.3– Iterative development of the model using the Delphi methodology

3.5.4.1 Composition of the panel of experts

In using the Delphi method, certain steps outlined in Table 3.3, were followed in this study. The careful selection of participants is one of the crucial stages.

Table 3.3 – Delphi method steps (adapted from Yousuf, 2007)

Delphi method steps	Application in this study
1. Identification of panel of experts	(a) ***Five PMs*** from the five selected projects, as mentioned in Subsection 3.5.3.1; (b) ***Twenty-five PT members*** from the five projects, which were selected to participate in the study, as explained in Subsection 3.5.3.1. That is, five PT members from each of the five projects. (c) ***Five experienced (with teaching experience of at least 8 years in ICT project management) ICT project management academics*** known to the researcher were chosen. These came from two different tertiary institutions – two academics from the first institution and the other 3 from the second institution. **Total of experts chosen = 35**
2. Develop interview schedule 1 questions	Prepared interview schedule 1 questions – See Appendix D. First, the model and the PM*Int* tool were sent to the experts. Then interviews followed with the aim of inviting the views of the experts on the model and PM*Int* tool in order to refine and assess their usefulness.
3. Develop interview schedule 2 questions	The model and the PM*Int* tool were refined based on the input received from the first interviews. Interview schedule 2 questions (See Appendix E) were used to assess and refine the model and PM*Int* tool. This was the last round of the Delphi process, because two rounds were sufficient to establish a high level of consensus amongst the experts about the model as well as the PM*Int* tool, and there were no new recommendations made to improve them, thus no need continue with the process (Hsu and Sandford, 2012; Scheibe, Skutsch and Schofer, 2002). The use of two rounds by the study is in line with studies by Grobbelaar (2006) and Hoermann, Schermann and Aust (2012), which used two phases of the Delphi method.

There is no recommended number of experts to be used in the Delphi method (Hsu and Sandford, 2012), but Okoli and Pawlowski (2004) state that any number between ten and 18 is normally acceptable, while Hsu and Sandford (2012) put the figure between 15 and 20. This study selected the following experts:

- Five project managers of the five projects that were selected for participation in this study, as mentioned in Subsection 3.5.3.1.
- Twenty-five experienced team members (all the team members who participated in the study had at least two years of work experience) from the five projects that were selected for participation in this study. The reason for choosing these experts was because of their availability (all agreed to participate in the study) as well as their level of experience (in the case of PT members) in the environment of software development. According to Hoermann, Schermann and Aust (2012), the availability and level of experience impacts the quality of the research results.
- Five experienced (eight+ years of teaching in the field of ICT project management) academics. The academics came from two tertiary institutions, as explained in Table 3.3, and this was done to ensure a level of heterogeneity in order to ensure validity of results, as alluded to by Grobbelaar (2006). These were also selected on the basis of their easy accessibility to the researcher and availability to participate in the study.

The experts were grouped into three panels according to their careers, skills and expertise. The five ICT project managers constituted the first panel, while the twenty-five project team members formed the second panel. Once more, purposive selection of panellists used by the study is in line with using a case study approach, as discussed in Subsection 3.5.2. The model is a product of work that is based on input from both industry (which provides practical project management) and academia (which develops theoretical aspects of project management), thus confirming the important contribution played by both academia and industry to the development of project management, as claimed by Söderlund and Maylor (2012).

3.5.4.2 Data collection and analysis methods

Yousuf (2007) states that the Delphi method may use any data collection instrument which ensures anonymity of panellists. However, according to a study carried out by

Van Dijk (1990) the interview techniques (group and individual interviews) proved to be superior (gave better results) to the questionnaire technique. Therefore, this study collected data from the experts using semi-structured interviews. The interview questions developed served to solicit information to improve and to evaluate the two artefacts of this study, and the process took place over two rounds, as explained in Table 3.3.

During round one, participants were asked about the need for, and usefulness of, the developed model and the PM*Int* tool. The responses received from the experts were analysed and the results were used to improve the model and the PM*Int* tool. In round two, participants were presented with the revised model as well as the revised PM*Int* tool based on their input from round one and were further asked (in an interview) to consider (evaluate) the two revised artefacts, based on their first-round input and position. The question on the need of a model such as the one developed in this study by the ICT sector was not asked in the second phase interviews of the Delphi study. The question was asked of participants mainly to understand their position on such a model. During round two, the new versions of the revised artefacts were once again shared with the experts, who were asked to review them again in terms of their first-round input. The results of round two's analysis were convergent, such that the Delphi process iteration was halted at this round. The stopping of the process at this stage was in accordance with the recommendation made by Hsu and Sandford (2012) and Okoli and Pawlowski (2004) that the process stops when respondents reach a sufficient degree of consensus or no new information emerges from the feedback. The resulting feedback analysis results were once again used to revise the two artefacts and the final versions of the model and the PM*Int* tool were produced. The final version of the model is depicted in Figure 4.1.

After the data was collected, the researcher used the recorded interviews to verify that the answers that were manually recorded were a true reflection of what was said in an interview. A qualitative data analysis tool, ATLAS.ti (Friese, 2012), was used for data coding and analysis for qualitative data collected during the Delphi method phases. For Phase 1, Questions 1 to 4, respondents had to select answers from a list of Likert items. For each Likert scale item selected, a respondent had to provide a reason. The aim was to 'compel' the participants to give thoughtful answers.

Questions 5 and 6 were open-ended questions. Therefore, the reasons that were given by the experts as well as their responses to Questions 5 and 6 were in a form of unstructured data. During Phase 2, Questions 1 to 3 were Likert scale, while Questions 4 and 5 were open-ended questions. Experts had to provide reasons for every selected Likert scale value, as was the case in Phase 1. The Likert scale items were numerically pre-coded (thus the responses became ordinal data), an example of such coding is shown in Table 3.4, while a complete list may be found in Subsection 6.4.1.

Table 3.4 – Example of pre-coded Likert scale items used during Delphi method

Delphi phase	Question	Likert item	Likert item code
Phase 1	Question 1	Strongly Agree	1
		Agree	2
		Somewhat Agree	3
		Neither	4
		Somewhat Disagree	5
		Disagree	6
		Strongly Disagree	7

The unstructured qualitative data that was solicited from the experts were aimed at getting better understanding of the concerns and views that the experts might had with regard to the model and the PM*Int* tool. The non-complimentary comments or reasons that the researcher thought were to be given *very serious attention* were from the respondents who selected the 'negative' Likert items that had codes between 3 and 5 or 7 (in the case of Question 1 of Phase 1) because these experts would have had very serious issues with the model and/or the tool and therefore, their comments would have captured their unhappiness. Any other non-complimentary comments that were linked to 'positive' Likert item code 1 or 2, were regarded as needing *serious attention*. A non-complimentary comment could have expressed a concern, suggested improvements to the model or the PM*Int* tool, or could have been a question seeking clarity on the model or the tool. Furthermore, all non-complimentary responses which were provided for Questions 5 and 6 for Phase1 or Questions 4 and 5 for Phase 2, were also regarded as needing very serious attention, because the expectation was that the remarks made would have been directed at improving the model and/or the tool. Categories and sub-categories were created so as to classify the unstructured

data collected during the two phases of the Delphi method. Figure 3.4 shows sub-categories for the very serious comments category. Figure 6.3 provides a complete list of categories and also shows a diagrammatic process that was followed in categorising unstructured data. In return, the responses (suggestions) from the experts were used to improve the model and the PM*Int* tool as needed.

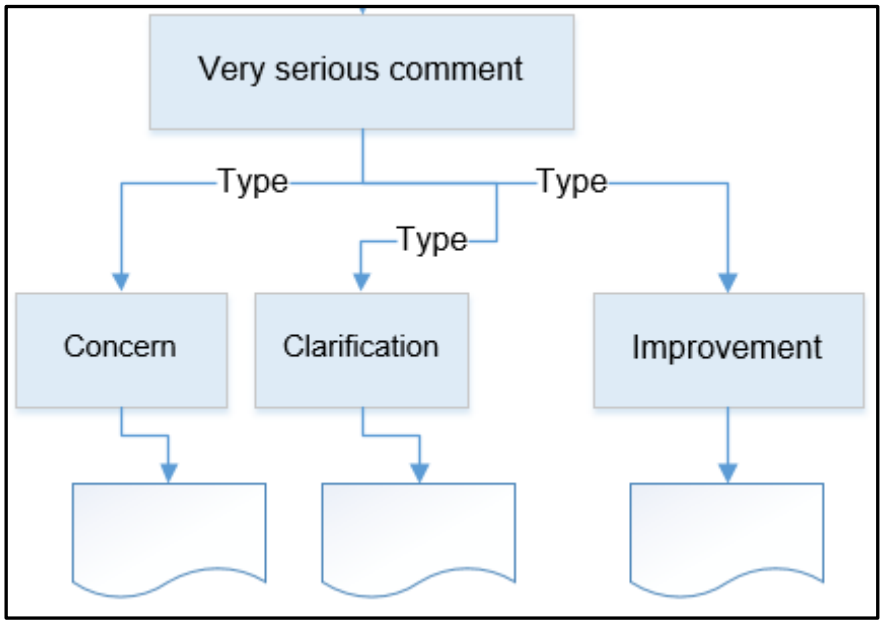


Figure 3.4 – Category and sub-categories for very serious comments

For statistical analysis, R, a statistical analysis tool was used. Descriptive statistical analysis was carried out on the collected data to provide insights about the collected data from experts, and the measures used to provide the insights are mean, median and standard deviation. The value of the standard deviation calculated was used to determine the level of consensus reached amongst the experts, which is line with a study carried out by Grobbelaar (2006). Three types of sources (experts), namely, PMs, PT members and academics, were used in the evaluation of the model, as discussed in this section. The use of the three types of experts, namely, PMs, PT members and academics, has enabled the corroboration of evaluation information from different sources. The credibility of the evaluation process in the study has been achieved through triangulation, where data has been drawn from different sources, as suggested by Bacon and Fitzgerald (2001).

3.5.5 The validation of the model and the PM*Int* tool at a real-life project environment

After the model and the PM*Int* tool were developed, refined and evaluated, as discussed in Subsection 3.5.4, they were then validated in accordance with the recommendations made by (Khazanchi, 1996). The validation process was meant to meet the following criteria, which are given by Khazanchi (1996): *Feasibility* (to determine the model and the tool's applicability in a real-life situation), *Effectiveness* (to establish the effectiveness of the model and the tool in addressing the study's phenomenon), *Empirical* (to determine if the model can be tested in a real-life situation) *Inter-subjectively certifiable* (To have the model evaluated by a number of stakeholders – a PM and PT members). One of the five projects, which were selected for participation in this study, was used to validate the model and the tool. The results of the 'as is' environmental analysis informed the decision of which project team to use for the validation process, as discussed in Chapter 6 of this study.

After the validation process, which lasted for one month, both the project manager and the team members were interviewed, to establish how well the model and the tool met their intended purposes in a real-life project environment. The same interview questions, which were used during Phase 2 of the Delphi method, were also used. A sixth question was added for the project manager aimed at establishing at what points of the project phase was each stage of the model activated. Appendix F provides the list of interview questions, which were directed to the participants.

Given that the collected data post validation stage was structured and unstructured, and thus similar to the data collected during the Delphi method phases, then a similar analysis approach was used to analyse the data. The feedback from the participants was used to improve the model and the PM*Int* tool where possible. The data analysis results of the validation process are presented in Section 6.4.

3.5.6 Construct validity and reliability

For any research study, it is important that the researcher demonstrates that the research study conforms to design tests (Riege, 2003). For a case study research, the design tests to be considered are (Joia, 2002; Riege, 2003):

Construct validity – which is achieved through:

- Use of multiple sources of evidence (e.g. through triangulation) during data collection. These are aimed at addressing a researcher's possible bias.
- Creation of a chain of evidence during data collection. This may include recorded interview scripts or notes obtained from field observation. These are meant to cross-check sources of information.
- Review case study reports during the report-writing phase. This could be achieved by allowing key participants to review interview transcripts and final reports on the findings.

This research study used all of the abovementioned techniques to increase the construct validity. For example, in one case (project) both the project manager and project team members were interviewed to establish how the model enabled a PM to pay necessary attention to the needs and interests of PTs, and therefore resulting in PTs being treated as key stakeholders.

Internal validity – which is achieved through:

- Use of within-case and cross-case pattern-matching when performing data analysis. Cross-case pattern matching is performed to establish similarities and differences on the data being analysed. Should a pattern emerge, one may assume there is an improved level of internal validity in the study (Babbie *et al.*, 2009).
- Use of diagrams during the data analysis phase to facilitate explanation-building, which is a type of pattern-building (Babbie *et al.*, 2009).
- Crosschecking the results (data analysis results) to establish internal coherence of findings.

These techniques were used in this study to establish internal validity. Within-case pattern establishment provided emergent themes, which assisted in determining cross-case pattern matching, and facilitated in cross-case comparison, which was important in establishing external validity, which is presented in the next discussion.

External validity – which may be achieved by:

- Replication logic in multiple-case studies, for example, choosing cases from different industries or countries when designing the study.

- Analytical generalisation by demonstrating that the case study findings link with previous research and theory (Babbie *et al.,* 2009).
- Comparing of evidence found in the data collected with evidence found in existing literature, with the aim of showing the study's contribution and achieving some level of generalisation within the scope of the research study.

In striving for external validity, this study used both analytical generalization and comparison of evidence.

Reliability – which may be achieved through:

- Providing full account of theories and ideas in the research study.
- Showing that there is harmony and agreement between the study's research issues and features of the study design.
- Development and refinement of case study protocol. This can be achieved by piloting the research data collection instrument(s).
- Use of semi-structured or structured interviews.
- Recording data mechanically, for example, using a digital voice or image recorder.

In the process of ensuring reliability, full accounts of theories and ideas were provided, the data collection instruments were pilot-tested thoroughly, semi-structured interviews were used, as explained in Subsection 3.5.4.2, and a digital voice recorder were used during interviews.

3.6 Research blueprint

The discussion of all the previous sections in this chapter is summarised in Figure 3.5, which is the study's research blueprint (a research-map).

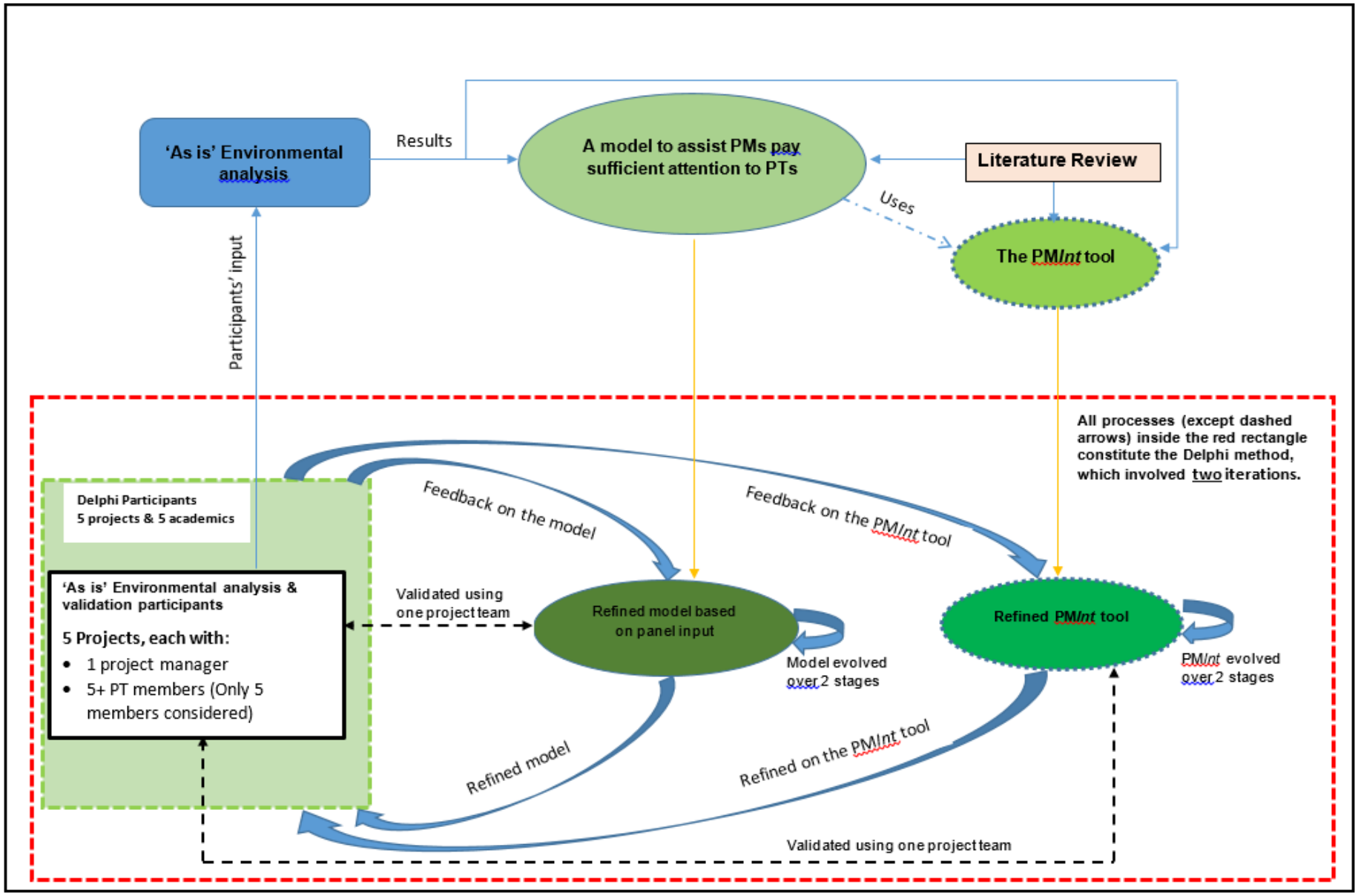


Figure 3.5 – The blueprint of this research study

3.7 Ethical considerations

It is expected that a researcher should conduct research in an ethical manner. Furthermore, a researcher is also expected to carry out a study honestly (Olivier, 2013:24). Cooper and Schindler (2011:16) say the following regarding ethics:

> *Ethical issues in research reflect important moral concerns about the practice of responsible behaviour in society.*

Amongst other things that a researcher is expected to refrain from doing are fabrication of results and plagiarism. Unisa requires for this very reason that a researcher submit a request to the ethics committee before carrying out any studies (e.g. sending out questionnaires) that will have an impact on human beings in particular. Before the collection of data, the researcher of this study submitted an application to Unisa's ethics committee and obtained permission (see Appendix A) to collect data from the participants. Over and above the other ethical issues mentioned in the preceding discussion, the researcher ensured the following:

- That consent was received from the participants to take part in this study.
- That participants remained anonymous and their responses were kept confidential.
- That privacy of the participants was respected.
- That all other ethical matters which researchers are expected to observe by Unisa were followed as required.

3.8 Summary

The chapter discussed a blueprint followed in pursue of the research objectives presented in Chapter 1 of this research study. The model developed in the study is the unit of analysis, while the type of research pursued by the research is a model-building one, where exploratory and explanatory approaches were used for obtaining insight into the outcome brought about by the use of the model. The main research methodologies used by the study are Design Science Research Methodology (DSRM) and the Delphi methodology. The first objective is to develop a model suited to the use of DSRM, while the model evaluation objective is achieved by using the Delphi methodology. During the development process of the model, a case study approach

was applied for a number of reasons, which include the use of DSRM and the type of research questions that this study intended to answer.

The semi-structured interviews were used to collect primary data over two stages, namely, the ‘as is’ environmental analysis stage and this study’s two artefacts refinement and evaluation process stage. Data collected during the ‘as is’ environmental analysis stage was obtained from five projects, where a PM and five corresponding PT members participated in the process. On the other hand, data collected during the other stage was obtained from 15 experts, as discussed in Section 3.5.4.1. Data was analysed following qualitative and quantitative approaches. The qualitative data was analysed with the help of ATLAS.ti tool, while quantitative data was analysed using the R programming language, which is a statistical descriptive analysis tool. The construct validity and reliability of this study were confirmed following various approaches, which included the use of multiple data sources, using within-case and cross-case pattern matching as well as comparison of evidence obtained from various sources. Lastly, the chapter discussed how the ethical issues were addressed in this study.

CHAPTER 4: A MODEL FOR ASSISTING ICT PROJECT MANAGERS TO TREAT PROJECT TEAMS AS KEY STAKEHOLDERS

4.1 Introduction

This chapter presents the research results of the prevailing status quo about the attention given to project interests of PTs by PMs in the South African ICT sector and the proposed model of this research study. Based on the outcome of this assessment and the literature review, a model proposed in this study is developed. The next section discusses the research results of the data collected to assess the 'as is' environmental conditions in terms of the prevailing status quo regarding the attention given by South African ICT sector PMs to PT issues. That is, the assessment is aimed at establishing the level of attention given to PT matters by PMs in the South African ICT sector.

4.2 'As is' environmental conditions assessment results

As mentioned in the previous chapter, data considered in this study for 'as is' environmental condition assessment was collected from the five project managers (PMs) and five project team members who were selected from five different ICT projects, as mentioned in Chapter 3. Each project considered in this study had to have a minimum of five PT members. In a situation where a team had more than five team members, only five were selected for participation. Before data was collected from the participants, the interview questions were pilot-tested using one ICT project from the targeted population. It was evident from the pilot test results that Question 3 needed rephrasing, as it was vague.

4.2.1 Data analysis of the data collected from software project teams

As indicated in Chapter 3, ATLAS.ti (Friese, 2012), a qualitative data analysis tool, was used for both data coding and analysis in this research study. ATLAS.ti is considered ideal for the 'stability and reliability' of codes used during the data analysis process (Missonier and Loufrani-Fedida, 2014). Pre-coding was used for closed-ended questions. For example, **INFORMATION_USAGE** was employed as a code for the answer to the question aimed at establishing whether information collected from PTs was used in the decision-making process by PMs. On the other hand, post-coding was employed to classify answers to open-ended questions. For example, **INFORMATION_TYPE** was used to code answers to the following prompt: 'Explain

what type of information is gathered'. The remainder of the codes used in the study are shown in Table 4.1, on page 66. A theme was created from every code, thereby enabling patterns to emerge from the answers of the respondents; this accorded sharper organisation and easy interpretation of the data.

4.2.1.1 Within-case pattern matching

This subsection discusses the data analysis results of the data collected from team members of the five project teams, appropriately called Team A, Team B, Team C, Team D and Team E, while PT members of the respective teams were assigned unique identifiers. For example, the first PT member of Team A was assigned PT_{A1}, the second one PT_{A2}, the third PT_{A3} and so on. In addition, project managers were each assigned unique codes, for example, the PM of Team A was identified as PM_A. The PT members and PMs of other teams were identified in a similar manner.

Team A

Processes existence/non-existence

One team member indicated that processes were existing, while the other four team members claimed that the processes to collect the opinions and needs of PT members were non-existent.

How are views and concerns collected?

The only team member who mentioned the existence of processes also indicated that PT views were collected during the once-a-week project meetings.

Type of information collected

According to the team member who claimed that processes existed, the type of information collected pertained to schedules (how PTs were performing in relation to set deadlines) and other challenges experienced in the fulfilment of their duties.

Table 4.1 – Codes used for data classification

Type of questions	Questions	Code	Code description
Closed-ended	Is there a process in place to gather team member views and concerns regarding a project?	**PROCESS_EXISTS**	The code was intended to record responses to the question on whether or not processes existed to collect opinions and needs of PTs.
Open-ended	If there is a process, how is the information regarding team member concerns and views pertaining to a project obtained or gathered?	**HOW_WAS_INFO_SOURCED**	This code was used for answers regarding how the opinions and needs of project teams were gathered, if such processes existed.
Open-ended	Please explain what type of information is gathered.	**INFORMATION_TYPE**	The code was used for answers to the question aimed at determining the type of information collected from PTs.
Closed-ended	Are you aware as to whether or not the collected information from team members is used in the decision-making process by the project manager?	**INFO_USAGE_AWARENESS**	This code was intended to record answers concerning whether or not a team member was aware of the usage of the collected information in decision-making processes by a PM.
Open-ended	If you are aware, please elaborate on how the information is used.	**INFORMATION_USAGE**	The code was used to record answers on how the information was used in the decisions by a PM.
Open-ended	What improvements would you propose be made to the current process for gathering information from team members?	**SUGGESTED_IMPROVEMENTS**	This code was used to record answers regarding suggested improvements on the process used to gather team member views.
Open-ended	What would be your ideal process for gathering team member views and concerns regarding what is happening in a project?	**IDEAL_PROCESS**	This code was aimed at recording responses to the question that was meant for determining an ideal process, if any, for collecting opinions of project teams.

PT views and concerns matter/do not matter in decision-making processes

The single team member who claimed the existence of appropriate feedback processes mentioned that the gathered information was considered in the decision-making process by the PM, because the PM would, for example, review project team member deadlines based on information received from the PTs. On the other hand, the claim of lack of processes by the four other PT members implied that project managers disregarded the views and concerns of project teams in their decisions. Furthermore, some of the four team members lamented the existence of bureaucratic processes ('*red tape*'), which, according to them, were aimed at suppressing their feelings and views. '*They are aimed at suppressing views and concerns of project team members*', added PT_{A2}.

Improvements to current processes

According to the team member who indicated the existence of processes, the processes were '*perfect and need no improvement*'.

Ideal process to gather PT views and concerns

According to three of the four team members who claimed non-existence of processes, an ideal process would be the one that accommodates their views and promotes superior interaction between project teams and project managers. The fourth member stated that they had no ideal process in mind. The fifth team member mentioned that the current process was ideal.

Team B

Process existence/non-existence

Two PT members categorically indicated the existence of processes to collect project team opinions and needs.

Processes are PM-dependent

According to three team members, some project managers gathered the views and concerns of project teams, while others did not – in other words, the collection for gathering of project team's views were at the mercy of individual project managers. The processes were not enforceable. One of the team members, namely, PT_{B3} went on to say, '*One can't say there are or there are no processes in place to solicit our*

views and concerns, as this depends which project manager is in charge of the project'. According to the three team members, communication between project managers and their teams would be enhanced if the processes were enforceable. "*The level of communications between individual team members and project managers leaves a lot to be desired at times and impacts on productivity*", said PT_{B4}.

How are views and concerns collected?

The two team members who claimed the existence of processes indicated that project team opinions and concerns were formally solicited during weekly project meetings. The remaining three team members who said that the existence of processes depended on the project manager also acknowledged that their views and concerns were collected during official project meetings, thus corroborating the statement of the other two PT members.

Type of information collected

The two PT members who asserted that processes existed mentioned that the type of information collected was work-related such as schedules and challenges regarding work. The other three PT members who insisted that processes were dependent on project managers also supported this claim.

PTs views and concerns matter/do not matter in decision-making process

One of the two team members who claimed the existence of processes indicated that PT views were taken into consideration in decisions by project managers, but could not elaborate as to how was this done. The other team member of the initial two stated that the consideration of PT needs and opinions in decisions was also project manager-dependent: '*In one project one's views may count, while in another they may mean absolutely nothing*', said PT_{B1}. However, the three respondents who declared that the processes were project manager-dependent indicated that their opinions did not matter to project managers – PT_{B5} mentioned that *'some project managers are dictatorial'.*

Improvements to current processes

One of the two team members who claimed the existence of processes indicated that there was no need to improve the processes, as they were serving their purpose. However, the other team member indicated that PTs needed training on project

management tools that were in use to improve on interaction amongst project managers and their teams, because *'currently communication is disoriented',* claimed PT_{B2}. The three team members who mentioned that the existence of processes depended on individual project managers said that the enforcement of such processes was needed to ensure that all PMs implemented them. Furthermore, they indicated that there was a need to involve project teams in decision-making by project managers. *"We rarely get involved in project decisions, it is as though our views are not needed"*, mentioned PT_{B4}.

Ideal process to gather PT views and concerns

The three team members who asserted that the processes were dependent on PMs said they would prefer a process (tool) that could be easily integrated with the existing tools to seamlessly collect their opinions and project needs. One of the respondents proposed that the tool be informal, that is, it should allow the collection of information from PTs informally rather than through formal project meetings. The other two respondents remarked that the current process was ideal for them.

Team C

Processes' existence/non-existence

The team members from this team were the only respondents, without exception, who mentioned that processes were non-existence, thus implying that their project managers, when making decisions, did not consider project teams' views. PT_{C1} emphatically said, '*there are no such processes here. If there were any, we would have been the first to know since we have been in this company for years*'.

PTs views and concerns matter/do not matter in decision-making process

By virtue of the PT members stating that processes were lacking, this meant that project managers in their decisions disregarded opinions and concerns of project team members.

Ideal process to gather PT views and concerns

Two participants asserted that an ideal process for them would enable project teams to voice their opinions and needs privately to avoid reprisal by PMs. The other three

team members maintained that all they wanted was a process to collect their opinions and project needs.

Team D

Processes' existence/non-existence

Four team members agreed that processes were in place, while the fifth PT member stated a contrary view, indicating the absence of processes to collect the opinions and needs of project teams. "*There are no such processes, even in the previous teams that I worked for no views were collected*", said PT_{D5}.

How were views and concerns collected?

The four respondents who indicated the existence of processes also stated that PT views were collected during weekly team meetings: '*The only time where project team members' views and concerns get heard is during weekly meetings*', PT_{D3}. Some stated that it would be good if this information was also collected through individual one-on-one meetings with a PM or by other means, and not simply raised at weekly meetings.

Type of information collected

According to the four team members who claimed the existence of processes, the type of information collected regarded performance of assigned work – progress and challenges that may have arisen.

PT views and concerns matter/do not matter in decision-making process

The four team members who mentioned the existence of processes further indicated that the collected information was used in the decision-making process by project managers, because the PM addressed whatever work challenges they might have experienced. The only team member who claimed that processes were not in existence insisted that project managers, in their decisions, disregarded the views of project teams.

Improvements to current processes

One of the four participants who claimed the existence of processes urged that the processes needed improvement to enable team members to benefit from individual

interaction with project managers, while the other three participants mentioned that the processes needed no improvement.

Ideal process to gather PT views and concerns

The team members who said there were no processes remarked that an ideal process should consider '*obstacles on a moment-by-moment basis*'; it should be flexible to accommodate different environments and situations.

Team E

Processes' existence/non-existence

Three team members of Team E mentioned the lack of processes, while the fourth member of the team claimed the processes existed, albeit undocumented. The fifth team member echoed the sentiments of the fourth team member, stating that processes were undocumented and as a result, not existing, according to the respondent. Furthermore, the team member mentioned that the reason for saying the processes were not in existence was that their implementation was PM-dependent. PT_{E5} said, "*The undocumented processes are not enforceable and this allows project managers (some project managers) not to follow the processes"*.

How were views and concerns collected?

The fourth team member, who claimed that processes were in place but not documented, stated that PT views were collected during their Friday weekly team meetings. The fifth team member who said the implementation of the undocumented processes were at the discretion of PMs, said the opinions and needs of team members were collected during weekly meetings, whenever this happened.

Type of information collected

The two team members who mentioned the existence of processes, albeit undocumented, agreed that the type of information collected concerned individual task progress and problems that individual team members were encountering.

PT views and concerns matter/do not matter in decision-making process

The three team members who claimed the absence of processes indicated the disregard of project team concerns by project managers in their decisions. One of the three team members went on to reiterate; '*Your views don't matter*'. The respondent who mentioned that the implementation of processes was PM-dependent also stated that consideration of the views and concerns of project teams were dependent on individual project managers. The last team member claimed that project managers valued the opinions of project teams.

Improvements to current processes

The team respondent who mentioned that the existence of processes was PM-dependent said that the process needed improvement to enable team members and project managers individualised meetings. On the other hand, the team participant who claimed the existence of processes expressed a desire for an improved communication process, as well as the capability of the process to enable the tracking of issues raised by PT members.

Ideal process to gather PT views and concerns

The four team members – three team members who claimed that there was a lack of processes and the PT member who said processes were PM-dependent – indicated that an ideal process for them would be one that promotes clearer and more fluent communication between a PM and PTs through regular meetings. The fifth team member said he had no ideal process in mind.

Table 4.2 presents a summary of the data analysis results discussed in this section.

Table 4.2 – Data analysis summary of data collected from PTs

Team Name	Yes, there are process	No processes	Yes/No - Process depends on a PM	Views matter in decisions taken by PMs	Improvements to the current process	Ideal process
Team A	One team member claimed existence of processes.	Four team members mentioned an absence of processes to gather project team views.	No one	One team participant said the teams' opinions were valued by PMs, while four team members indicated that there were no such processes, thus implying that the views of project teams were disregarded.	The team member who claimed process existence stated that there was no need for process enhancement.	Three team members of the four who indicated the absence of processes expressed the desire for a process that would solicit PT views, but could not explain the operation of the process, while the fourth team member said he had no ideal process in mind. Nevertheless, they unanimously recommended the removal of 'red tape' (which in their view was there to supress opinions of project teams). According to them, red tape occurs because of the assumption that PMs know it all and therefore need no input from their teams. The existing process was an ideal one for the fifth PT member.
Team B	Two participants mentioned the existence of processes to collect opinions and		Three team members indicated that the existence of processes was project manager-dependent – some project managers gathered the	Three respondents claimed that PMs disregarded PT concerns in their decisions. *'some project managers are dictatorial',* said PT_{B5}. The fourth respondent claimed that team	Three team members called for the enforceability of the processes, and that they not be based on individual project managers. They further suggested improvement on communication levels between project managers and their teams – calling for project team involvement in decision-making processes by	(This refers to the three respondents who claimed that processes were dependent on project managers): The team members suggested a comprehensive tool, which will consider the opinions and project needs of project team members. One of the three respondents

	concerns of project teams.		views; others did not. Project managers were not made to account for neglecting to implement the processes.	opinions were valued while the fifth respondent indicated that this was project manager-dependent.	project managers. The fourth team member expressed satisfaction with the current processes; the fifth team member characterised the communication between PMs and PTs as 'disoriented' and proposed training for project teams on project management tools to enhance communication levels.	preferred the proposed tool to be informal.
Team C	No one.	All five participants mentioned the lack of existence of such processes.	No one.	The absence of processes implied that project managers disregarded the opinions and concerns of project teams in their decisions.	Not applicable.	In addition to a process to collect the opinions and concerns of project teams, two respondents proposed that the processes should allow team members to give their views anonymously to avoid reprisal by project managers.
Team D	Four respondents affirmed the existence of processes.	One participant denied the existence of such processes.	No one.	The four team members who claimed the existence of processes also alleged that project managers valued views and concerns of project teams.	One of the respondents who asserted process existence proposed that the process should cater for individual team member interaction with a project manager to improve communication between the mentioned stakeholders. The other three made no mention of changes.	The team member who mentioned the lack of processes suggested that an ideal process would be a flexible one that catered for diverse projects.

Team E	One team member alleged the presence of processes to collect opinions and concerns of project teams. Nevertheless, the respondent also acknowledged that the processes were not defined.	Three team members categorically denied the existence of such processes.	One team member claimed the existence of a process, which was undocumented; thus, the process was non-existent according to this member. Her sentiments confirmed a declaration by another responded in the team about the existence of an undefined process.	The participants who claimed the absence of processes expressed that the opinions of team members did not matter to project managers. '*Your views do not matter*', said PM_{E4}. The respondent who said processes existed claimed their views were valued by PMs. The one team member, who indicated that the presence of processes was project manager-dependent, also expressed that consideration of their views was project manager-dependent.	The team member who remarked that the processes existed proposed the improvement of communication levels and follow-up of matters raised by project teams. The team member who mentioned that the processes were project manager-dependent said the process needed to include private sessions between individual PT members and project managers.	Four team members – three team members who claimed the lack of processes and one who indicated that such processes were dependent on individual project managers – said their ideal process should promote better communication between project managers and teams.

4.2.1.2 Cross-case pattern matching

This subsection establishes and presents observed cross-case patterns in the data analysis of results of the five different projects, as presented in the preceding subsection. This technique is meant to aggregate the findings across individual cases (projects) as suggested by Yin (2017).

Processes existence/non-existence

One PT member from Team A, two PT members from Team B, four PT members from Team D and one PT member from Team E confirmed the existence of processes to collect views of project teams. That is, ***eight PT members across all teams*** indicated the presence of processes to elicit the opinions and needs of project teams. Contrarily, ***13 team members from all teams*** alleged a lack of such processes. The 13 PT members who claimed that there was a lack of processes consisted of four team members from Team A, all five team members of Team C, a team member from Team D and three PT members from Team E.

Processes are PM-dependent

Four team members, of which three were members of Team B and one a team member of Team E, ***said there were processes and no, there were no processes, because processes were project manager-dependent.*** They indicated that some PMs observed the processes and others ignored them. If the responses of the four project team members could be considered as indicating a lack of enforceability of elicitation of project team opinions and needs by project managers, this would imply that 17 PT members considered the processes non-existent.

PT views and concerns matter/do not matter in decision-making process

Seven PT members – one each from Team A, Team B and Team E respectively, and four from Team D – said ***opinions and needs of project teams were valued by PMs in their decisions***. At the same time, ***16 team members indicated that their views did not matter in the decision-making process*** – with comments that some PMs were '*dictators'* and '*your views do not matter*'. The composition of the 16 PT members who said their views counted for nothing is as follows: four PT members from Team A, three from Team B, all five PT members from Team C, one team member from Team D and three PT members from Team E. ***Only two team members across all***

teams (one member each from Teams B and E, respectively) alleged that some project managers valued their views while others did not, meaning the consideration of ***their views was project manager-dependent***.

Improvements to current processes

All project teams, one way or another, mentioned that ***communication within project teams (PMs included) needed attention in some way***, with one team member (PT_{B2}) reporting the communication between PMs and PT members as 'disoriented'. Some team members claimed that the communication processes were not encouraging project teams to openly provide their contribution to the project managers' decision-making processes. Some PT team members stressed the need for the enforcement and standardisation of gathering views and concerns of PT members. Two PT members – one team member from Team D and the other from Team E – insisted it was imperative that the current processes cater for one-on-one meetings between PMs and their individual team members.

Ideal process to gather PT views and concerns

There was nothing exceptional that was mentioned by the PTs regarding the ideal process, except that the process should gather PT member views and concerns, which should then inform, at least in part, the decision-making processes of PMs. Some team members indicated that it should be 'flexible' to accommodate different ICT development environments.

Table 4.3 presents summary results of the cross-case patterns as discussed in this section.

Table 4.3 – Data analysis summary of data collected from PTs

	Yes, there are processes	No processes	Process depends on a PM	Views matter in decisions taken by PMs	Improvements to the current process	Ideal process
Total	Eight team members	13 team members	Four team members	Seven said PMs valued their views; 16 claimed that their views were disregarded; while two said the consideration of their views was PM-dependent.		

4.2.2 Data analysis of the data collected from software project managers

This subsection discusses the data analysis results for the data gathered from project managers of the five teams. Table 4.4 presents a summary of these results.

The project manager for Team A indicated a lack of processes aimed at collecting project team opinions and needs, and this assertion corroborates a claim by the majority of the members of Team A. Furthermore, the project manager suggested that the current process for project governance was ideal and should only be adapted to local context instead of the German context, in spite of the PM's own admission of a lack of processes to gather views and concerns of project teams.

The PM for Team B claimed the existence of process. Given that three members of the project manager's team said processes were dependent on project managers, it therefore would appear that the project manager was one of the project managers who observed the organisational processes of collecting views and needs of project teams. PM_B went on to emphasize the usefulness of the information gathered from project teams by saying, *'It enables one to address project risks'*.

Team C's project manager claimed that processes existed to gather the opinions and concerns of team members, but this contrasted with the sentiments expressed by the manager's team. Moreover, the claim by the PM that the opinions of project teams were welcomed by project managers was also in sharp contrast to what the team members admitted.

The answer of Team D's project managers was congruent with the responses of the four team members which pointed to the existence of processes, as well as the valuing of project team views by project managers in their decisions.

The claim by the project manager for Team E that processes existed contradicted what the three team members of the team declared. Further, the assertion by the project managers that views and concerns of the project team were regarded in PM decisions refuted the answers of three team members of Team E. On the importance of collected information from teams, PM_E said, *'It enables us to enhance processes and solve problems'*.

Table 4.4 – Data analysis summary of data collected from PMs

PM	Yes, there are processes	No processes	Yes/No - Process depends on PM	Do PT views matter in decisions taken by PMs?	Information enables/ does not enable better decision-making process	Improvements to the current process	Ideal process
PM_A		No processes existed for gathering views and concerns of project teams. The processes that were in place were for project governance.					PM_A said the current process needed to be localised, as it was German-based.
PM_B	A process existed and team views were collected during weekly meetings with individual team members.			PM_B claimed they did. The information pertained to: (a) task accomplishment of individual members; (b) weekly work schedule for each team member; and (c) challenges that teams encountered in meeting their targets. All this information assisted the project manager in planning.	The PM said it aided in better decision making. For example, it enabled the PM to deal with risks.	A tool which would enable tasks assigned to individual team members to update the committed start and end dates as necessary.	
PM_C	Processes were in place that enabled project managers to engage in daily sessions with project teams.			According to the PM_C, views of PTs were valuable in decision-making. The collected information assisted in addressing non-performing team members.	It enabled better decisions to be reached. The information assisted PMs in providing better support to their teams.	The process was deemed fine.	

PM_D	The processes existed, which allowed information to be gathered during various phases of a project. Some information was collected during one-on-one sessions and daily/weekly meetings, as needed.			The PM claimed they did value PT input. Such information was necessary to deliver successful projects.	The project manager said the information has enabled the dissemination of appropriate feedback to upper echelon.	There was no proposal directed at process improvement.	
PM_E	Processes existed but were undocumented. Project team views were collected through various collective efforts during a project life cycle.			PM_E maintained that the views of project teams were vital in the decision-making process. The collected information aided in the determination of project risks.	Team input in addressing various process-related problems.	(a) The PM proposed that the tools needed to be enhanced to provide necessary information on-demand. This would eliminate meetings. (b) The use of human resources in various projects made the collection of information from team members very difficult.	
Total	Four project managers claimed that processes were in existence.	One project manager insisted the process was for governance of projects and not for collection of project team views and concerns.		All five PMs agreed that the project team input was valuable to them, even though the fifth project manager conceded that there were no processes in place for gathering such input.	All project managers confirmed that the input from PTs enabled better decisions.		

4.2.3 Discussion of the data analysis results presented in the previous sections

This section discusses the gaps or contradictions that were observed in the results presented in Subsections 4.2.1 and 4.2.2. Furthermore, the contribution of the study in addressing the identified gaps or contradictions is also presented in this subsection. Possible reasons for contradicting answers provided by PT members amongst themselves, as well as between PT members and PMs, are also presented. Feasible solutions to address the apparent problems, which seemed to have given rise to the contradicting answers are also discussed.

Four project managers mentioned the existence of processes for collecting views of project teams, whereas only eight PT members echoed these sentiments. One project manager claimed a deficit of processes to elicit views of project teams, while 13 PT members mentioned the absence of such processes. No PM mentioned anything about implementation of processes being PM-dependent, whereas four PT members suggested the implementation and existence of processes were PM-dependent. From this, there is clear contradiction/disagreement between PMs and PT members – most PMs claimed that there were processes in place to gather PT views and concerns, while most PT members stated the opposite. According to Hans and Mnkandla (2018), the basis for the contradictions could stem directly from the following factors which emanate from responses provided by several of the PT members:

- ***Undocumented processes/informal processes*** – Some of the PT members indicated that processes were undocumented; this could have resulted in the organisations having difficulties enforcing such processes with PMs and PT members. Some project stakeholders, e.g. some PMs, might have ignored (intentionally or unintentionally) the undocumented/informal processes. Some PMs could have interpreted the fact that processes were undocumented as a sign that they were unimportant, and therefore saw no need to implement such processes. Hans and Mnkandla (2018a) point out that as it is extremely difficult to hold individuals (PMs in particular) accountable for undocumented and/or informal processes, this may lead to undesirable project outcomes. However, formalised processes influence projects positively (Labuschagne, Marnewick, Eloff, Steyn & Tobin, 2013), while informal (undefined) processes contribute to project failure in IT (Pankratz and Basten, 2013). It is the project management

office which is responsible for project management practices in organisations, that should document and also enforce project-related processes (Hans and Mnkandla, 2018b).

- ***Non-standardised processes and policies*** – Some project team members claimed the existence of processes to solicit views and concerns of project team members as PM-dependent. This might evidence the lack of standardisation of practices of gathering PT member views and concerns across the various units or projects of the organisation. This lack of standardisation of practices could be a result of the organisation not having PMOs, or the PMOs not standardising the project management practice of engaging with PT members. Another alternative could be that PMOs were providing a supportive role to project stakeholders, and lacked directive or controlling powers, as suggested by the PMI (Project Management Institute, 2013). This problem can be addressed by ensuring that the PMO plays its rightful supportive and directive role of standardising and enforcing compliance to the practice of solicitation of PT member views and concerns by PMs across projects in the organisation. Such a project management practice will only be entrenched as an organisational philosophy when project management processes and practices are standardised across projects within an organisation (Hans and Mnkandla, 2018b). Research shows that project managers in successful organisations use common (standardised) project management road maps (Schwalbe, 2015:16).

The prevalence of the abovementioned factors might have engendered an environment where some PT members never considered the existing processes and policies to be official organisation-wide ones, given that the processes were either undocumented or non-standardised or informal. At the same time, some PMs viewed the undocumented processes and policies as official organisational processes and policies, while others did not, and hence some PMs complied, and others did not. This study's model incorporated the PMO with the intention of addressing the aforementioned factors and to respond to the proposal made by Hans and Mnkandla (2018a) of using the project management office for enforcing solicitation of PT views and concerns across the organisation.

Considering the results of the data analysis of PT member responses regarding the lack of collection of their views and concerns and non-consideration of PT voices in the decision-making processes by PMs, it would seem PMs in the South African ICT development sector *do not* pay necessary attention to the needs and concerns of PT members and thus *do not* treat PTs as key project stakeholders.

The findings of a study carried out by Hans and Mnkandla (2019b) indicate that the inclusion of PTs in the decision-making processes and proper communication in project teams are both lacking in South African ICT organisations, a further confirmation of the preceding observation. This should be a grave concern for South African organisations because both of these factors have been proven to have a positive impact on project success (McManus, 2004; Milosevic and Patanakul, 2005) and team productivity (Henderson, 2004). In the South African context, Kaliprasad (2006) identified involvement of team members in decision-making using participative leadership style as a critical staff retention factor. Thus, the absence of these important factors in the ICT project environment does not bode well for both project success and the retention of key project team members. The findings by Hans and Mnkandla (2019b) therefore corroborate what the literature lays out, particularly in terms of project managers paying little attention to their teams in the ICT sector. The next section discusses this study's proposed model, intended to assist PMs in paying due attention to PT needs and interests and thereby granting PTs a voice 'at the table' of PMs.

4.3 A model for assisting PMs to manage PTs as key project stakeholders

The proposed model in Figure 4.1 operationalises and enfolds the framework developed by Hans and Mnkandla (2019a) for managing PT members as key stakeholders of ICT projects. Hans and Mnkandla (2019a) indicate that the framework was primarily prompted by the general perception of a lack of attention given to PT member needs, and the results (which corroborate with findings in literature) of the data analysis performed in Section 4.2 of this study regarding empirical evidence of this. Similarly, the aforementioned, as well as the project stakeholder management strategy framework of Sutterfield *et al.* (2006), gave rise to the model developed herein.

The following issues influenced the development of the model depicted in Figure 4.1:

The interests and salience of PT members as stakeholders may change at any time during a project life cycle (Aaltonen and Kujala, 2010; Aapaoja and Haapasalo, 2014; Chinyio and Akintoye, 2008). As and when interests and salience of a project team member change, then a project manager should adjust the level and nature of attention given to the concerned PT member accordingly. Given the fluidity and dynamism associated with ICT project teams and their members, the model should handle this requirement of enabling PMs to adjust accordingly. The constant monitoring of PT member interests, as well as possible change of salience throughout a project life cycle, ensures that PMs do not consider a PT member's interests and salience only once, but regularly, and this will ensure that each PT member's interests are noted by a PM and that the PM is able to recover if this information if a PT member's salience at any particular point during a project life cycle is misread or misinterpreted. The preceding discussion also considers a call made by Turkulainen, Aaltonen and Lohikoski (2016) that management of stakeholders should reflect the dynamic nature of the project environment as a project undergoes various phases in its life cycle.

A project is expected to be an open system (Aaltonen, 2011) and as such continuous checking and reaction to variations are critical for sustaining a strong people-focused environment and external interaction focus. Projects are open systems because they are affected by the environment within which they operate (Cleland, 1997; Eskerod and Larsen, 2018; Schwalbe, 2015:87). In encouraging the open system idea, Aaltonen (2011:170) proposes that a project be '*active towards its stakeholder environment*', susceptible and influencing the project environment. Stages 2, 5, 6 and the activity between Stage 1 and Stage 6 of the model reflect this need for openness and activeness.

A PT member may cease to be a member of a project, and thus cease being a stakeholder, at any time during the project's life cycle. The cessation of membership of a project team member is reflected in the model by an exit arrow.

When this occurs, lessons learnt and a review of engagement processes with the departing/departed team member should be compiled by a PM, who in turn should provide the PMO with feedback on lessons learnt and review of engagement processes.

The data analysis results in Section 4.2 of the study make apparent that the gathering of project team views and concerns by project managers was an optional process: the practice was not institutionalised and not followed consistently across all projects in the organisations. This finding confirms an assertion by Sampietro (2016:3) that there are still many '*organisations with poor project management practices*'. Contemporary studies indicate that there are differences in the application of stakeholder management practices (Aaltonen, 2011). If the project management procedural practices are to be successfully standardised enterprise-wide, then enforcement thereof should be from top management through a PMO (Bolles, 2002:7), rather than left to project managers to decide whether to implement or not (Aaltonen, 2011).

Collection of project team opinions and concerns and actively attending to their needs must be a standardised practice integrated into procedures and the organisation's project management methodologies and practices, as the discussion of data analysis results in Subsection 4.2.3 indicated. In order for organisations to positively influence successful delivery of their projects, company-wide standardisation of their project management procedures and discipline is critical (Bolles, 2002:7). According to the Project Management Institute (2017), failure to standardise project management practices could contribute to unsuccessful project. The PMO is (and should be) a guardian of project management practices within an institution, an entity delegated with the responsibility of standardising and enforcing project management practices within the organisation. To achieve this important requirement of standardising and enforcing solicitation of PT views and concerns across the organisation, the PMO is positioned at the heart of the activities of the proposed model. This will ensure that the treatment of project teams as key stakeholders by project managers is administered from the top office of project management; not left to the project managers to decide, who may or may not be keen implement.

Therefore, the project management office is at the heart of the activities of the proposed model with the sole purpose of ensuring that the practice of treating project teams as key stakeholders by project managers is enforced from top management through the office of project management. The project management office's duty is to ensure that all internal stakeholders in the organisation do correct things, consistently and uniformly, as expected by the enterprise (Bolles and Hubbard, 2008). This vital role played by the project management office in our model is a differentiating factor of our model from other generic models and frameworks, such as the one outlined by Sutterfield *et al.* (2006).

The next discussion is about this study's model, which is shown in Figure 4.1.

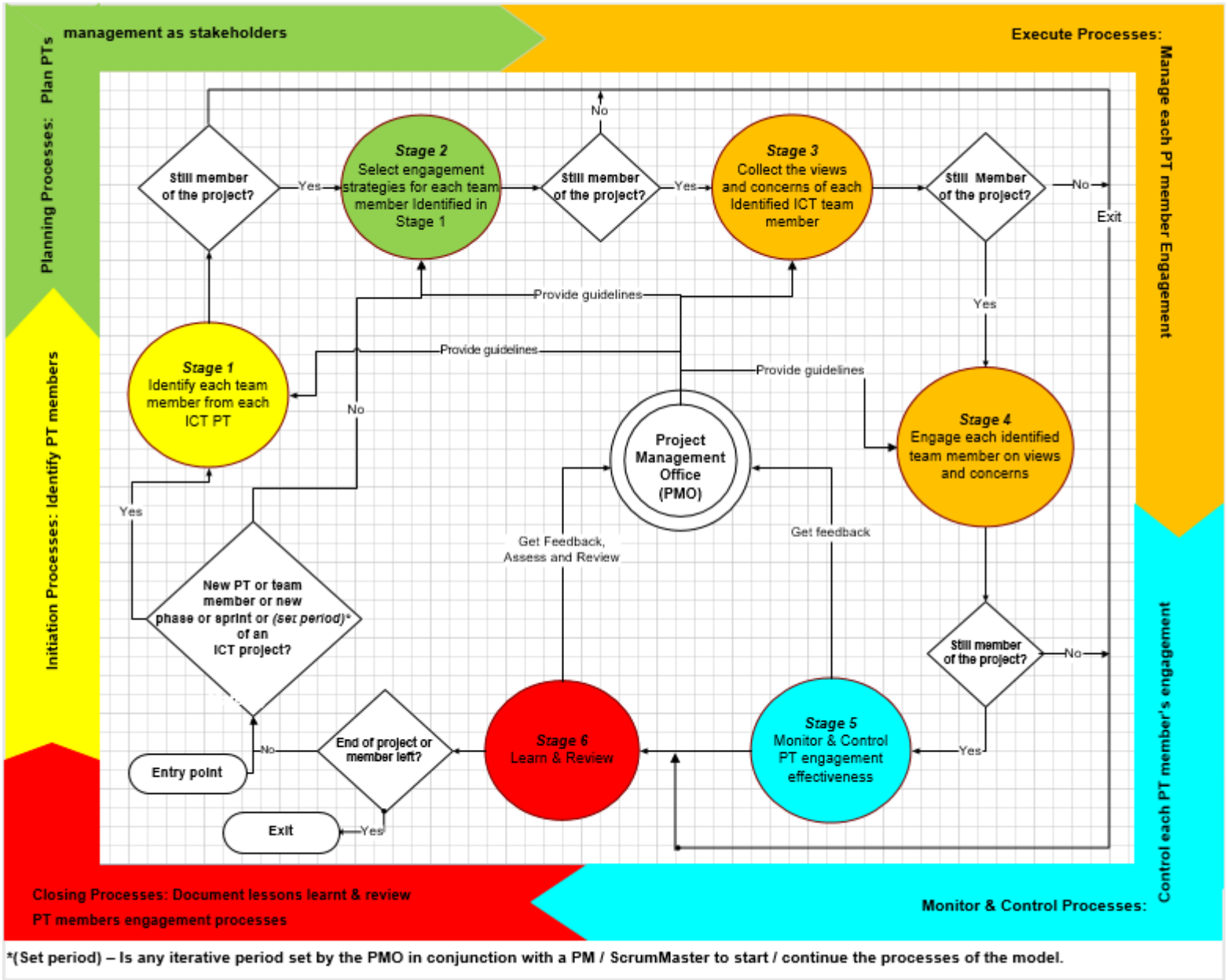
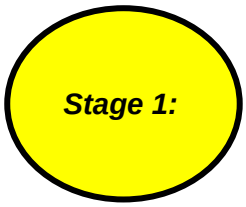


Figure 4.1 – A model to assist ICT project managers to treat project teams as key stakeholders

The model has the following stages that are to be followed in every software project life cycle phase so that PMs treat PT members as critical stakeholders:



Identify each project team member from each ICT PT – The purpose of this stage is for a PM to identify every team member who is a stakeholder at this phase of the project. Projects consists of phases which could be slightly different based on a project or industry (Schwalbe, 2015:31). Each software project life cycle phase has five process groups – namely, initiating, planning, executing, monitoring and controlling – as well as closing processes (Schwalbe, 2015:32). Normally, the identification of project stakeholders happens during the initiating process. However, given the fluidity of PTs in ICT projects, the identification of a team member could happen at any given time during a project's life cycle, not only at the beginning of a project phase, a claim also supported by Eskerod and Vaagaasar (2012) and Missonier and Loufrani-Fedida (2014). Hence, the questions between Stages 1 and 6 are aimed at detecting any project team member that might have joined the PT during this phase.

As indicated in the preceding paragraph, the aim of Stage 1 is to establish every member of the team who is participating in the current phase of the project so as to assess each one's project interests, concerns, needs and behaviours (Aga *et al.*, 2016; Eskerod and Larsen, 2018; Varvasovszky and Brugha, 2000) as discussed in Stage 3. This stage is similar to step 3 of the stakeholder management strategy framework developed by Sutterfield *et al.* (2006). However, in our model the identification of stakeholders only concerns project team members, as the model is solely intended to assist ICT project managers to treat project teams as key stakeholders, unlike Sutterfield *et al.*'s (2006) framework incorporates this step as generic for all stakeholders. Moreover, our model makes explicit that the identification of team members as stakeholders is expected to occur at each project phase or at a point decided by the PMO of the organisation, while in Sutterfield *et al.*'s (2006) framework, this requirement is not clear or explicit. This is crucial, because project teams and their members in ICT projects evolve with the project life cycle, with every phase consisting of different project teams or team members (Belout and Gauvreau,

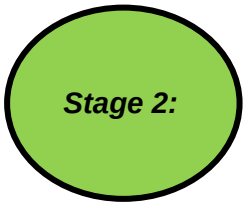
2004). For example, in a project that uses a Waterfall development model, systems analysts are involved in a project during system analysis and design phase, while software quality engineers participate during the software-testing phase. The identification of every team member during each phase with the purpose of not only attending to their needs but also ensuring that no team member goes unrecognised is imperative (Hans and Mnkandla, 2019a).

Various tools exist for identification of individual project team members as stakeholders (not just a set of stakeholders representing the interest of other similar stakeholders, that is, proxy stakeholders, as mentioned by Coakes and Elliman (1999)). These tools include stakeholder mapping (Bonke, 2000), stakeholder circle (Bourne and Walker, 2008) (not withstanding its weakness, as discussed in Subsection 2.2.3), role-based stakeholder models (Achterkamp and Vos, 2008) and stakeholder web (Coakes and Elliman, 1999). The project management office, as the guardian of project management practices and standards within an enterprise (Desmond, 2015; Hans and Mnkandla, 2018b)(Desmond, 2015) is expected to supply project managers with tools and mandatory guidelines for collecting views and concerns of team members during the various stages of a project. Such guidelines, for instance, could suggest optimal methods helpful to PMs for soliciting views and concerns of project teams.

Once the PT members have been identified, the classification process follows, where each PT member is classified according to individual salience (*power*, *legitimacy* and *urgency*) which represents the level of attention that the PM needs to pay to each PT member, as suggested by Aapaoja and Haapasalo (2014). The *power* of a PT member refers to the team member's ability to withhold labour from the project, while *legitimacy* in this case refers to the appropriateness of a PT member's labour withdrawal action under a labour law system. Finally, the *urgency* attribute relates to how urgent a project team member's action calls for a project manager's immediate attention. For example, if the role of a PT member in a project is a critical one, then the withdrawal of that team member's labour from the project calls for immediate attention from the PM.

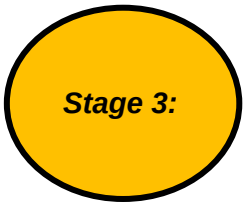
When considering the criticality of the role of a team member in a project, the following should be considered: the importance of the task performed by the team member, the

expertise possessed by the PT member and the level of difficulty of replacing the PT member, should the team member decide to leave the project.



Select engagement strategies for each ICT team member identified in Stage 1 – As project team members are unique, so are their preferred engagement strategies with their PM. According to Mnkandla (2013), a chosen communication technique may be an enabler or an impediment to achieving intended results between a project manager and a team member. The outcome of this stage is selected engagement strategies for each PT member, identified in the current project phase. Institutions which conscientiously engage employees (project team members) with sincerity experience lower employee turnover and fewer project-related problems (Aaltonen, 2011). A study by Kaliprasad (2006) shows that an inclusive and engaging management approach is an important factor in retaining skilled, talented PT members in South Africa. In order to effectively engage employees, the selection of appropriate and team member specific strategies is vital. A plan, for example, could specify that the collection of project team views from individual team members be a weekly process. The plan could also specify the preferred engagement strategies for each project team member.

Various researchers have proposed different project stakeholder engagement strategies, including project team or individual team member meetings (Yang, 2014), interviews and workshops (El-Gohary Osman and El-Diraby, 2006; Yang, 2014), semi-structured questionnaires (Karlsen, 2002), emails and social media platforms linked to a project (Hans and Mnkandla, 2017) and formal and informal discussions or focus group discussions (Aaltonen, 2011; Fisher, 2011; Lawson and Kearns, 2010).

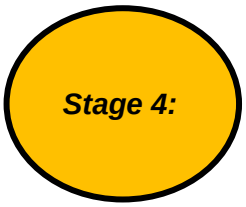


Collect the views and concerns of each identified ICT team member – During this stage, views and concerns from PT members are collected by a PM, and thereafter the collected data is analysed or interpreted to establish each PT member's needs. Elicitation of views and concerns of PTs and appropriately addressing their needs is a precursor to the delivery of successful projects, a claim that is supported by El-Gohary, Osman and El-Diraby (2006).

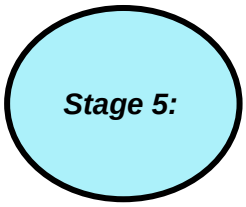
Both Fisher (2011) and Kaliprasad (2006) also concur with this view and argue that successful project managers appreciate and encourage input from project teams. Moreover, project success depends heavily on contributions from all project key role players, project teams included (Fisher, 2011; André et al., 2011). When project teams perceive that project managers attend to their needs and interests, they are encouraged to perform. However, the literature reviewed in this study and the data analysis results presented in Subsection 4.2.1 confirmed that project managers do not do this. Moreover, the results in Section 4.2.1 showed that the practice of collecting team views was not standardised or enforceable; as a result, some project managers implemented the practice while others applied it as and when they felt like doing so. Effective stakeholder management necessitates that project managers elicit useful information from project stakeholders in order to address stakeholder problems timeously (Mazur and Pisarski, 2015).

The lack of institutionalising the collection of project team views and concerns contributed to the varying application of the practice (Hans and Mnkandla, 2018b) and project managers failing to anticipate the consistent application of this practice during project execution. If project teams are to be accorded key stakeholder status, then the practice of collecting their views and concerns should be enforceable and purposefully standardised across an institution. Moreover, standardisation of project management practices will likely lead to ICT project success (Milosevic and Patanakul, 2005).

Project managers may use various methods, including the ones mentioned as stakeholder engagement strategies in Stage 2 discussion, to collect project team views. Yang (2014) insists as there is no single method is suitable for every situation, a combination of methods is recommended. After the collection of team views, an analysis and interpretation process should follow so as to discern and understand the needs of individual team members (Aaltonen, 2011). The authors of this study developed a sentiment analysis tool called PM*Int* (Hans and Mnkandla, 2016) to assist project managers to discern the sentiments of a project team member from a text, for example, an email. The tool promotes informal collection of project team views and concerns.

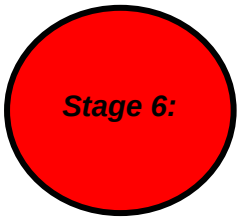


Engage each identified team member on views and concerns – Appropriate engagement strategies selected in Stage 1 are applied to communicate with every team member in order to address to their identified concerns and needs. Essentially, communication with stakeholders is aimed at understanding each stakeholder individually, discerning interests of stakeholders and establishing suitable ways of addressing their needs (Aapaoja and Haapasalo, 2014; Loosemore, 2011). As a result, each communication technique is tailored to suit individual team members to effectively attend to their needs. Consideration of views of PT members. an integral part of engaging and interacting with one's workforce (Kennedy and Daim, 2010), is an indication that PT views and interests are valuable for the success of a project. Engagement necessitates two-way *communication* between a PM and a PT member – it requires that a PT member be *involved* (including being actively listened to (Henderson, 2004) with contribution and input considered (Coakes and Elliman, 1999) in the decisions that pertain to work (Kennedy and Daim, 2010). This step is identical to Step 7 of the stakeholder management strategy framework developed by Sutterfield *et al.* (2006).



Monitor and control project team engagement effectiveness – This step is to monitor and establish the efficacy of the chosen engagement techniques in order to enhance or remove them if they yield an unintended outcome. The engagement strategies could be evaluated by assessing their effectiveness in enabling better communication between a project manager and individual team members. According to Demarco (1982), one can't control what one can't measure; hence the effectiveness of engagement strategies should be determined. The effectiveness of an engagement strategy could be determined by establishing a team member's satisfaction regarding the level of attention given to individual concerns. The turnover rate of team members may signal the effectiveness or ineffectiveness of the individual engagement techniques. These monitoring techniques would allow project managers to dynamically examine and track the project team stakeholder setting for possible deficit during project execution, thereby applying the stakeholder interpretation model, as recommended by Aaltonen (2011). Further,

the project management office should rely on feedback obtained from PTs to establish the effectiveness of project team engagement guidelines and improve them where necessary. Moreover, the feedback from project teams should also assist the project management office to ascertain the level of consistency that project managers engage in and apply the processes of solicitation of team views. As mentioned in the preceding discussion, the important oversight by the project management office herein distinguishes this study's model from the framework of Sutterfield *et al.* (2006).



Learn and review – Bolles (2002:84,103) states that project reviews are vital for the continuous enhancement and development of project management practices of an institution as they enable organisations to increase proficiency in applying project management practices. Schwalbe (2015:136), concurring with the sentiments, explains that the use of project performance measurements enables organisations to deliver successful projects. A project management office with its mandatory and commanding leadership powers should verify that all internal stakeholders observe institutionalised project management practices. During this stage, the PMO, using the valuable input from project teams and project managers, should review the efficacy of project management engagement practices, standards and guidelines for project managers and their teams.

The assessment and appraisal process of practices will assist the PMO in detecting discrepancies and variations, if any, in the implementation of the practices by each project manager for addressing concerns and needs of project teams. Furthermore, the feedback will help PMs to identify gaps in the processes to assist them to pay due attention to project team interests. This stage (Learn and Review) should not only be carried out at the close of a project, but during other phases of the project as well. The review outcomes, which occur during project execution, are related to project performance measurements taken during the project life (Cooke-Davies, 2002); on the other hand, the review outcomes that are determined at the end of the project are related to project success measurements. The effectiveness of engagement activities (dialogue) between a PM and individual PT member should be established, as suggested by Feather (2007).

This process should indicate PT members with whom the PM engaged, as well as how and when this engagement took place, and how the engagement influenced their relationship with the project. The review and appraisal process of practices will assist an institution to transforming into a learning organisation that eagerly improves on its project management capabilities, as also advocated by Lee *et al.* (2018). It will also serve as important empirical input to the retention strategies of an organisation. The measurement of PM behaviour 'provides a clear, demonstrable metric to the improvement of project management within a company' (Eve, 2007:88). To ensure that PM behaviours are in accordance with the organisation's project management practices, which the model seeks to promote, PM performance management must be linked to their management of PTs as key stakeholders, thereby promoting expected behavioural outcome (Feather, 2007). This is also supported by Sloan (2009), who suggests that company reward systems should reflect that PMs are required to show commitment to stakeholder management. Kerr (1989) explains that if PM performance measurement is linked to their efforts of meeting the needs of PTs, then they will be encouraged in addressing the needs of their teams as they do with the needs of other project stakeholders. Project teams must be convinced that it is worthwhile to provide their views and concerns; if not, they will conceivably be unwilling and resistant to participate in the processes. Transparency in the processes, giving timeous feedback to their input, and decisions of project managers reflecting team member input are some of the techniques for stimulating the participation of individuals. Furthermore, if the results of this stage yield targeted tangible improvements, this will elevate project team trust in the processes and thereby encourage participation (El-Gohary, Osman & El-Diraby, 2006; Feather, 2008).

Cheng, Wu and Wu (2010) and Hoch and Dulebohn (2013) call for better levels of teamwork and corporation between project managers and their project teams in ICT projects. The model presented in this study provides a response to this call. The need for high levels of collaboration is not necessarily an imperative for teams in other industries. However, the nature of work that project teams in ICT are involved with demands a high level of interaction between project teams and the PM. Once more, this new model facilitates this vital level of interaction, and again, this distinguishes the model from others.

The model presented here ensures that the voices of project teams in ICT are not unheard and that project management practices aimed at collecting their views, concerns and interests are institutionalised and enforced by the project management office. The preceding discussion on the model was meant to turn project manager attention to project teams, the indispensable resources for successful delivery of projects. The six stages of the model described previously are aimed at assisting ICT project managers to handle project teams as key stakeholders, as they ought to. The model presented in this chapter answers the first research question of the study: *How can a model supported by a project management intelligence (*PM*Int) tool assist ICT project managers to pay necessary attention to project team issues and thus treat them as key project stakeholders?* The evaluation (opinion-based test) and validation (results/experimental-based test) of the model, directed at determining the extent to which the model answers this question, are presented in Chapter 6 of this study.

4.4 Summary

This chapter presented this research study's proposed model for assisting ICT PMs to treat their PTs as key project stakeholders. Firstly, the prevailing level of attention given to the interests, views and concerns of South African software PTs by PMs was established through an 'as is' environmental analysis. The results of the data analysis of responses of the PT members confirmed what the existing project management literature purports about the inadequate attention that ICT PTs receive from their PMs. However, the results of the data analysis of PM responses presented a contradicting view, where most PMs claimed that views and concerns of PTs did receive their attention. The bases of the contradicting responses between PTs and PMs were also discussed and linked to a previous study by Hans and Mnkandla (2018b). Following the presentation of the results of the 'as is' environmental analysis, the proposed model was presented and discussed. Chapter 6 presents the results of the refinement and evaluation as well as the validation processes of the model developed in this chapter.

CHAPTER 5: THE DESIGN AND DEVELOPMENT OF THE PM*Int* TOOL

5.1 Introduction

This chapter discusses the design and development of the PM*Int* tool which was proposed and developed by Hans and Mnkandla (2013, 2014, 2016, 2017). The tool provides intelligent information about PT members. The chapter is broken down into the following sections: Section 5.2 discusses the origin of the PM*Int* tool; Section 5.3 presents the architecture of the PM*Int* tool, where the input data sources, the application layer, and the user interface are discussed; Section 5.4 discusses the technology behind the PM*Int* tool; and Section 5.5 concludes this chapter with a summary.

5.2 The origin of the PM*Int* tool

The previous chapter presented a model aimed at assisting project managers to pay necessary attention to the needs and interests of project team members. As discussed in the previous chapters, the model uses the PM*Int* tool for analysing and discerning the interests and concerns of individual PT members. According to Hans and Mnkandla (2014), the proposal of the PM*Int* tool was due to the absence of intelligence tools in project management on project teams for project managers. The tool establishes the sentiments of project members by text mining activities on different formats of data, namely, structured and unstructured data. The ability to understand the sentiments of a PT member by using the PM*Int* tool, enables a PM to better motivate PTs (Hans and Mnkandla, 2016), an issue (motivation of project teams) which has remained a problematic matter for project managers (Schwalbe, 2015:365). The need for, and importance of, project management intelligence tools such as the PM*Int* tool was extensively argued by Hans and Mnkandla (2014, 2017). The same authors went on to design and develop a prototype of the tool as presented in their research work (Hans and Mnkandla 2016).

The development of any software system follows a phased approach, and system design is one of the phases or activities in a systems development life cycle (SDLC). According to Whitten, Bentley and Barlow (1994:146) the main aim of the design phase is to outline a computerised solution for solving a business problem, as described in the specifications. Zhu (2005) regards a design for software as

representing of an entity that needs to be implemented, while Iqbal (2013) considers a design to be representing a description of a software system with regard to its arrangement and behaviour. It is important to point out that the design by itself is not the end product, but a detailed explanation of what needs to be built (Stumpf and Teague, 2005). The use of Unified Modelling Language (UML) enables one to model the structure through class diagrams and the behaviour through interaction and/or state diagrams.

Preceding the systems design phase is the systems analysis phase, which is aimed at producing business requirements for the new system based on the analysis of a problem or situation a business is confronted with (Whitten *et al.,* 1994:203). For this study, the business requirement, as identified under Sections 1.2 and 1.3, is the development of a project management intelligence tool aimed at assisting a project manager to solicit team members' sentiments on project-related matters. The PM*Int* tool will perform text mining/analytics techniques on input data, both structured and unstructured, by extracting word frequency distributions in the data with the aim of establishing project member(s) sentiments in a project. A project manager would then be able to make informed decisions based on sentiment analysis provided by the tool. Through the PM*Int* tool, a project manager has the ability to unlock knowledge, which is hidden in text data. The next sections provide details of the PM*Int* system from the design point of view.

5.3 The architecture of the PM*Int* tool

The PM*Int* system is a three-tier system, which consists of the *presentation layer* (user interface), the *application layer*, which includes text pre-processing, sentiment results interpretation and visualization, as well as the text-mining engine processes, and *data input sources layer*. Figure 5.1 presents the tool's architectural design.

The user interface layer enables the user (a project manager) to select a team member whose sentiments the project manager would like to determine. The system also prompts the PM for the data input source, such as email, text file or direct input from a keyboard. Other possible forms of data sources, such as WhatsApp and Facebook, could not be used by this study, due to the strict security measures around these tools

by their organisations. The system's user interface is also used to provide feedback on the sentiment analysis of a project team member.

The application layer processes all the requests received from the user interface. This layer further consists of two processes, namely, the report generation process and text analysis tool (Stanford CORENLP Sentiment Analysis) (Manning, Surdeanu, Bauer, Finkel, Bethard & McClosky, 2015). The report generation processes information returned by the text analysis tool, and based on this processing, a report is then sent to the presentation layer. Subsection 5.3.2 of this chapter provides an in-depth discussion of the application layer. Figure 5.1 provides an overview of how the system's three layers interact. The next section presents the input data source layer.

5.3.1 Input data sources layer

On a project, there are various media of communication, which may be used by the project teams, and therefore project team members may express their sentiments on any of the media, which may be used at any given time. For example, a project manager may set up a project Facebook page such that only project team members may participate on that page. It is therefore imperative that the PM*Int* tool be able to allow a project manager to use any digital text input source in determining a project team member's sentiment. Data can be fed into the PM*In*t system from three primary input data sources. These primary input data sources are direct input from the *keyboard*, *emails*, and *plain text files*. As explained in the previous section, the tool could not cater for platforms such as Facebook and WhatsApp, because of the security measures around these platforms. The three input data sources used by the tool are shown in Figure 5.1. According to Figure 5.1, a PM may request the PM*Int* tool to process text to determine a PT member's sentiments. The input text could be from a keyboard or email or a text file. The PM*Int* tool would then format the input text according to what the Stanford CORENLP tool expects as input, and thereafter pass it to Stanford CORENLP tool for processing. The results returned by the Stanford CORENLP tool would then be processed accordingly (see Subsection 5.3.2.3 on what processing is carried out) and be displayed to the PM. Figure 5.2 shows how the flow of events in the processing of input text occurs. A project manager may chose any of the three input data sources, as discussed earlier in this subsection. If emails serve as input, then the PM*In*t tool would require additional information (see Subsection 5.3.3

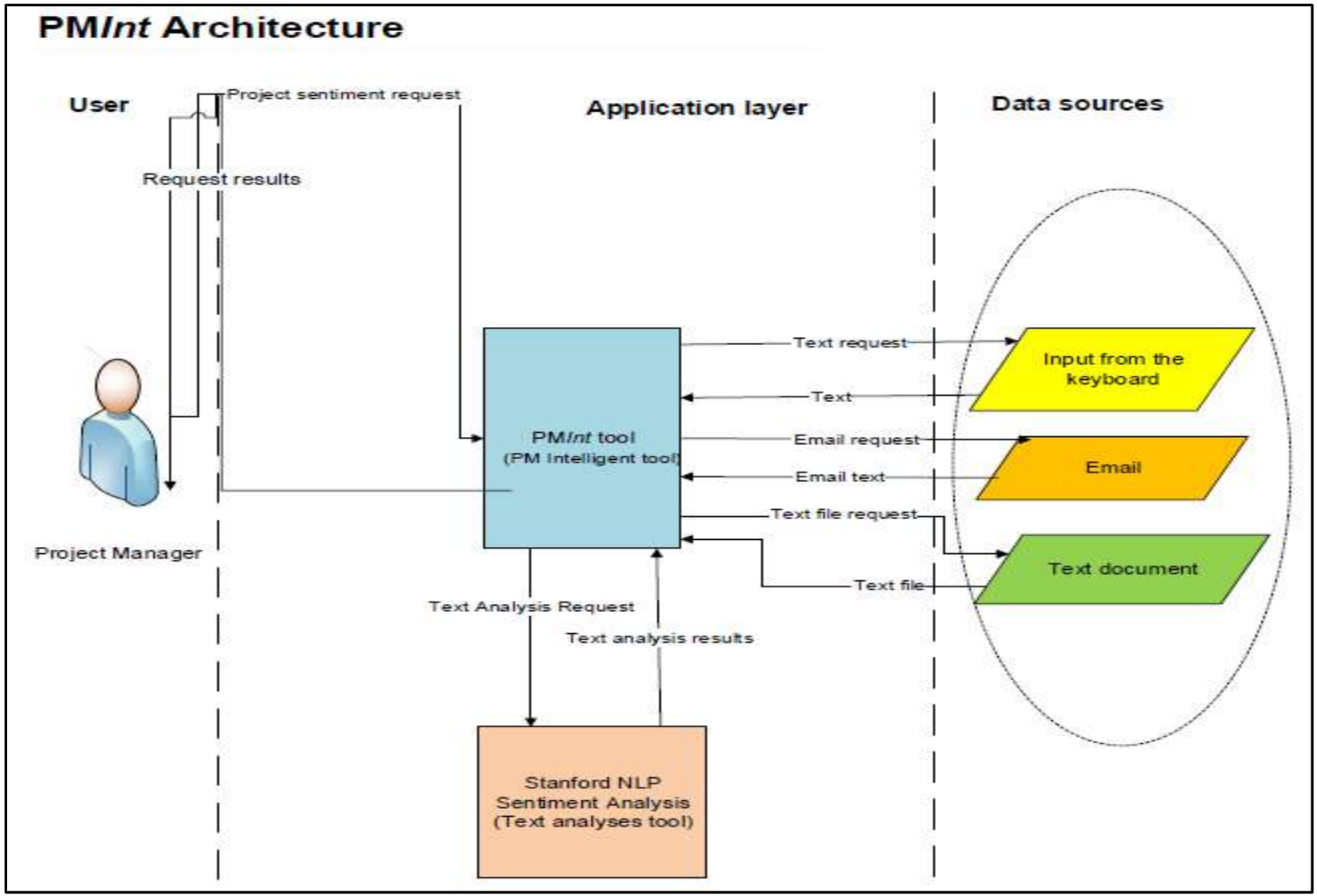


Figure 5.1 – Architecture of the PM*Int* tool

for details on this) to retrieve needed email(s). Once the text has been retrieved from the email(s) it would be prepared to be submitted to the Stanford CORENLP tool for processing. Similarly, if any of the other two input data sources were selected, the PM*Int* tool would prompt the user accordingly for necessary information as discussed in Subsection 5.3.3.

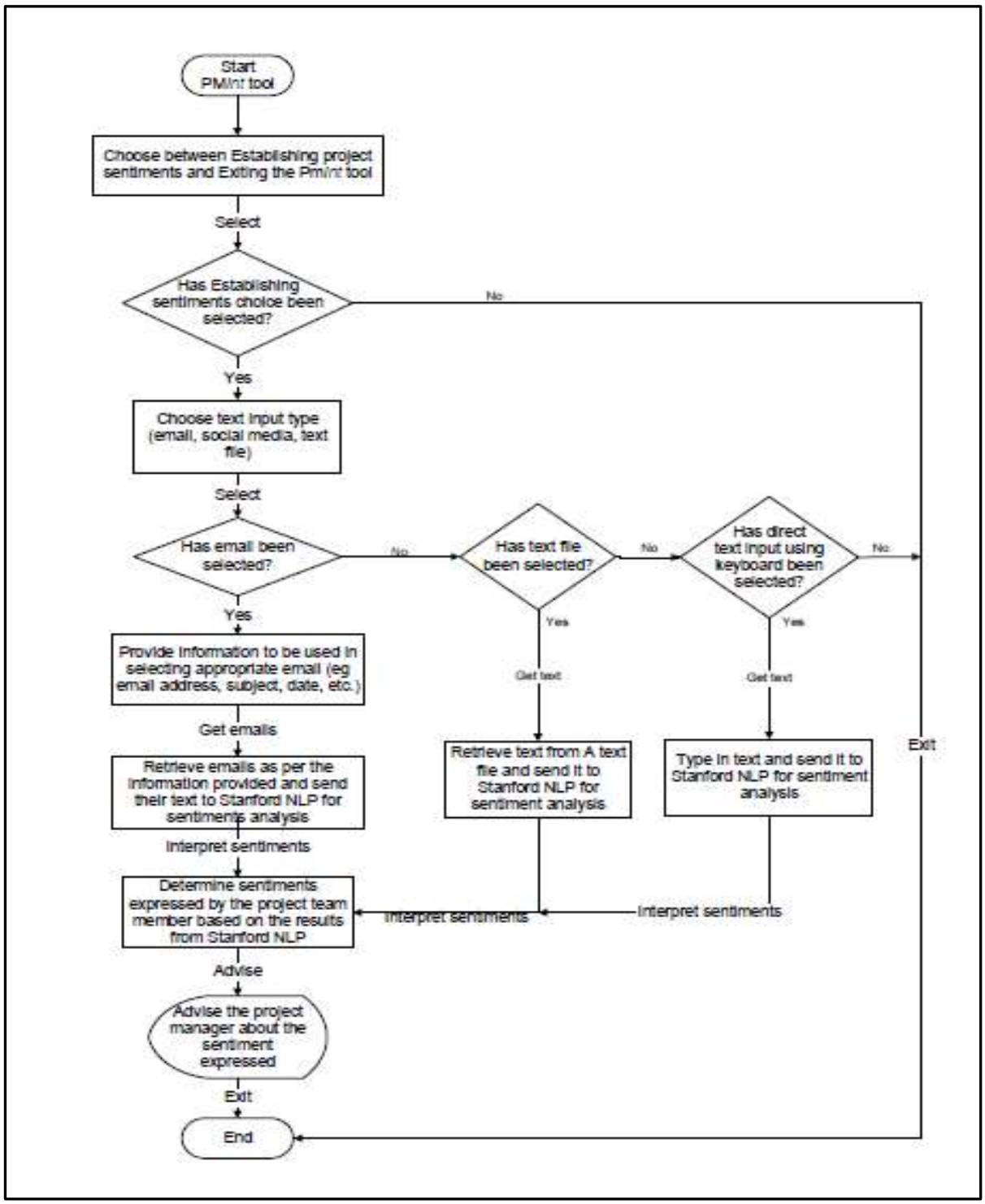


Figure 5.2 – Flowchart of how the PM*Int* system's processes interact

Since emails are one source of data for the tool, Figure 5.3 presents a typical system sequence diagram for the system performing sentiment text analysis of the data received from emails. From the scenario in Figure 5.3, the project manager has selected emails as an input data source and has provided additional information with regard to the emails to be extracted from the email server. The emails are read from the email server as needed and the text is then sent to the Stanford CORENLP toolkit (Manning *et al.,* 2015) (more on this tool in Subsection 5.3.2.2 of this chapter) to be analysed in order to establish the sentiments expressed in the emails. In turn, the Stanford CORENLP system returns sentiment analysis results and the PM*Int* tool generates a report based on the results received from the sentiment analysis tool.

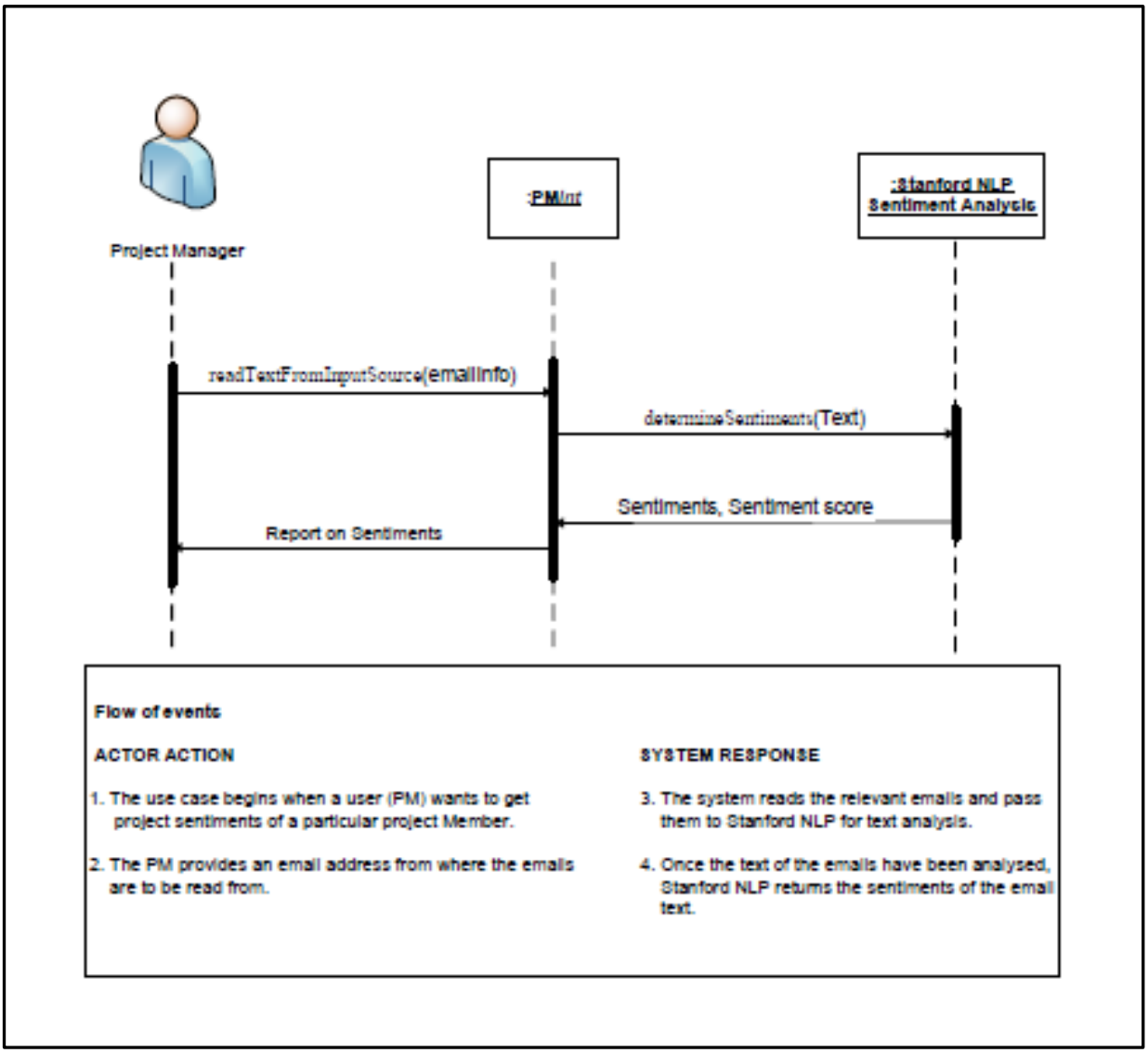


Figure 5.3 – System sequence diagram for email text analysis

5.3.2 Application layer

As indicated in the previous subsection, the application layer consists of three processes, that is, pre-text processing, sentiment analysis results processing and data visualisation. The next subsection deals with the pre-text process, while the other two processes are discussed in subsequent subsections.

5.3.2.1 Pre-text processing

Text may be submitted to the PM*Int* tool using any of the three text input sources, which were discussed in Subsection 5.3.1 of this chapter. Whichever source of text input is used, the text needs to be read and stored as a single text string made up of sentences, because the Stanford CORENLP toolkit (Manning *et al.,* 2015) takes its input as a single text string. The single text string is then sent through to the text mining engine, Stanford CORENLP toolkit (Manning *et al.,* 2015) for sentiment analysis. For example, let us assume that the file submitted for processing to the PM*Int* tool contained the following sentences:

> ***This project is one of the best projects I have worked on. I wish all my future projects could be like this one! However, life is not all about what one prefers.***

Then the pre-text processing would read the file sentence by sentence and join the sentences into a single text string, which would then be submitted to the sentiment analysis tool for processing. A similar process would be followed for extracting input text from the other two sources of input. Figure 5.4 shows how the system generally receives input text, pass it on to the text analysis tool and then generate the results report from the text analysis tool's results.

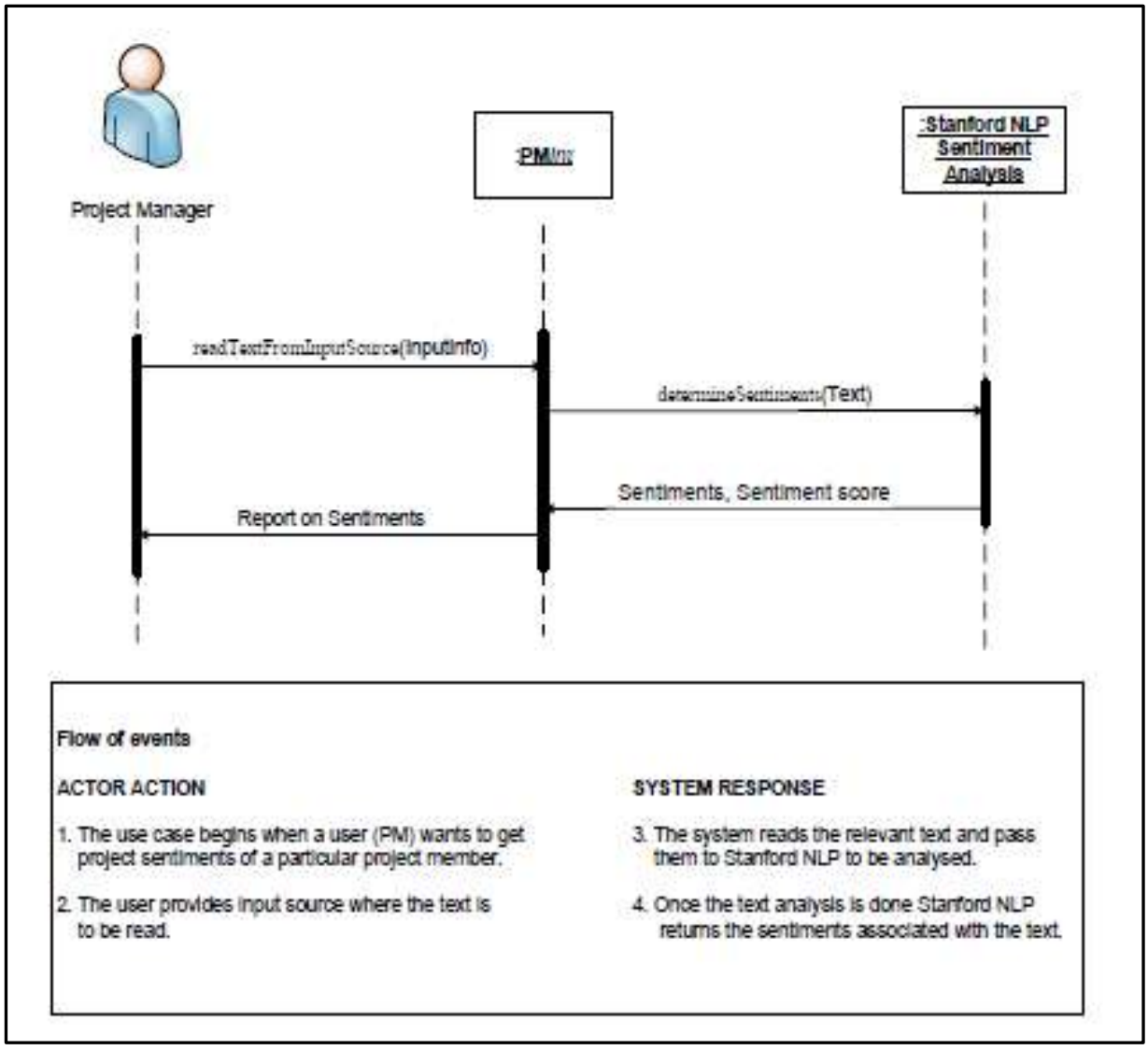


Figure 5.4 – Sequence diagram for text analysis in general

The next subsection renders an in-depth discussion on the text mining tool used by the PM*Int* tool.

5.3.2.2 Text mining engine

Text provided by a data source needs processing to establish sentiments of a team member towards a project. The PM*Int* tool expects a data input source from which data to be processed will be extracted. Once the text is received from the input source, it is then forwarded to the text analysis tool, the Stanford CORENLP toolkit, for processing, as seen in Figure 5.1. The Stanford CORENLP is a software toolkit developed by Stanford University for natural language (plain text) processing (Manning *et al.,* 2015). According to The Stanford NLP Group (2020), a research group at the University of Stanford, the system has a number of capabilities, including part-of-speech (POS)

tagging, named entity recognition, parsing, core-referencing and sentiment analysis. The toolkit, a top natural language processing tool world-wide (Socher, Perelygin, Wu, Chuang, Manning, Ng & Potts, 2013), provides easy-to-use APIs (Application Programming Interface: a set of functions that enable third party applications to access an application); hence, it became the tool of choice in this study.

The sentiment analysis is the function of interest for this study, because any project manager would like to establish how PT members feel about project-related activities at any given time. The sentiments of happiness or unhappiness of a team member on a project may be found in various phrases and words expressed by the team member. There are other cases where the expressed sentiments might not be conclusive regarding whether the PT member is happy or not happy on the project, for example, one could have a phrase such as, “I am not sure whether I am excited or not about this project”. The tool should pick up, consider such cases, and inform the project manager accordingly. That is, the tool should report that the sentiments expressed are of happiness and unhappiness about the project and therefore this reflects the sentiments of someone who is not sure of personal sentiments about the project. To further clarify this issue of sentiments, let us consider the following examples:

(a) <u>Example 1 – Sentiments of a happy project team member</u>

Input: *I am very excited about the project.*

Expected output: *The project member in question is satisfied with the project.*

The output returned by the text analysis tool, the Stanford CORENLP sentiment analysis system, is in the JavaScript Object Notation (JSON) format, as indicated in Figure 5.6. The returned results contain, amongst other information, the sentiment expressed in the text submitted. The returned sentiment results consist of the following: Sentiment value(s) (0, 1, 2, 3 or 4 as values); sentiment(s) (ranging from very negative – with a sentiment value of 0 (zero) to very positive – with a sentiment value of 4). In natural language processing, every word in a natural language expresses some sentiment and therefore has a sentiment value associated with it (Socher *et al.,* 2013). However, the Stanford NLP Group seems to have replaced the output represented in

Figure 5.5 with one that provides less detailed output, hence we opted to show the one in the research work of Socher *et al.* (2013).

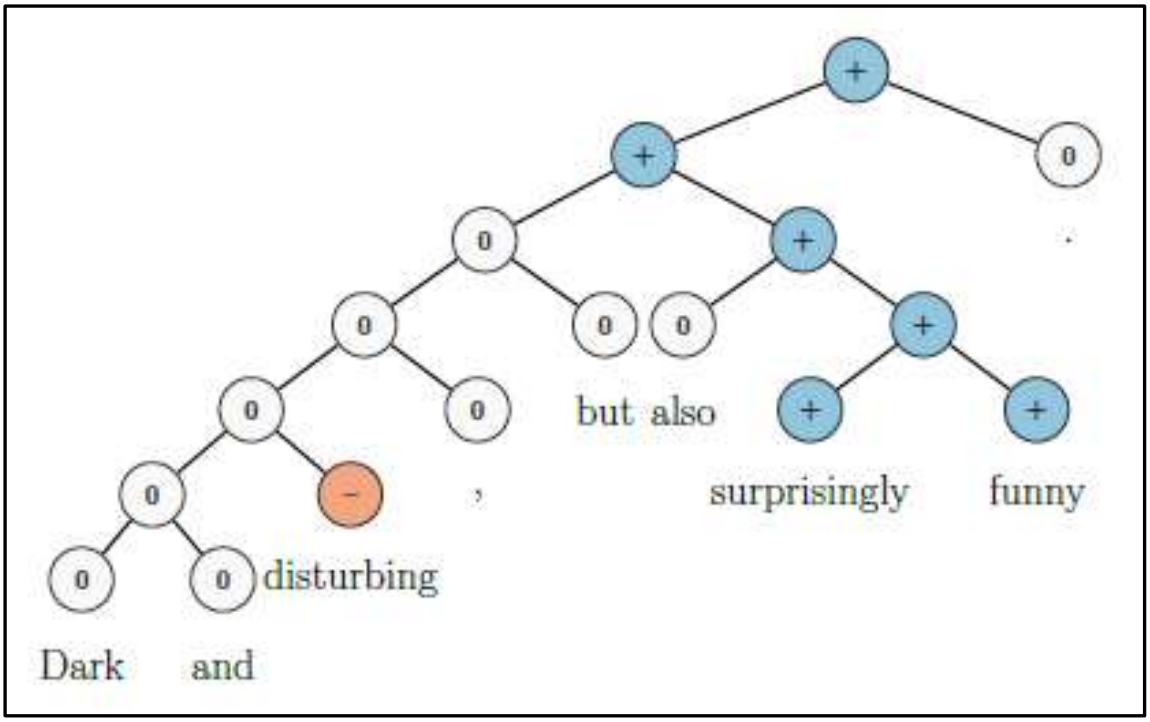


Figure 5.5 – Stanford NLP CORE associates every word with a sentiment value (Source: Socher *et al.*, 2013)

While there is other information returned by the Stanford CORENLP sentiment analysis tool, sentiment values and their corresponding sentiments are two pieces of information which are of interest in this research study. For the input sentence of the first example, the tool returned the JSON format output (only the sentiment related results have been extracted and shown here) shown in Figure 5.6. The results indicate the following information: the sentiment expressed by the sentence, which is that of positivity (positive – with a sentiment value of 3). The sentiment tree contains sentiment values (highlighted in blue in Figure 5.6) of each word or symbol. For example, in Figure 5.6, the word *very* has a sentiment value of 2, while the full stop (.) symbol has a 2 as a sentiment value associated with it.

'sentimentValue': '3', 'sentiment': 'Positive', 'sentimentDistribution': [0.0954875644219, 0.20146507363418, 0.11587471355654, 0.37829912969114, 0.20887351869623], 'sentimentTree': '(ROOT|sentiment=3|prob=0.378 (NP|sentiment=2|prob=0.996 I)\r\n (@S|sentiment=3|prob=0.402\r\n (VP|sentiment=3|prob=0.454 (VBP|sentiment=2|prob=0.957 am)\r\n (ADJP|sentiment=3|prob=0.528 (RB|sentiment=2|prob=0.995 very)\r\n (@ADJP|sentiment=3|prob=0.441 (VBN|sentiment=3|prob=0.556 excited)\r\n (PP|sentiment=2|prob=0.888 (IN|sentiment=2|prob=0.991 about)\r\n (NP|sentiment=2|prob=0.992 (DT|sentiment=2|prob=0.994 the) (NN|sentiment=2|prob=0.997 project))))))\r\n (.|sentiment=2|prob=0.997 .)))'

Figure 5.6 – Stanford NLP sentiment analysis results of the input text in example (a)

Table 5.1 shows each word or symbol from the sentence and its corresponding sentiment value, as given by the results in Figure 5.6. From the information provided in Table 5.1 it can be deduced that the only word that contributed to the classification of the sentence as being positive is the word excited, which has a positive sentiment value of 3 (highlighted in red in Table 5.1). All the other words in the sentence have a sentiment value of 2, meaning they "don't" express any sentiments (they are neutral).

Table 5.1 – Word or symbol and corresponding sentiment value of sentence (a)

Word or Symbol	Sentiment value and sentiment
I	Sentiment = 2 – Neutral
am	Sentiment = 2 – Neutral
very	Sentiment = 2 – Neutral
excited	Sentiment = 3 – Positive
about	Sentiment = 2 – Neutral
this	Sentiment = 2 – Neutral
project	Sentiment = 2 – Neutral
. (full-stop)	Sentiment = 2 – Neutral

The output shows that the classification of this sentence as expressing positive sentiments as determined by the Stanford CORENLP sentiment analysis tool is

correct. The next example pertains to a project team member who expressed unhappiness with what was happening on the project.

(b) Example 2 – Sentiments of an unhappy project team member

Input: ***I am annoyed and tired of what is happening here.***

Expected output: The project team member is not happy with the project.

Similarly, with the sentence given as an input to the Stanford CORENLP sentiment analysis tool, it returned a JSON format output shown in Figure 5.7 (again only sentiment-related results are shown here). As with the previous example, Table 5.2 presents each word and symbol from the sentence, together with their corresponding sentiment values and the associated sentiments.

'sentimentValue': '1', 'sentiment': 'Negative', 'sentimentDistribution': [0.20919706777644, 0.64367299096178, 0.12219523023894, 0.01700804223662, 0.00792666878622], 'sentimentTree': '(ROOT|sentiment=1|prob=0.644 (NP|*sentiment=2*|prob=0.996 *I*)\r\n (@S|sentiment=1|prob=0.607\r\n (VP|sentiment=1|prob=0.698 (VBP|*sentiment=2*|prob=0.957 *am*)\r\n (ADJP|sentiment=1|prob=0.738\r\n(@ADJP|sentiment=1|prob=0.643\r\n (@ADJP|sentiment=2|prob=0.570 (JJ|*sentiment=1*|prob=0.529 *annoyed*)\r\n (CC|sentiment=2|prob=0.996 *and*))\r\n (JJ|*sentiment=1*|prob=0.938 *tired*))\r\n (PP|sentiment=2|prob=0.884 (IN|*sentiment=2*|prob=0.993 *of*)\r\n (SBAR|sentiment=2|prob=0.831 (WHNP|*sentiment=2*|prob=0.994 *what*)\r\n (S|sentiment=2|prob=0.758 (VBZ|*sentiment=2*|prob=0.989 *is*)\r\n (VP|sentiment=2|prob=0.956 (VBG|*sentiment=2*|prob=0.974 *happening*) (ADVP|*sentiment=2*|prob=0.997 *here*)))))))\r\n (.|*sentiment=2*|prob=0.997 .)))',

Figure 5.7 – Stanford NLP sentiment analysis output for the input text of example (b)

Table 5.2 – Word or symbol and corresponding sentiment value of sentence (b)

Word or Symbol	Sentiment value and sentiment
I	Sentiment = 2 – Neutral
Am	Sentiment = 2 – Neutral
very	Sentiment = 2 – Neutral
annoyed	Sentiment = 1 – Negative
and	Sentiment = 2 – Neutral
tired	Sentiment = 1 – Negative
by	Sentiment = 2 – Neutral
what	Sentiment = 2 – Neutral
is	Sentiment = 2 – Neutral
happening	Sentiment = 2 – Neutral
Here	Sentiment = 2 – Neutral
. (full-stop)	Sentiment = 2 – Neutral

All the other words and the symbol in the sentence have a sentiment value of 2, except for the words “annoyed” and “tired”, which have 1 as a sentiment value, indicating negative sentiments. In this scenario, the words annoyed and tired are the only words that contributed to the sentence being classified as expressing negative sentiment, unlike in the previous example where only one word contributed to its sentimental classification. For both of the examples considered, the text analysis tool was able to correctly classify the sentiments expressed by the project team members.

The correct classification of a sentence’s sentiment is dependent on individual contributing words’ sentimental values. The preceding discussion on the two examples demonstrated this dependency. No words that have neutral (2) sentimental value have an influence on the sentence being classified as very positive, positive, negative or very negative. If a team member, for example, expresses two opposing feelings (sentiments) at the same time, one expects the two opposing sentiments to “cancel” each other out, meaning that the overall sentiment expressed should be a neutral one. As an example, we consider the following two contradicting sentiments expressed by the two sentences of this text:

I have worked well with so many people on the project and therefore I am happy. I want to quit, I am exhausted. *

The expected output from the Stanford CORENLP sentiment analysis tool should be a Positive (3) sentiment for the first sentence and a Negative (1) sentiment for the second one. Indeed, the output shown in Figure 5.8 (showing the results of the first sentence and the results of the second sentence) confirms the expected results. For easy reference and clarity, the sentiment results of the two sentences returned by the Stanford CORENLP sentiment analysis tool have been split into two and depicted in Figure 5.8.

Furthermore, the other parts of the sentiment results, such as the individual sentiment values of individual words from each sentence have been omitted, only the sentiment values and sentiments of the two sentences have been extracted and shown in Figure 5.8. It is worth noting that the results were returned as one output by the tool. Indeed, the contradictory sentiments expressed by the two sentences can also be identified in the output, with the output showing that the team member is expressing positive (3) and negative (1) sentiments at the same time. The Stanford CORENLP sentiment analysis tool returns sentiments of individual words for each sentence (a text is regarded to be a complete sentence if it has a full stop at the end) as well as the sentiment associated with the sentence based on the sentiments of the individual words making up the sentence.

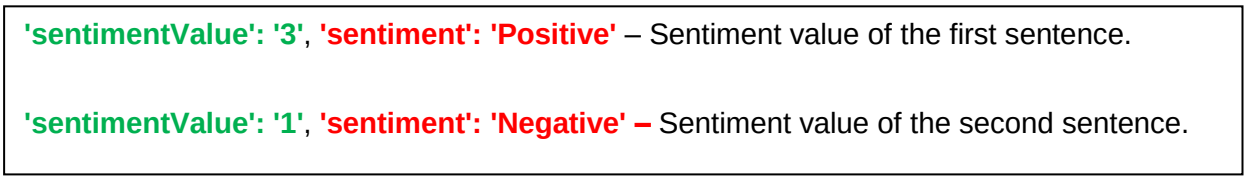


Figure 5.8 – Stanford NLP sentiment analysis output of the two sentences of the text marked by * in the preceding discussion

From this discussion, it is important then that an overall sentiment of a text, made up of sentences, be established to identify the overall feelings of a project team member. The next subsection discusses how the overall sentiments of a given text are established.

5.3.2.3 Sentiment analysis results processing and visualisation

The overall sentiment of a text may be determined from the sentiments of individual sentences that make up the text, by performing some calculations on the sentimental values of the sentences. For the ease of performing such calculations, we have

changed the values assigned to individual sentiments by the Stanford CORENLP sentiment analysis tool as follows: Very positive is given 2 as a value, positive has 1, neutral is 0, negative is given -1 and very negative has a value of -2. The reassignment process is part of the sentiment results processing by the PM*Int* tool, so that informative feedback can be given to project managers. Figure 5.9 depicts the reassignment of the sentiments to the new values.

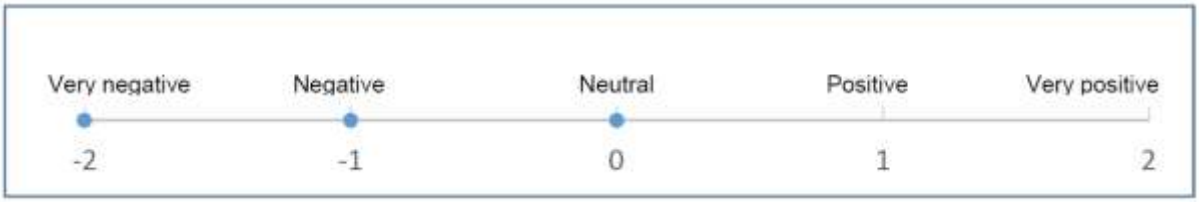


Figure 5.9 – Sentiments and the new reassigned sentiment values

Table 5.3 shows the values given to the sentiments by The Stanford CORENLP sentiment analysis tool and the new values assigned to the sentiments by this study. Again, the reassigning of different values to the sentiments is for easy determination of the overall sentiment of an input text.

Table 5.3 – Stanford CORENLP sentiment values vs sentiment values used by this study

Sentiment	Value assigned by Stanford CORENLP	Value assigned by this study
Very negative (V_Neg)	0	-2
Negative (Neg)	1	-1
Neutral (N)	2	0
Positive (Pos)	3	1
Very positive (V_Pos)	4	2

The determination of the overall sentimental value of a given sentence should be easier to determine using the new values of sentiments. Let us start with the determination of the overall sentiment of the last text, which was discussed in the previous subsection. The two sentences that make up the text have two opposing sentiments, as indicated by Figure 5.9, that is: positive = 1 and negative = -1. As indicated in the previous subsection, the two sentiments should “cancel” each other out and thus result in a neutral sentiment. That is, positive (1) sentiment plus negative (-1) sentiment should result in a neutral (0) sentiment. If we perform the calculations by adding the returned sentiment values of the text to establish the overall feeling (sentiments), then it works out as follows:

Overall sentiment (OS) value = Positive sentiment + Negative sentiment

= 1 + (-1)

= 0 = Neutral.

Based on the preceding discussion, it is evident that a formula to calculate the overall sentiment value is necessary. The formula will enable us to establish the overall sentiments of the given text. From the Stanford CORENLP sentiment analysis tool, one is able to establish the number of sentiments for each text, depending on the number of sentences that make up the text. For example, for any text there are X number of very positive sentiments in the text, where X >= 0. This is true for all the other sentiments. From this discussion, a very positive sentiment has a sentiment value of 2, as indicated in Table 5.3. Therefore, to get the total sum of the sentiment values of X number of *very positive sentiments* we can just multiply X by 2. That is, the sum of the sentiment values of the X number for very positive sentiments is: $\mathbf{S_{V\_Pos} = 2 * X.}$

Using a similar analogy, for any text there are Y number of *positive sentiments* in the text, where Y >= 0. Therefore, the total sum of the sentiment values for the positive sentiments is: $\mathbf{S_{Pos} = 1 * Y = Y}$. Similarly, the total sum of the sentiment values for *negative sentiments* is: $\mathbf{S_{Neg} = -1 * N = -N}$, where N is the number of negative sentiments in the text, and N >= 0. Now the total sum of *very negative sentiments* may be established by the following calculation: $\mathbf{S_{V\_Neg} = -2 * Z}$, where Z is the number of very negative sentiments in the text, and Z >= 0. Lastly, the total sum of the sentiment values for *neutral sentiments* is always 0, according to the information provided in Table 5.3.

Having established the formulae for calculating the sums of the sentiment values, we can now calculate the sum of all the sentiment values with the aim of determining the overall sentiment of the text. The sum of all the sentiment values of all the sentences in a text may be determined as follows:

$$\mathbf{S_{all\_sent} = S_{V\_Pos} + S_{Pos} + S_{Neg} + S_{V\_Neg}.}$$

The values of $\mathbf{S_{all\_sent}}$ may be:

(i) 0; this will be true when $\mathbf{S_{V\_Pos} + S_{Pos} + S_{Neg} + S_{V\_Neg} = 0}$ and this is possible when $\mathbf{S_{V\_Pos} + S_{Pos}}$ which is >= 0 value is equal to $\mathbf{|S_{Neg} + S_{V\_Neg}|}$, which is a

value >= 0. Adding (note: $\mathbf{S_{Neg} + S_{V\_Neg}} <= 0$) the two equal values will produce 0.

(ii) x, such that x > 0. This can only happen when $(\mathbf{S_{V\_Pos} + S_{Pos}}) > (\mathbf{S_{Neg} + S_{V\_Neg}})$.

(iii) y, such that y < 0. This can only hold when $|(\mathbf{S_{Neg} + S_{V\_Neg}})| > (\mathbf{S_{V\_Pos} + S_{Pos}})$.

Where $\mathbf{S_{all\_sent} = S_{V\_Pos} + S_{Pos} + S_{Neg} + S_{V\_Neg}} > 0$, this implies that the text has more sentences with positive (*very positive and positive*) sentiments than negative (*very negative and negative*) sentiments. Therefore, this means that the overall sentiment of the text is a positive one (that is, positive or very positive). Now, to establish whether the overall sentiment is positive or very positive, we simply perform the following test: ***If S_{all_sent} > Pos (1), then the overall sentiment expressed by the text is very positive, else the overall sentiment expressed is positive.***

A similar argument may be made for a case where $\mathbf{S_{all\_sent} = S_{V\_Pos} + S_{Pos} + S_{Neg} + S_{V\_Neg}} < 0$. This would occur in a situation where the text has more sentences with negative (*very negative and negative*) sentiments than those with positive (*very positive and positive*) sentiments, and this would imply that the overall text sentiment is a negative one (that is, negative or very negative). Again, to determine whether the negative sentiment expressed by the text falls under the very negative or negative category, the following conditional statement could be used. ***If S_{all_sent} < Neg (-1), then the overall sentiment expressed by the text is very negative, else the overall sentiment expressed is negative.***

It is important that we validate the correctness of our formula for calculating the overall sentiment value with the aim of determining the overall sentiment of a given text. Let us start with the results of the three texts, which were used as examples in this subsection. Example (a), the sentiment value returned by the Stanford CORENLP sentiment analysis tool for the text was positive (3), which would be given a value of 1 (positive) by our conversion, as indicated in Table 5.3. Therefore, this means that the other sentiment variables, namely, $\mathbf{S_{V\_Pos}}$, $\mathbf{S_{Neg}}$, and $\mathbf{S_{V\_Neg}}$ all had zeros. Now the value for the overall sentiment value of the text is: $\mathbf{S_{all\_sent} = S_{V\_Pos} + S_{Pos} + S_{Neg} + S_{V\_Neg}} = 0 + 1 + 0 + 0 = 1$, meaning that the overall sentiment of the text is positive, and this is in accordance with what was established previously. A similar determination can be made for the text used in Example (b), where a negative sentimental value was

returned, that is, -1. The value of S_{all_sent} = -1, implying that the sentiment expressed is a negative one, and again this is in line with our previous findings. The other text that we considered was the one that had contradicting sentiments, as shown by Figure 5.8. The sentiment values returned for the two sentences were a positive sentiment = 1 and a negative sentiment = -1, respectively. The other sentiment values of S_{V_Pos} and S_{V_Neg} were both 0. Given these values, then the value of S_{all_sent} = -1 + 1 = 0 = Neutral, indicating that the overall sentiment expressed in the text is that of neutrality. Once more, the results confirm what was established earlier.

Based on the preceding discussion in this subsection, the PM*Int* tool will use the following function algorithm in the process of determining the project team member's overall sentiment based on the Stanford CORENLP sentiment analysis tool returned results:

```
#This algorithm is for determining overall sentiment of a given text that has been analysed by
#the Stanford NLP sentiment analysis tool.
#The function defined by this algorithm accepts a list of sentiments

define function getOverallSentimentValue (sentiment_list)
   list_len = len (sentiment_list)
   index = 0
   sum_Vpositive = 0
   sum_positive = 0
   sum_Vnegative = 0
   sum_negative = 0
   sum_neutral = 0

   while (index < list_len)
      if (my_sent_list[index] == 'Very positive')
        sum_Vpositive = sum_Vpositive + 2
      else if (my_sent_list[index] == 'Positive')
        sum_positive = sum_positive + 1
      else if (my_sent_list[index] == 'Very negative')
        sum_Vnegative = -2 + sum_Vnegative
      else if (my_sent_list[index] == 'Negative')
        sum_negative = -1 + sum_negative
      else if (my_sent_list[index] == 'Neutral')
        sum_neutral = 0
      index = index + 1
   end loop
 results = sum_Vpositive + sum_positive + sum_Vnegative + sum_negative
 if (results >= 2)  #If the results >= 2  = Sentiment is Very positive
    overall_sentiment = 'Overall sentiment is: Very positive = ' + string(results)
 else if (results == 1 ) #If the results == 1  = Sentiment is Positive
    overall_sentiment = 'Overall sentiment is: Positive = ' + string(results)
 else if (results <= -2)   #If the results <= -2  = Sentiment is Very negative
    overall_sentiment = 'Overall sentiment is: Very Negative = ' + string(results)
 else if (results == -1) #If the results == -1  = Sentiment is Negative
    overall_sentiment = 'Overall sentiment is: Negative = ' + str(results)
 else if (results == 0) #If the results == 0  = Sentiment is Negative
    overall_sentiment = 'Overall sentiment is: Neutral = ' + str(results)

 return overall_sentiment
```

Following the preceding discussion, it is imperative that the PM*Int* tool communicates the sentiment analysis results in an informative way. For example, a project manager may want to establish a project team member's sentiment based on the number of emails that the team member has sent to the project manager.

Over and above simply informing the project manager of the overall sentiment of the team member, it would also be useful for the project manager to know the sentiments expressed by each email sent by the team member. From such results, a project manager would be able to see if the sentiments are improving (becoming more positive over time), getting worse (negative), or are constant. When displaying such results, a visual format is one in which it would be easy to identify patterns. Figure 5.9 is a typical graphical presentation of sentiments expressed by five emails sent to a project manager by her team member. The emails were sent on different dates, and the fifth one was the last email. The results in Figure 5.9 of the sentiment analysis of the team member in question do not suggest that the team member's sentiments are improving, even though the last email shows very positive feelings. The overall sentiment, indicating very negative feelings, as depicted in Figure 5.9, also confirms our observation.

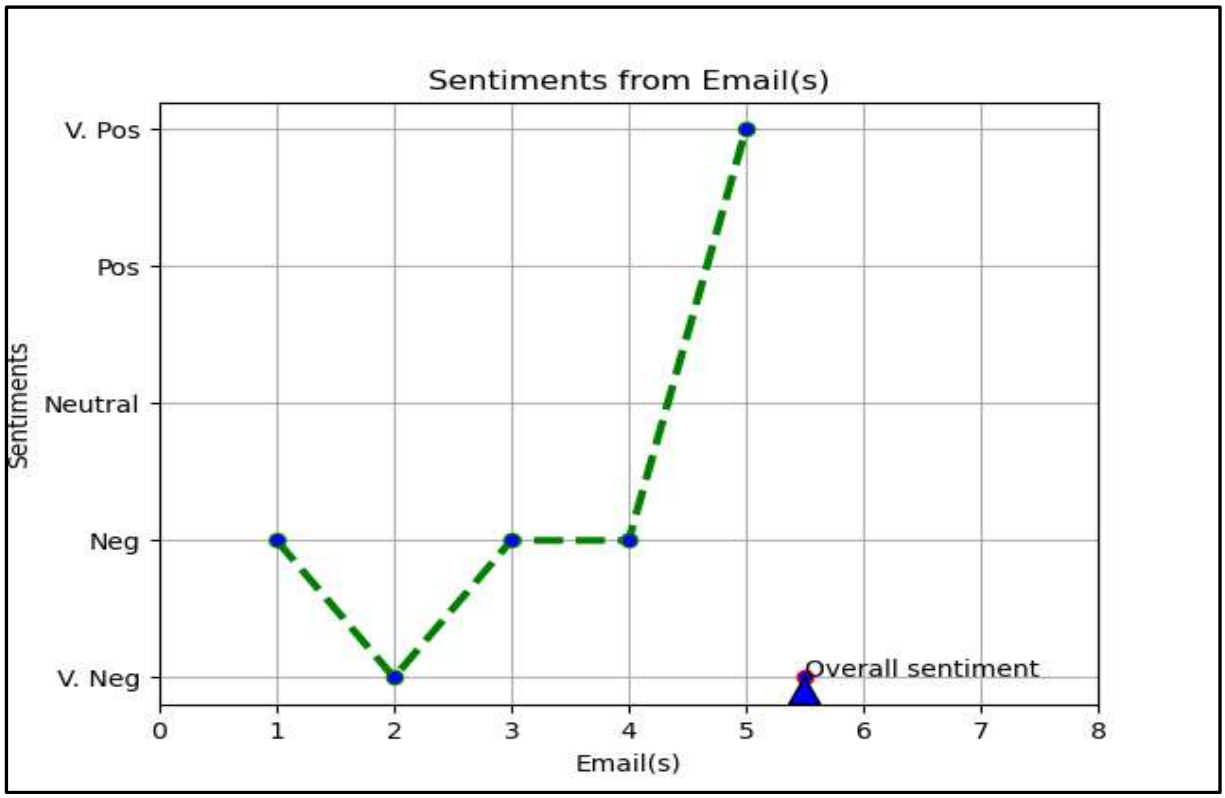


Figure 5.7 – Sentiments expressed by a PT member in five emails

For readability purposes, the visualisation of the sentiment results of emails is limited to 20 emails, even though practically speaking the PM*Int* tool may provide the output for any number of emails. The PM*Int* tool will only show the overall sentiment for the sentiment results of the text received from a keyboard or a text file. For example, Figure 5.10 depicts the sentiment analysis results of the following text that was supplied to the tool via a keyboard:

> ***Every team member on this project matters and this to me is important. But working overtime is killing me.***

The results in Figure 5.10 show that the sentiments relate to the two sentences, as the title of the graph indicates. Furthermore, the figure shows that the overall sentiment of the two sentences is that of neutrality.

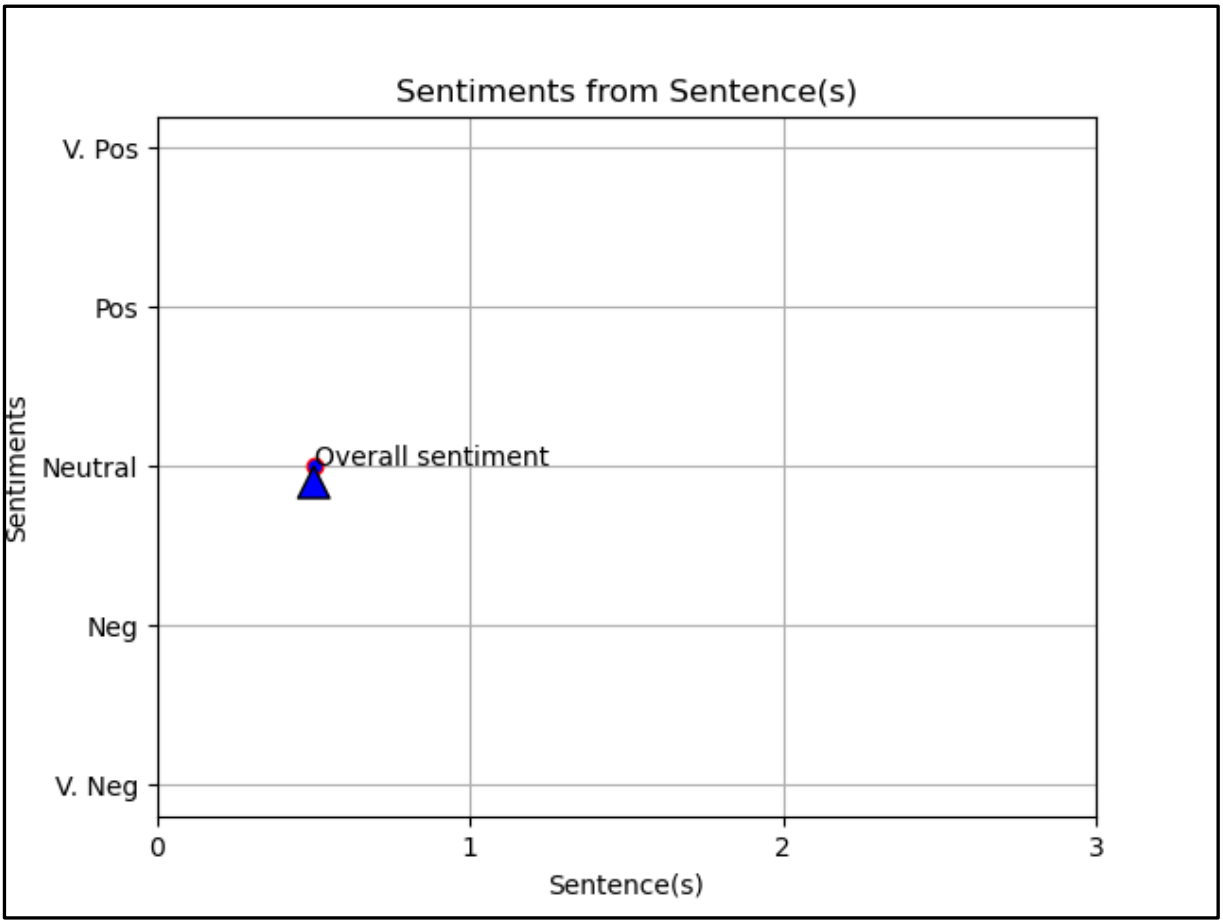


Figure 5.8 – Overall sentiments expressed in the two sentences

5.3.2.4 Design class diagrams for the system's application layer

In object-oriented programming design, class diagrams are used for depicting a system's structure using classes, their attributes and methods. Since the Stanford CORENLP system provides APIs, which have been developed in objected-oriented languages such as Java and Python, then the PM*Int* tool had to be developed in a programming language that would connect seamlessly with the Stanford CORENLP toolkit. For this reason, and other reasons given in Section 5.4 of the chapter, the programming language of choice for the PM*Int* is Python. The main classes identified are tkinter (which is the predefined class in Python), Sentiment and emailClass, which have attributes and methods assigned to carry out the necessary tasks. The Sentiment class contains attributes and methods, which pertain to a project team member's project sentiment. After the presentation of the class diagrams in Figures 5.11 to 5.13, each method is presented with a short description on its responsibility.

tkinter #A class in Python to draw the main window
#Methods + Tk () #And other methods

Figure 5.9 – Class diagram of the predefined tkinter class

Sentiment
#Attributes strText : String strTextSentiment : String lstSentimentList : List clEmail : emailClass
#Methods + chooseInputType () : String + readTextFromInputSource (strInputSource : String) readKeyboardText() : String readTextFile(filePath) : String + getSentiment_StanfordNLP (strInputText : String) : List getOverallSentiment (lstSentList : List) : String + plotSentenceSentiments(strOverallSent : String) : graph

Figure 5.10 – Class diagram of the Sentiment class

emailClass
#Attributes strEmailAddress : String strPassword : String strServer : String strServerProtocol : String strFromDate : String strToDate : String strSender : String strRecipient : String strSubject : String intTotalEmails : Integer tplSentiments : Tuple #eg {(E1, sentiment), (E2, sentiment), (E3, sentiment), …} strOverallSentiment : String
#Methods + setEmailAddr (strEmailAddr : String) + setPassword (strPW : String) + setServer (_strServer : String) + setServerProtocol (_strServer : String) + getEmailAddr () : String + getPassword () : String + getServer () : String + getServerProtocol () : String + readEmails() : String + getSentiment_StanfordNLP (strInputText : String) determineEmailSentiment(lstSentList : List) : Tuple + plotEmailSentiments() : graph getOverallSentiment () : String

Figure 5.11 – Class diagram of the emailClass

Figures 5.14 to 5.21 present the specifications for the methods identified in the Sentiment class (see Figure 5.12).

Contract Name:	chooseInputType () : String
Class:	Sentiment
Use case:	Choose text input source type.
Responsibilities:	Choose input source type so as to establish where the text is to be read from.
Exceptions:	None.
Pre-conditions:	Input source types are known to the system.
Post-conditions:	The user has selected an input type and returned.

Figure 5.12 – Specification for the chooseInputType () method

Contract Name:	readTextFromInputSource (strInputSource : String)
Class:	Sentiment
Use case:	Read text from the selected input source.
Responsibilities:	Reads text to be used later to establish project member's sentiments. This method makes use of the following methods to read text from a specified source: readKeyboardText(), readTextFile() and readEmails() in the emailClass.
Exceptions:	None.
Pre-conditions:	Input source type has been chosen.

Figure 5.13 – Specification for the readTextFromInputSource () method

Contract Name:	readKeyboardText () : String
Class:	Sentiment
Use case:	Read text from the keyboard.
Responsibilities:	The method reads text from a keyboard.
Exceptions:	None.
Pre-conditions:	Keyboard as an input source type has been chosen.
Post-conditions:	The text has been read and a string returned to the calling method.

Figure 5.14 – Specification for the readKeyboardText () method

Contract Name:	readTextFile(filePath) : String
Class:	Sentiment
Use case:	Read text from the a text file.
Responsibilities:	The method reads text from a text file.
Exceptions:	None.
Pre-conditions:	Text file as an input source type has been chosen.
Post-conditions:	The text file has been read and a string returned to the calling method.

Figure 5.15 – Specification for the readTextFile () method

Contract Name:	getSentiment_StanfordNLP ()
Class:	Sentiment
Use cases:	Perform text analysis.
Responsibilities:	Opens a connection between PM*Int* tool and Stanford NLP system and send a text to the Stanford NLP system for sentiment analysis.
Exceptions:	None.
Pre-conditions:	The Stanford NLP system is up and running (the system is not down).
Post-conditions:	The connection has been established and sentiments of the text have been returned.

Figure 5.16 – Specification for the getSentiment_StanfordNLP () method

Contract Name:	getOverallSentiment (lstSentList : List) : String
Class:	Sentiment
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Establishes project team member's sentiments based on the results of the text analysis tool (Stanford NLP system).
Exceptions:	None.
Pre-conditions:	Stanford NLP system has performed text analysis on the input text sent to it and has returned the text analysis results.
Post-conditions:	Overall sentiments of a team member have been determined.

Figure 5.17 – Specification for the getOverallSentiment () method

Contract Name:	plotSentenceSentiments(strOverallSent : String) : graph
Class:	Sentiment
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Creates a graph of the overall sentiment of the text as was established by the text analysis tool (Stanford NLP system).
Exceptions:	None.
Pre-conditions:	The getOverallSentiment () has determined the overall sentiment.
Post-conditions:	A graph showing overall sentiments of a team member has been produced.

Figure 5.18 – Specification for the plotSentenceSentiments () method

Contract Name:	setEmailAddress (strEmailAddr : String)
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Sets the value of the strEmailAddress member variable to value strEmailAddr.
Exceptions:	None.
Pre-conditions:	Email as an input source should have been selected.

Figure 5.19 – Specification for the setEmailAddress () method

Figures 5.22 to 5.32 present the specifications for the methods identified in the emailClass class as indicated in Figure 5.13. The emailClass class is responsible for the input related to email.

Contract Name:	setPassword (strPW : String)
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Sets the value of the strPassword member variable to value strPW.
Exceptions:	None.
Pre-conditions:	Email as the source of text input should have been selected.
Post-conditions:	The value of strPassword should be set accordingly.

Figure 5.20 – Specification for the setPassword () method

Contract Name:	setServer (_strServer : String)
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Sets the value of the strServer member variable to value strServer.
Exceptions:	None.
Pre-conditions:	Email as the source of text input should have been selected.
Post-conditions:	The value of strServer should be set accordingly.

Figure 5.21 – Specification for the setServer () method

Contract Name:	setServerProtocol (_strServerP : String)
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Sets the value of the strServerProtocol member variable to value _strServerP.
Exceptions:	None.
Pre-conditions:	Email as the source of text input should have been selected.
Post-conditions:	The value of strServerProtocol should be set accordingly.

Figure 5.22 – Specification for the setServerProtocol () method

Contract Name:	getEmailAddr ( ) : String
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Returns the value of the strEmailAddress member variable.
Exceptions:	None.
Pre-conditions:	Email as the source of text input should have been selected.
Post-conditions:	The value of strEmailAddress is returned.

Figure 5.23 – Specification for the getEmailAddr () method

Contract Name:	getPassword ( ) : String
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Returns the value of the strPassword member variable.
Exceptions:	None.
Pre-conditions:	Email as the source of text input should have been selected.
Post-conditions:	The value of strPassword is returned.

Figure 5.24 – Specification for the getPassword () method

Contract Name:	getServer ( ) : String
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Returns the value of the strServer member variable.
Exceptions:	None.
Pre-conditions:	Email as the source of text input should have been selected.
Post-conditions:	The value of strServer is returned.

Figure 5.25 – Specification for the getServer () method

Contract Name:	getServerProtocol ( ) : String
Class:	emailClass
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Returns the value of the strServerProtocol member variable.
Exceptions:	None.
Pre-conditions:	Email as the source of text input should have been selected.
Post-conditions:	The value of strServerProtocol is returned.

Figure 5.26 – Specification for the getServerProtocol () method

Contract Name:	getSentiment_StanfordNLP ()
Class:	emailClass
Use cases:	Perform text analysis.
Responsibilities:	Opens a connection between PM*Int* tool and Stanford NLP system and send a text to the Stanford NLP system for sentiment analysis.
Exceptions:	None.
Pre-conditions:	The Stanford NLP system is up and running (the system is not down).
Post-conditions:	The sentiments of the text have been determined and returned.

Figure 5.27 – Specification for the getSentiment_StanfordNLP() method

Contract Name:	plotEmailSentiments() : graph
Class:	Sentiment
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Creates a graph of the sentiments of the emails as stored in tplSentiments. On the same graph an overall sentiment value of the emails stored in strOverallSentiment will be plotted.
Exceptions:	None.
Pre-conditions:	Both tplSentiments and strOverallSentiment have been assigned values.
Post-conditions:	A graph has been produced.

Figure 5.28 – Specification for the plotEmailSentiments () method

Contract Name:	determineEmailSentiment(lstSentList : List) : Tuple
Class:	clEmail
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Establishes project team member's sentiments based on the results of the email text analysis tool (Stanford NLP system).
Exceptions:	None.
Pre-conditions:	Stanford NLP system has performed text analysis on the email text sent to it and has returned the analysis results.
Post-conditions:	The sentiments of a team member in an email have been determined.

Figure 5.29 – Specification for the determineEmailSentiment () method

Contract Name:	getOverallSentiment () : String
Class:	clEmail
Use cases:	Establish project team member's project sentiments.
Responsibilities:	Establishes project team member's sentiments based on the results of the text analysis tool (Stanford NLP system).
Exceptions:	None.
Pre-conditions:	Stanford NLP system has performed text analysis on the input text sent to it and has returned the text analysis results.
Post-conditions:	Overall sentiments of a team member have been determined.

Figure 5.30 – Specification for the getOverallSentiment () method

The specifications for the tkinter class's methods are not included here, since it is a predefined class in Python.

5.3.2.5 The system's application layer database structure

The PM*Int* tool uses MySQL database to retrieve project related information. There are five main entities of interest for the tool, and these are: a project manager, a project team member, a project team, a project and a project task. In a real-life project environment, a project manager may be responsible for one or many projects, while a project may be managed by one project manager only. On the other hand, a project may have one or many project teams, whereas a team may be associated with one project. A team member may belong to one or two teams (these are the business rules that the tool has adopted), while a team may have one or more team members. Lastly, a team member may be assigned to no task or to many project tasks, whereas a project task may be assigned to one team member. The aforementioned relationships amongst the entities are shown in Figure 5.33.

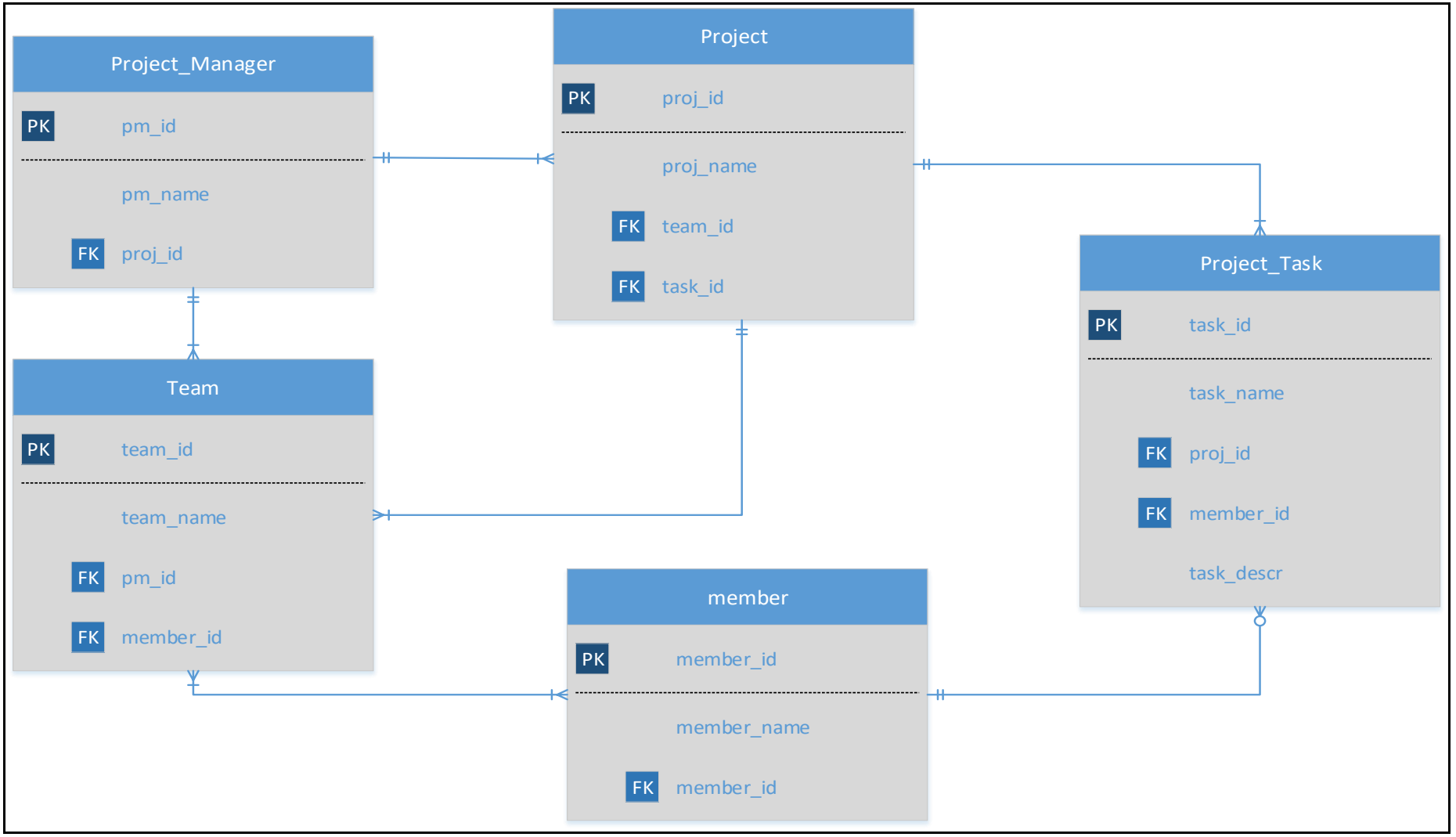


Figure 5.31 – Relationship between the database tables used by the PM*Int* tool

When the PM*Int* system starts, the user (project manager) is presented with a screen to select a project of interest from a list of projects. After the project has been selected, the project manager is required to choose the project team for which the needed team member is a member of. Once the team is selected, the system then prompts the PM to select a project team member from a list of team members. After the selection of a project team member, the project manager would then be expected to specify the source of text to be analysed by the system to determine the sentiments of the chosen PT member.

In order for a project manager to be able to select the required information as prompted by the system, the tool should retrieve the data (a list of project, teams and team members) from the database. Firstly, the tool connects to MySQL database server. If the connection is successful, then the tool retrieves all the projects, which are managed by the project manager, from the database (the Project table). As explained in the previous paragraph, the project manager would then have to select a project. Using this information (the selected project), the tool then retrieves the teams assigned to the selected project and presents them to the PM to select the appropriate team. After the team has been selected, the tool sends a request to the database for the list of team members who belong to the selected team. The following code is the sample code used by the tool to retrieve the project team members for a chosen project team:

```
#The code before this one would have established a connection to MySQL
sql_select_query = " SELECT member.name, member.member_id FROM member
                     INNER JOIN team ON (team.team_id = $sel_team_id) AND
                     (member.member_id = team.id)"

# Create a cursor which returns rows as Python dictionary

team_cursor = connection.cursor(dictionary=True)

team_cursor.execute(sql_select_query)

all_records = team_cursor.fetchall()

#Insert each team member's name in the dropbox using a for-loop.

for tm in records:

   member = tm['member_name'] + ' ' + tm['member_id']

   self.cboxTeams['values'] = (*self.cboxTeams['values'], member)
```

5.3.3 User interface design

The following discussion and diagrams are related to the user interface design for the PM*Int* tool. The tool is designed to assist a project manager to assess the sentiments of project team members with the aim of addressing their needs. A PM may manage several projects, and a project may have a number of teams assigned to it, while a team may have several team members. For a project manager to establish the sentiments of a team member using the PM*Int* system, he/she needs to select a project, and then from it choose the team that the team is assigned to, and from the team select the required team member. Figure 5.34 shows the first screen that a project manager encounters when running the tool.

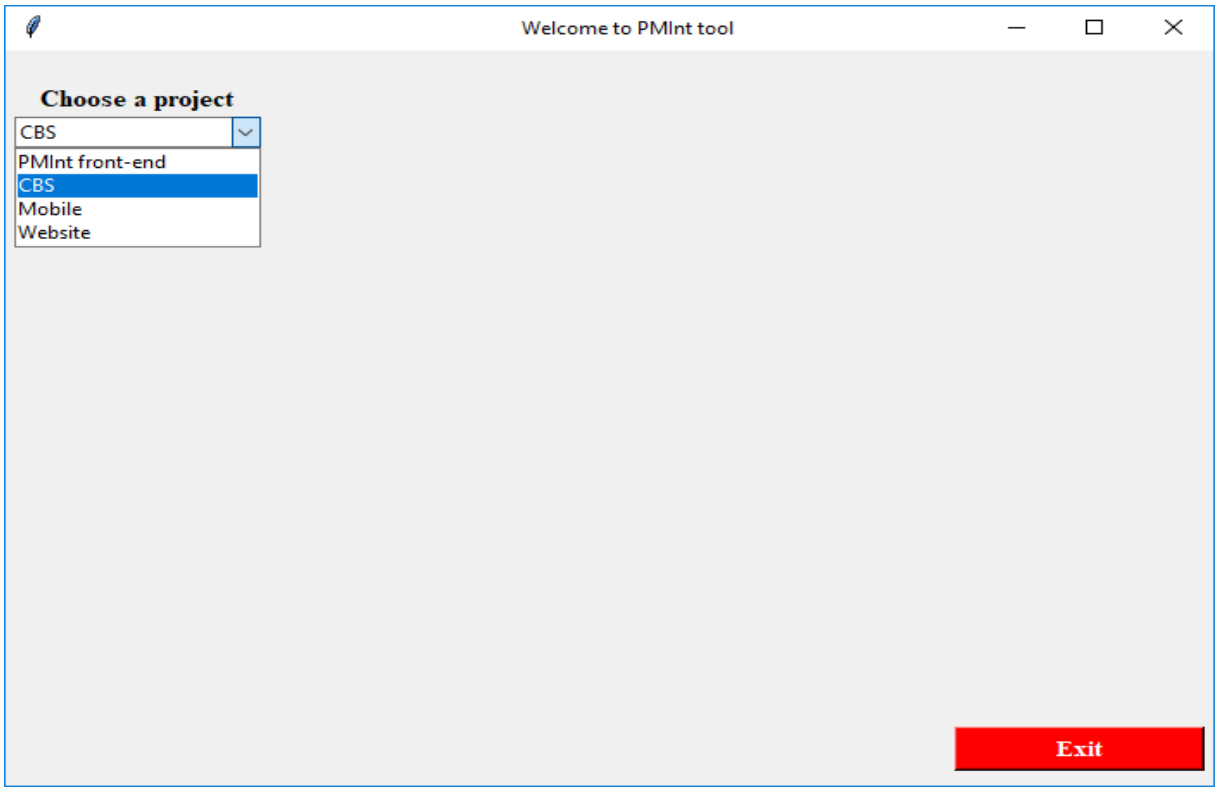


Figure 5.32 – The first screen that appears when the PM*Int* tool is started

Once the relevant project has been selected, the Dropbox with a list of teams, which have been assigned to the project will be displayed, as shown in Figure 5.35.

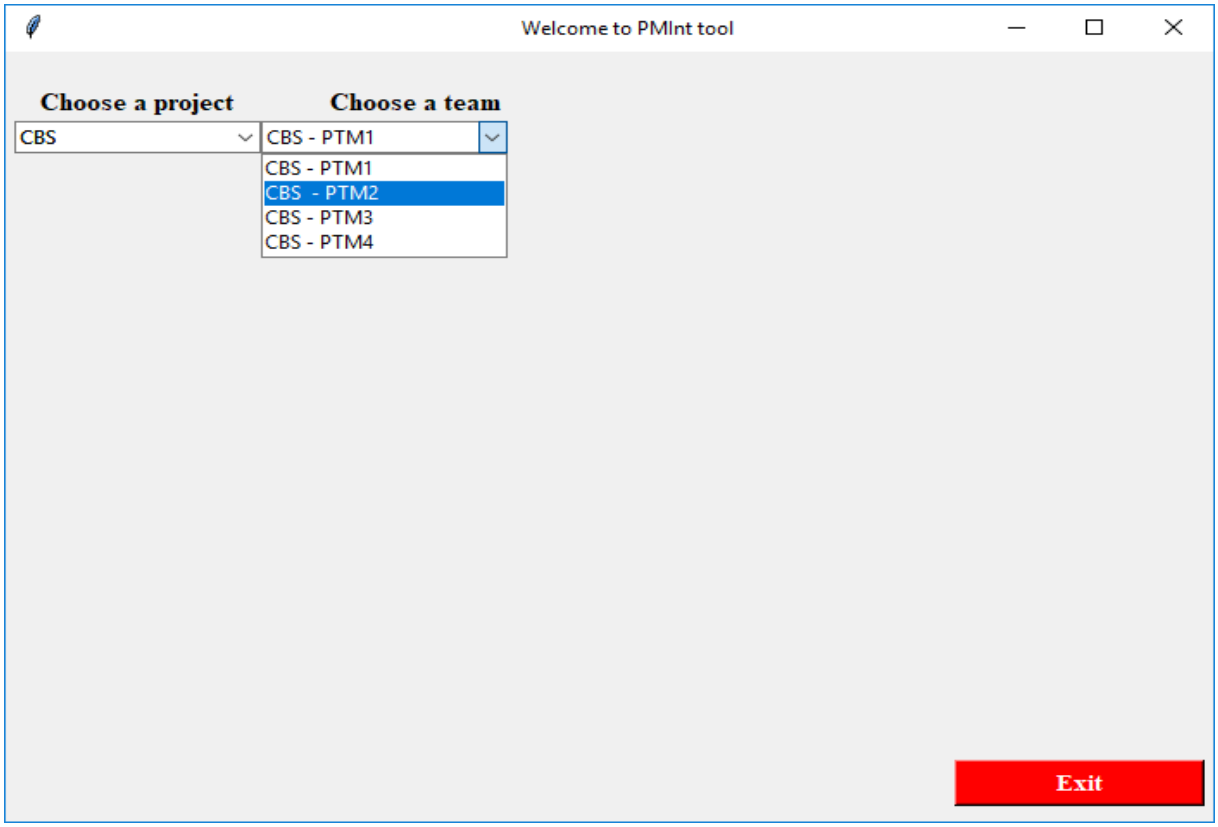


Figure 5.33 – A screen to select a project team

After the PM has chosen the project team to which the required team member belongs, then the system will display a list of project team members that are assigned to the team. Figure 5.36 shows a screenshot with the list of team members of the selected project team.

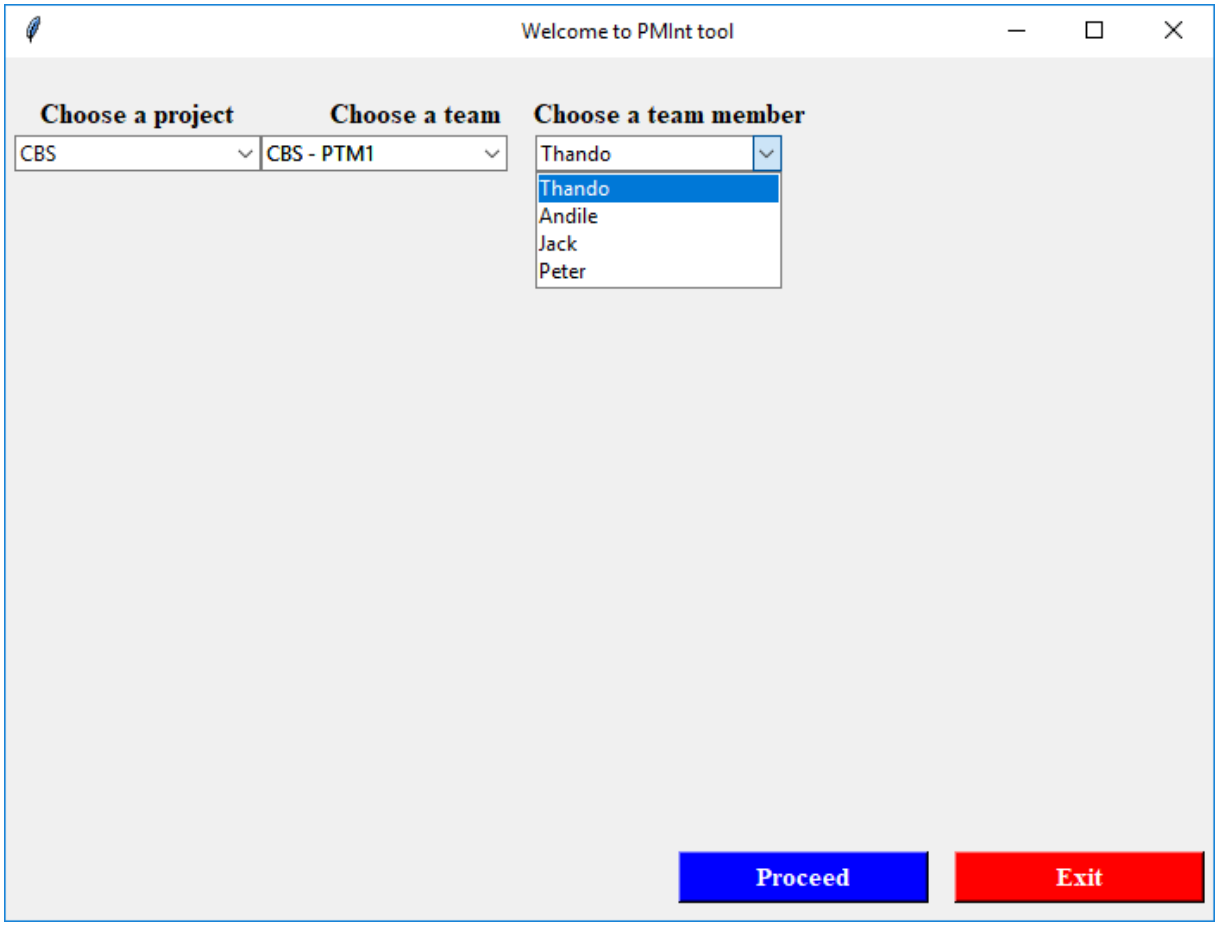


Figure 5.34 – A screen to choose a project team member

After the project manager has selected the project team member and has pressed the 'Proceed' button, the system displays the screen where the PM needs to choose the source of the input text. The screenshot in Figure 5.37 shows the input screen. As mentioned in Subsection 5.3.1, the system may get input from three types of sources, namely, input from a keyboard, text file and emails. If the input to the system is from emails, the PM may select the radio button that enables this, and when it is selected, the system will display the screen depicted by Figure 5.27. All the input fields on the on the left-hand side of the screen are compulsory, and this is indicated by an asterisk (*) at the end of the description of each field. On the other hand, all the input fields on the right-hand side of the screen are optional, except that at least one input field must be completed. In case where the 'from' date is provided and the 'to' date not provided, then the system date (current date) is used for the 'to' date. If the 'from' date is not provided but the 'to' date is furnished, then the 'from' date will be the same as the 'to'

date. When both dates are not provided, then the system date (current date) is used as a default date for both dates.

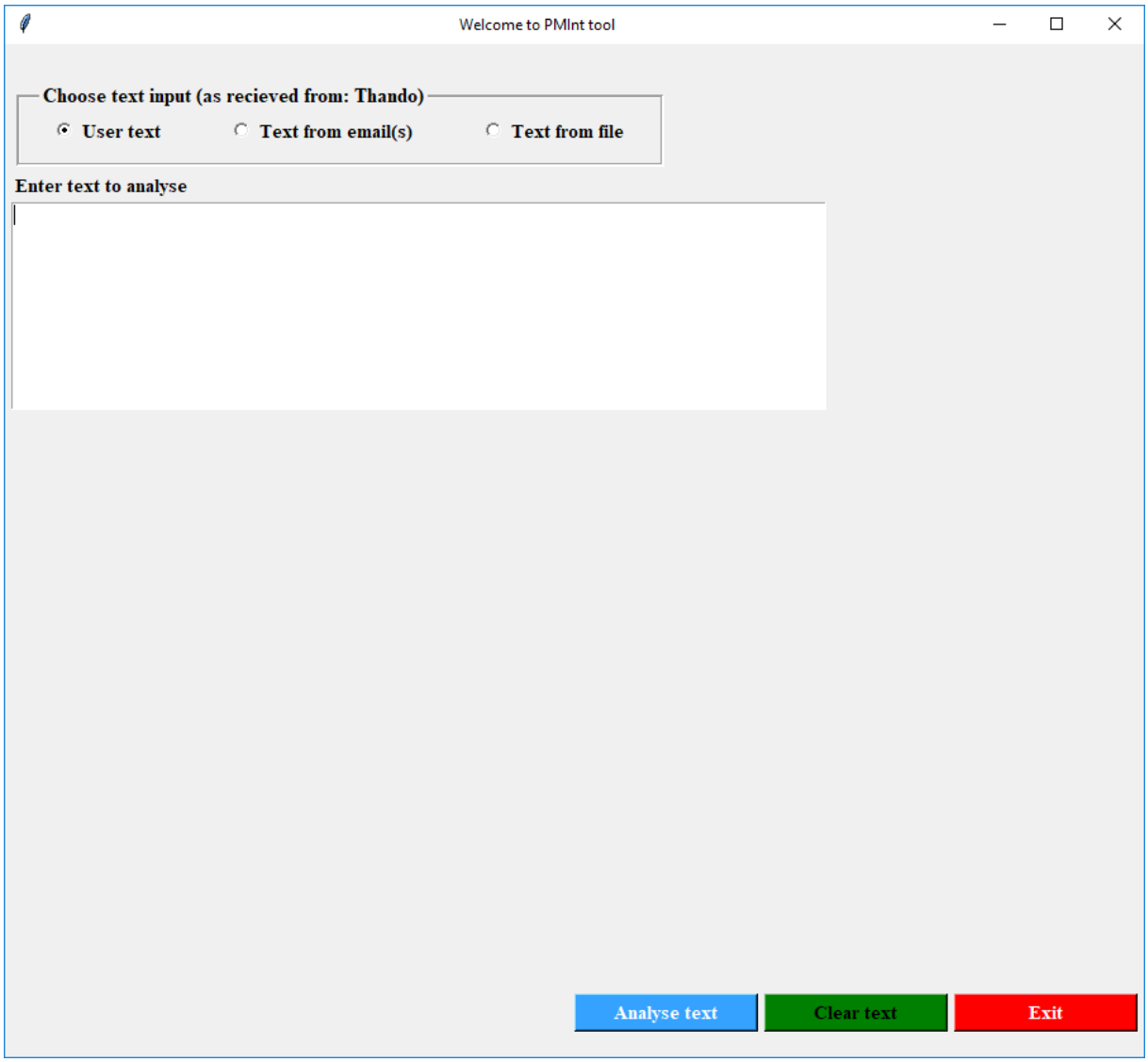


Figure 5.35 – A screen to choose a text input source

The email-related information provided on the input screen will be stored in the emailClass, as demonstrated by the following sample code:

```
……
clEmail = emailClass (window)      #Creating email class object

clEmail.strEmailAddress = eAddress_txt.txtEmailAdd
clEmail. strPassword = ePass_txt.txtPassword
clEmail. strServer = eServer_txt.txtServer
clEmail. strServerProtocol  = eServerProt_txt.txtServProcol
…..
```

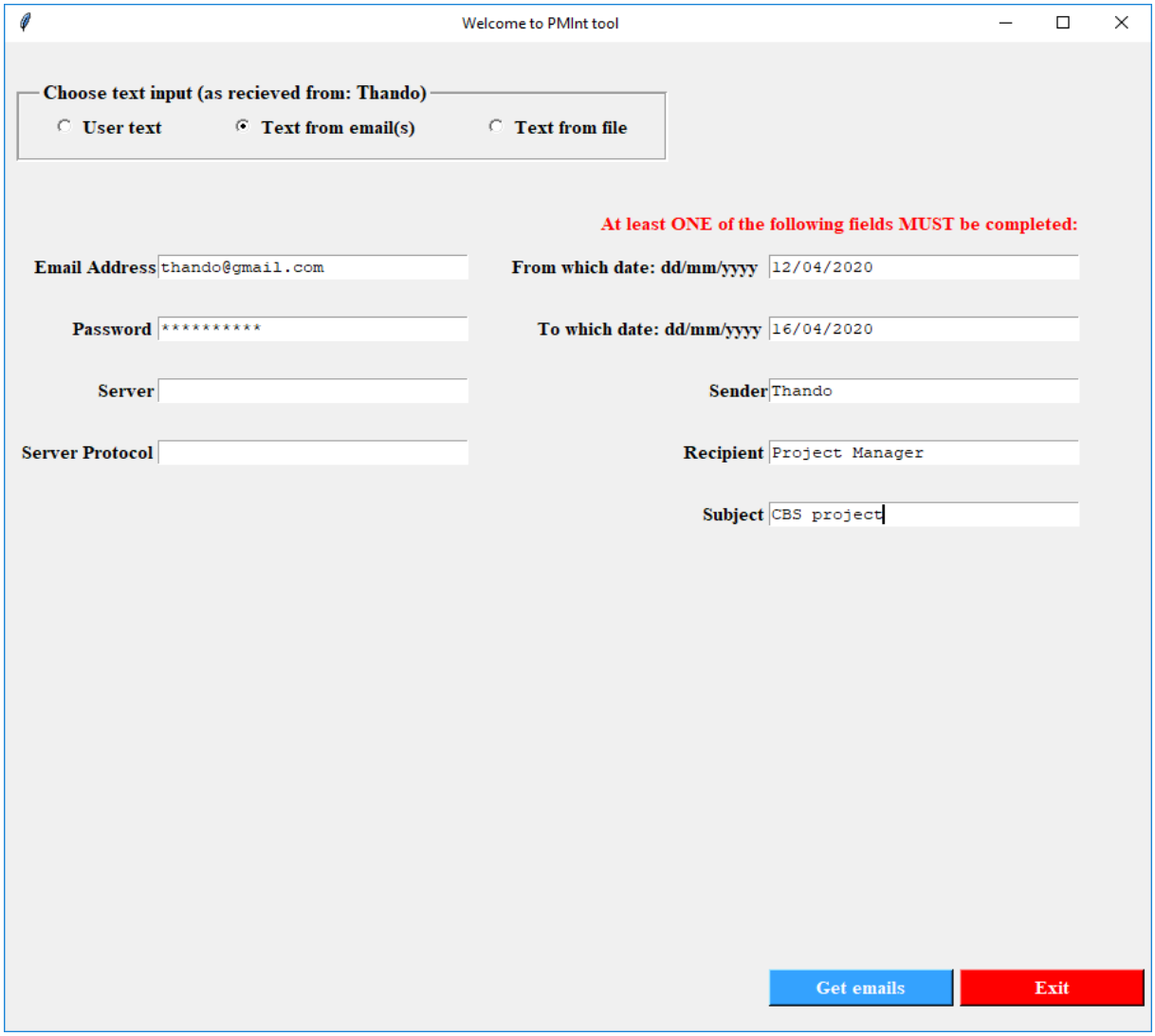


Figure 5.36 – A screen that shows when 'Text from email' radio button is selected

Figure 5.9 in Subsection 5.3.2.3 shows a sample output of emails that were processed to determine the sender's sentiments. If a file is chosen as the input source for the text to be analysed, then upon pressing 'Get file' button (see Figure 5.39) the system will respond by displaying a file dialog menu, as shown by Figure 5.40, where the PM may select a file to be used as an input. Once a file has been selected and the user presses the "Open" button on the screen, as shown in Figure 5.40, the file will be processed by the PM*Int* tool by extracting text line by line, combining the lines of text into a text string, which will then be sent to Stanford CORENLP system for processing. However, if the use decides not to select any file by pressing the "cancel" button, then the system will return to the screen shown in Figure 5.37.

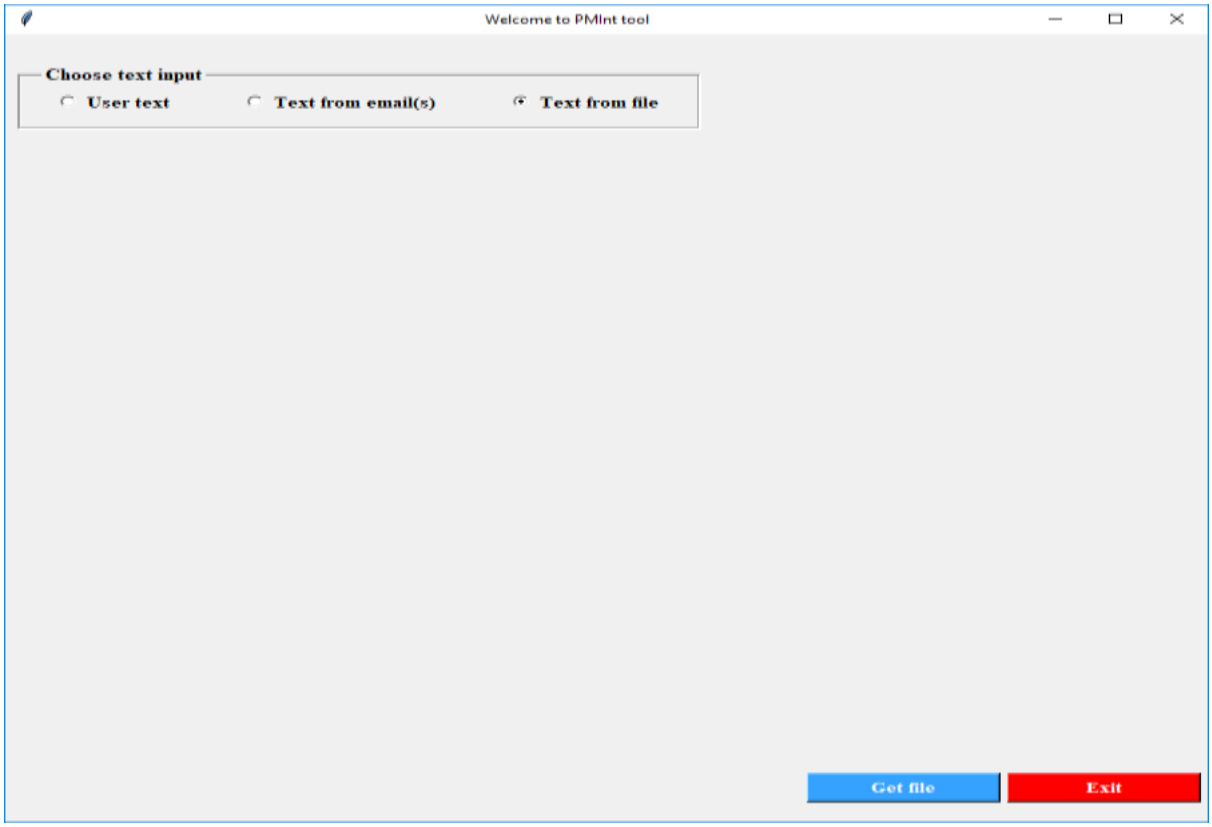


Figure 5.37 – A screen that shows when 'Text from file' radio button is selected

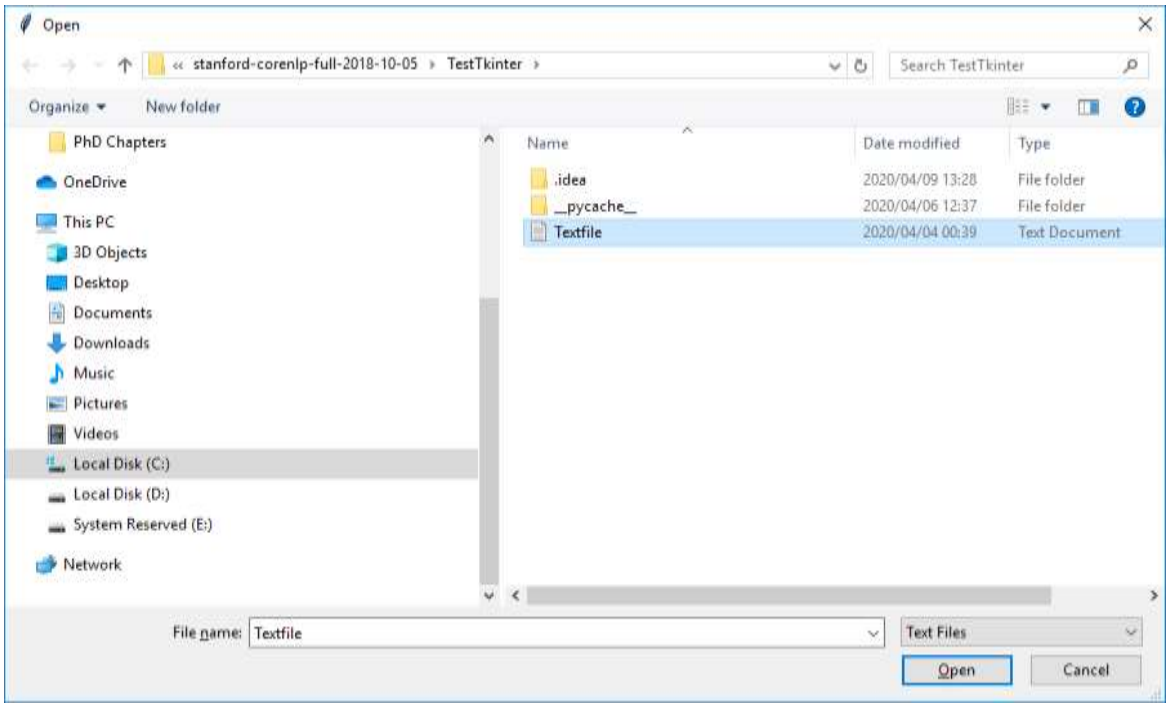


Figure 5.38 – File dialog box for selecting input text file for text analysis

The following source code that establishes which text input source has been selected for input and, based on the selected input, ensures that certain actions are taken by the system:

```
def getTextSource(var):
    selected_rdb = v.get()
    lbl_results.config(text="")  #This makes the label invisible
    if (int(selected_rdb) == RDB_KEYBOARD):
        lbl_enter_txt.place(x=5, y=100)
        lbl_enter_txt.config(text="Enter text to analyse")
        user_txt.place(x=5, y=125)
        user_txt["width"] = 80
        user_txt["height"] = 10
        user_txt.delete(1.0, END)
        user_txt.focus()
        btn_analyse = Button(master=frame, text="Analyse text",
                             font="Times 11 bold", width=15, bg="#34A2FE",
                             fg="white",
                             command=lambda: do_text_analysis(user_txt.get("1.0",
                             tk.END)))
        btn_analyse.place(x=600, y=750)

    elif (int(selected_rdb) == RDB_EMAILS):
        lbl_enter_txt.config(text="")  #This makes the label invisible
        user_txt.place(x=1200, y=1200)
        #Change button text
        btn_getfile = Button(master=frame, text="Get emails",
                             font="Times 11 bold", width=15, bg="#34A2FE",
                             fg="white",
                             command=lambda: do_text_analysis(user_txt.get("1.0",
                             tk.END)))
        btn_getfile.place(x=600, y=750)
        email_class = clEmail(frame_txt)
    elif (int(selected_rdb) == RDB_TEXT_FILE):
        lbl_enter_txt.config(text="")  #This makes the label invisible
        user_txt.place(x=1200, y=1200)
        #Change button text
        btn_getfile = Button(master=frame, text="Get file",
                             font="Times 11 bold", width=15, bg="#34A2FE",
                             fg="white",
                             command=lambda: do_text_analysis(user_txt.get("1.0",
                             tk.END)))
        btn_getfile.place(x=600, y=750)
    else:
        print("Unknown choice")
```

5.4 Technology used to develop the PM*Int* tool

Nowadays there are various technologies at one's disposal for developing a computer system. All have their strengths and weaknesses, depending on what one wants to achieve with the intended system. For the PM*Int* tool, the researcher chose Python based on its powerful capabilities of analysing and visualising data with relative ease. Furthermore, the Stanford CORENLP toolkit provide Python APIs so that third party applications may tap into their resources effortlessly. Given that Python is an object-oriented programming language, the learning curve for the researcher was not a steep one, since the researcher has knowledge of object-programming languages. The PM*Int* tool uses the database and for this MySQL database system was chosen, purely based on it being a popular open-source database management tool.

5.5 Summary

The chapter began by providing a background on the PM*Int* tool. As previously stated, Hans and Mnkandla (2013, 2014, 2016, 2017) have written extensively on the tool and have gone as far as producing a prototype of the tool. The architectural design aspects of the PM*Int* tool were discussed, covering the three layers of the system, which are: the presentation layer, application layer and data input layer. During the discussion of the input layer, three sources of input, namely, input from keyboards, emails and text files were mentioned. The justification for the omission of two possible text input sources in the form of Facebook and WhatsApp was provided.

The structure of the tool in the form of class diagrams and the behaviour in the form of sequence diagrams has been discussed in this chapter. As for the user interface, the screens to enable users to interact with the system were presented and discussed. The chapter also indicated that the Stanford CORENLP toolkit would be utilised in analysing text for the establishment of sentiments expressed by project team members. The reasoning behind the choice of using the Stanford CORENLP toolkit has been given. In the process of discussing how the Stanford CORENLP toolkit works in terms of determining sentiments of a given text, a formula for establishing overall sentiment expressed by the text was developed and tested for meeting its intended purpose. In the processes of discussing the user interface screen inputs, some examples of text analysis, as well as the expected results were discussed in this chapter.

Finally, this chapter concluded by indicating that Python has been chosen as the software for the development of the PM*Int* tool.

CHAPTER 6: RESEARCH RESULTS

6.1 Introduction

This chapter presents the results, the analysis and synthesis of the results of this research study. The primary data of the study was collected in four phases, the first being the 'as is' environmental analysis, and the second and third being the first and second stages of the Delphi process respectively, while the fourth and the final phase was a validation process of the model and the PM*Int* tool in a real-life project environment. The data analysis results collected during the 'as is' environmental analysis stage are presented first, in Section 6.2, while the data analysis results of the data gathered under the two-stage Delphi method are discussed in Section 6.4. Section 6.3 discusses the assessment criteria used to evaluate this study's model. The data analysis results of the data collected after the validation process are presented in Section 6.5. The chapter concludes with a summary of what was covered.

6.2 The 'as is' environmental analysis: summary of the data analysis results

As explained in Subsection 3.5.3, the purpose of the 'as is' environmental analysis was to determine the status quo regarding the level of attention given to the needs and views of PTs by the project managers in the South African ICT sector. The results of data analysis of the data collected during this phase were presented in in Chapter 4, because the analysis results were important for the design and the development of the model and PM*Int* tool of this study. This section, therefore, only presents a summary of data analysis results of the data collected during the 'as is' environmental analysis stage.

The data was gathered using face-to-face interviews from five project managers and five project team members who were selected from five different ICT projects, as explained in Chapter 3. Each project that was selected in this study needed to have at least five project team members. In cases where a project team had more than five team members, only five were permitted to participate. The use of two types of sources of data, namely, project managers and project teams, was for triangulation of the results and evidence in order to answer this study's research questions (Bacon and Fitzgerald, 2001; Fisher, 2011). The data collected during this stage was qualitative and was analysed using qualitative techniques, including inductive analysis approach

(Thomas, 2006) and ATLAS.ti., which was used for both coding and analysis, as discussed in Subsections 4.2.1 and 4.2.2.

6.2.1 A summary of the data analysis of the responses of the project teams

The following subsection presents data analysis results of the collective responses of the project teams (across-project data analysis).

6.2.1.1 Cross-case pattern matching

The first question for the participants was aimed at establishing whether or not there were any processes in place to solicit their project-related needs and concerns (see Appendix C). Figure 6.1 depicts the project team members' responses from the five projects collectively. Eight team members across all five teams claimed there were processes, whereas 13 project team members declared such processes non-existent. '*If there were any, we would have been the first to know, since we have been in this company for years*', said PTC1, who was one of the 13 team members. Four participants indicated that the existence of such processes was project manager-dependent. There was only one team, Team D, wherein a majority of the team members felt processes existed. A majority of team members of Teams A, C and E mentioned a lack of processes to gather the views and concerns of project teams, while a majority of team members of Team B mentioned that the processes fell at the discretion of the project manager, meaning some project managers collected project team views and concerns while others did not.

Most teams (projects) did not have processes in place to gather project teams' views and interests. The project managers seemed not to want to *'acquire genuine knowledge of the feelings'* of their teams, as advised by Fisher (2011:998), and were oblivious of the needs of their teams, appearing to show no care for them, and thus lacking consideration behaviour aimed at satisfying project team members' needs (Burke, Stagl, Klein, Goodwin, Salas & Halpin, 2006; Haselberger, 2016). This observation is consistent with what has been established by prior research by Bourne (2011), Development Review Management (1997), Hans and Mnkandla (2019a), Turner *et al.* (2008) and Pecherskaya *et al.* (2015).

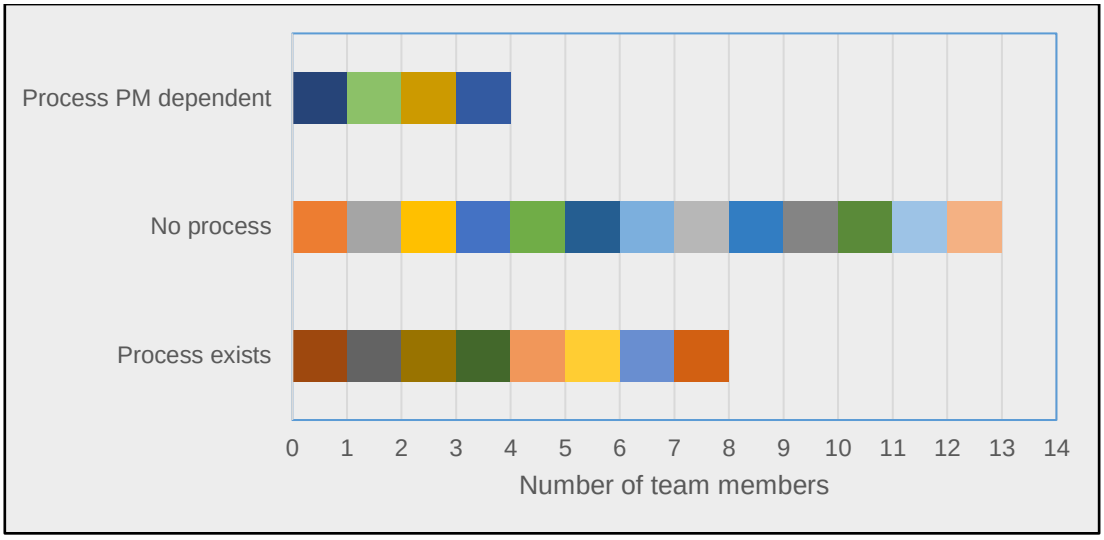


Figure 6.1 – Responses of 25 team members to Question 1

Question 2 was aimed at understanding how the information was gathered, if it was gathered. That is, the question was directed to PT members who indicated that there was a process in place, as well as the ones who said the process was PM-dependent. All the team members who claimed that there were processes in place, as well as those who indicated that the processes were PM-dependent, said their views and concerns were solicited during project weekly meetings. '*The only time where project team members' views and concerns get heard is during weekly meetings*', PT_{D3} emphasised. Claims by the team members indicated that project managers relied on a single method, namely, formal meetings, to gather project teams' views and interests. The dependence on one formal method (a meeting) may exclude or disadvantage those team members who prefer informal or other methods. This view is also supported by Fisher (2011) who posits that some team members place high value on informal conversations with project managers.

It is also important to understand the type of information collected from project teams by PMs, and Question 3 of the interview was directed at soliciting this evidence. Information related to schedules, work progress and challenges met in accomplishing assigned tasks was the type of information that project team members identified as being collected from them by project managers. The type of information sought by project managers appeared more task-oriented than person or team-oriented – it was more about accomplishing tasks (Burke *et al.*, 2006). They seemed to be more inclined towards management *of* stakeholders (a push for organisation's interest approach)

than management *for* stakeholders (a participatory approach for all stakeholders). This finding corroborates the findings by Aagaard, Eskerod, Huemann and Ringhofer (2016), who argue that project managers typically use a management *of* stakeholders approach more than a management *for* stakeholders one.

In response to the question (Question 4), which was meant to determine whether the sourced information was valued and used in the decision-making process by project managers, 16 project team members emphatically said their views did not matter. Four team members of Team A decried the existence of bureaucratic processes ('*red tapes*'), which, according to them were to suppress their views. '*They are aimed at suppressing views and concerns of project team members*', added PT_{A2}, one the four members of Team A. These sentiments were echoed by PT_{E4}, who said, *'Your views do not matter'.* Another team member (PT_{B5}) went on to say that some project managers were *'dictatorial'*. On the other hand, seven team members claimed project managers considered their views in the decision-making process. Two project team members stated that the consideration of their views in decisions depended on the individual project manager. '*In one project ones' views may count, while in another they may mean absolutely nothing*', reported PT_{B1}. Figure 6.2 shows a summary of responses by the project team members.

The views expressed by a majority of the project team members, indicating a lack of regard for their views in the decision-making processes on the part of project managers, would seem to confirm the observation made earlier of the PMs paying little or no attention to project teams' views and concerns. This therefore, would mean, by extension, that project managers do not treat project team members as key stakeholders, as established in a recent study by Hans and Mnkandla (2018a).

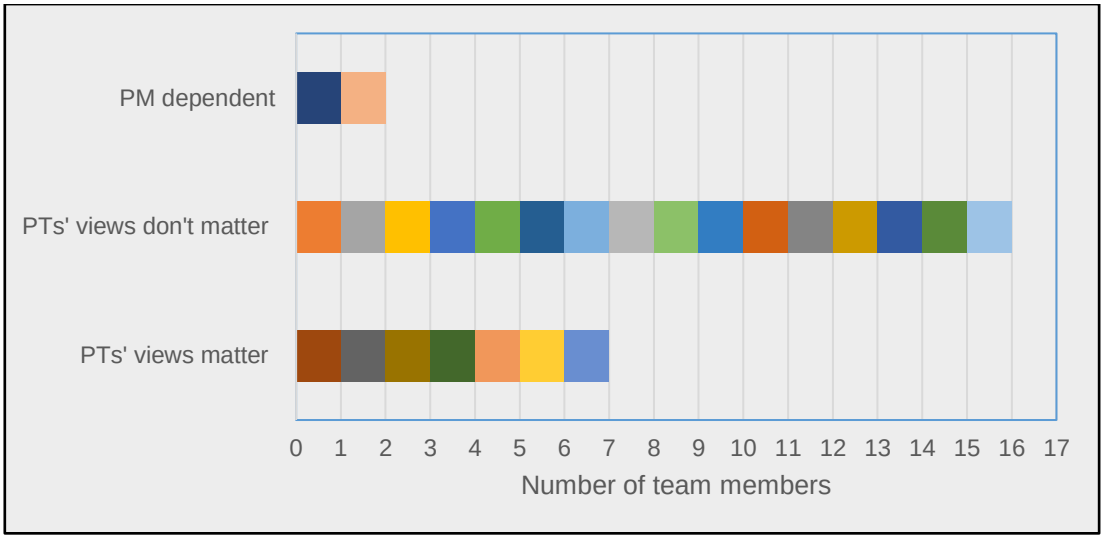


Figure 6.2 – Do views of PTs matter in decision-making by PMs?

Question 5 was aimed at establishing any possible improvements that the project teams might had regarding the existing processes. This question was directed to project team members who either reported that there were processes in place or that the processes were PM-dependent. In general, the team members who said the processes were project manager-dependent said they would propose a company-wide enforcement of the process, to ensure that all project managers were compliant with the process. This accords with the recommendations made by Hans and Mnkandla (2018b) as well as Milosevic and Patanakul (2005), who state that standardisation and formalisation of project management practices across an organisation would result in consistent and uniform implementation of such practices. The other suggestion for improvement that featured prominently was communication. PT_{B2} emphasised the need for communication improvement by saying: *'currently communication is disoriented'.* Given the disregard of PTs' voices in the decision-making process by the PMs, as discussed previously in this section, the suggestion to improve communication processes amongst project managers and their teams came as no surprise. Project teams consider consultation and proper communication amongst project managers and project teams as an important project success criterion (Davis, 2014). Effective communication does not just happen, but requires proper planning and implementation (Mnkandla, 2013).

The purpose of Question 6 was to obtain better understanding of what project teams considered to be an ideal process. Several team members indicated that an ideal tool

would support better communication amongst the teams, indicating once more that poor communication was the Achilles heel in many of the teams. One team member indicated that he preferred a tool that would informally collect project teams' views, rather using project meetings to achieve this. The suggestion supports the observation that was made earlier regarding project managers' reliance on a single method, namely meetings, for gathering of views and concerns. The choice of inappropriate communication tools and methods may be a hindrance to a project operation (Mnkandla, 2013).

Table 6.1 provides a summary of the data analysis results of the project teams' responses.

Table 6.1 – A summary of data analysis response results of data collected from project teams

Team Name	Yes, there are process	No processes	Yes/No - Process depends on a PM	Views matter in decisions taken by PMs	Improvements to the current process	Ideal process
Team A	One team member claimed existence of processes.	Four team members mentioned an absence of processes to gather project teams' views.	No one	One team participant said the teams' opinions were valued by PMs, while four team members indicated that there were no such processes, thus implying that the views of project teams were disregarded.	The team member, who claimed process existence, stated that there was no need for process enhancement.	Three team members of the four who indicated the absence of processes expressed the desire for a process that would solicit PTs' views, but could not explain the operation of the process, while the fourth team member said he had no ideal process in mind. Nevertheless, they unanimously recommended the removal of 'red tape' (which in their view was there to supress opinions of project teams). According to them, the red tape occurs because of the assumption that PMs know it all and therefore need no input from their teams. The existing process was an ideal one for the fifth PT member.
Team B	Two participants mentioned the existence of processes to collect opinions and concerns of project teams.		Three team members indicated that the existence of processes was project manager-dependent – some project managers gathered the	Three respondents claimed that PMs disregarded PTs' concerns in their decisions. Some PMs are 'dictatorial', said one team member. The fourth respondent claimed that team's	Three team members called for the enforceability of the processes, and not to be based on individual project managers. They further suggested improvement on communication levels between project managers and their teams – calling for project teams' involvement in decision-making processes by project	(This refers to the three respondents who claimed that processes were depended on project managers): The team members suggested a comprehensive tool, which will the opinions and project needs of project team members. One of

			views, while some did not. Project managers were not made to account for not implementing the processes.	opinions were valued while the fifth respondent indicated that this was project manager-depended.	managers. The fourth team member expressed her satisfaction with the current processes, the fifth team member characterised the communication between PMs, and PTs as 'disoriented' and proposed training for project teams on project management tools to enhance communication levels.	the three respondents preferred the proposed tool to be informal.
Team C	No one.	All five participants mentioned the lack of existence of such processes.	No one.	The absence of processes implied that project managers disregarded the opinions and concerns of project teams in their decisions.	Not applicable.	In addition to a process to collect the opinions and concerns of project teams, two respondents proposed that the processes should allow team members to give their views anonymously to avoid reprisal by project managers.
Team D	Four respondents affirmed the existence of processes.	One participant denied the existence of such processes.	No one.	The four team members who claimed the existence of processes also alleged that project managers valued views and concerns of project teams.	One of the respondents who asserted process existence proposed that the process should cater for individual team member interaction with a project manager to improve communication between the mentioned stakeholders. The other three made no mention of changes.	The team member who mentioned a lack of processes said that an ideal process would be a flexible one that catered for diverse projects.

Team E	One team member alleged the presence of processes to collect opinions and concerns of project teams. Nevertheless, the respondent also acknowledged that the processes were not defined.	Three team members categorically denied the existence of such processes.	One team member claimed the existence of a process, which was undocumented, thus the process was non-existence according to her. Her sentiments confirmed a declaration by another responded in the team about the existence of an undefined process.	The participants who claimed the absence of processes mentioned that the opinions of team members did not matter to project managers. One team member said, 'Your views do not matter'. The respondent, who said processes existed, claimed their views were valued by PMs. The one team member, who indicated that the presence of processes were project manager-dependent, also said the consideration of their views was project manager-dependent.	The team member, who said the processes existed, proposed the improvement of communication levels and following-up of matters raised by project teams. The team member who mentioned that the processes were project manager-dependent said the process needed to allow private sessions between individual PT members and project managers.	Four team members: three team members who claimed the lack of processes and one, who indicated that such processes were dependent on individual project managers, said their ideal process should promote better communication between project managers and their teams.

6.2.2 A summary of the data analysis of the responses of project managers

This subsection presents the summary results of the data analysis for the data collected from the five project managers of the five teams, using interview questions shown in Appendix B.

6.2.2.1 Cross-case pattern matching

The project managers responded as follows to the first question. Four project managers (for Teams B, C, D and E) indicated the existence of processes to gather views of project teams, while the project manager for Team A said there were no such processes.

On the question of the teams' views being considered in the decisions by project managers, all five project managers (despite the confession from Team A's PM that processes did not exist) confirmed that the views of project teams were valuable and were taken into account in the decision-making processes.

All five project managers unanimously indicated that the information received from their project teams enabled better decision-making. One project manager (PM_B) stressed the importance of the information gathered from her project teams: *'It enables one to address project risks'*. PM_E said, *'It enables us to enhance processes and solve problems'*. These claims confirm what Salas, Burke and Stagl (2004) allege regarding the value and insights that project team inputs provide to project managers. Furthermore, Martin, Cormican, Sampaio and Wu (2018) posit that the complexity of ICT project environments necessitate the participation of project teams in the decision-making process.

Not much was collected from the project managers about both process improvement and ideal processes. This was not unexpected, considering they consistently maintained that processes were in existence to elicit the views and concerns of project teams. However, as one could have predicted from the discussion of the data analysis for the two groups of participants, there were contradicting responses. The next subsection compares and contrasts responses given by project managers and project teams and draws some conclusions.

6.2.3 Comparison and discussion of the data analysis results presented in the preceding two subsections

This subsection compares answers from project managers and discusses possible reasons for contradicting answers provided by PT members amongst themselves, as well as between PT members and PMs. Table 6.2 provides a summary comparison of the responses for the PTs and the PMs.

- **Team A**: The project manager claimed that there was no process for collecting views and concerns of project teams. This was corroborated by the majority of project team members. However, four team members contradicted the PM's claim that project managers valued the views and concerns of team members.
- **Team B**: The PM indicated the existence of a process, but three team members acknowledged that such processes were project manager-dependent with (some following the processes and others not). It would appear, then, that the project manager for Team B could have been one of the project managers in the organisation who applied the processes to collect project team views and concerns. The project manager mentioned that the views of team members mattered in the decisions taken by PMs but this was in sharp contrast to what three team members said.
- **Team C**: The project manager reported that there were processes to gather opinions and concerns of project teams, but three team members denied this. Furthermore, the PM's claim that team member views were considered in the decision-making process contradicted the team members.
- **Team D**: The project manager and four project team members claimed that processes existed and that the views of PTs informed part of the decision-making process.
- **Team E**: The project manager's claim that there were processes contradicted what the three members of the team asserted. Moreover, the assertion by the project manager that the opinions and needs were reflected in the decisions made by PMs was diametrically opposed to the responses of three team members.

The preceding discussion shows evidence of contradictions and disagreements between project managers and their project team members. The following discussion points out the possible sources of the contradictions.

Table 6.2 – A summary comparison of data analysis response results of data collected from project teams and project managers

Team Name		Yes, there are processes	No processes	Yes/No - Process depends on a PM	Views matter in decisions taken by PMs	Comments
Team A	**PT members**	One team member claimed existence of processes.	Four team members mentioned an absence of processes to gather project team views.	No one.	One participant said the teams' views were valued by PMs. However, four team members said PT views did not matter.	• **Agreement** - The PM and four team members concurred that there were no processes. • **Contradiction** - The PM contradicted four team members concerning the importance of their views in decision-making processes.
	PM		No processes.		PT views matter, as team members were allowed to voice their views one way or another.	
Team B	**PT members**	Two participants mentioned the existence of processes.		Three team members indicated that the existence of processes was project manager-dependent	Three respondents claimed that PMs disregarded PT concerns in their decisions. The fourth respondent claimed that team opinions were valued while the fifth respondent indicated that this was project manager-dependent.	• **Agreement** - The PM and two team members concurred that there was a process. • **Contradiction** - The PM contradicted three team members concerning the importance of their views in decision-making processes.
	PM	There is a process.			Project team views mattered in the PM's decision-making process.	
Team C	**PT members**	No one.	All five participants reported a lack of existence of processes.	No one.	The lack of processes implied that PMs disregarded the views of PTs in their decisions.	• **Contradictions** - The PM contradicted the team members on the existence of processes and on the claim that PMs valued the views and concerns of PTs.
	PM	There were processes.			Views and concerns of PTs were reflected in the decisions made by PMs.	

Team D	**PT members**	Four respondents affirmed the existence of processes.	One participant denied the existence of such processes.	No one.	The four team members who claimed the existence of processes also alleged that project managers valued views and concerns of project teams.	• **Agreement** - The PM and four team members concurred that there was a process. They also agreed on the consideration of project team member views in the decision-making process.
	PM	There was a process.			PT members views were considered in the decision-making process by PMs.	
Team E	**PT members**	One team member alleged the presence of processes to collect opinions and concerns of project teams. Nevertheless, the respondent acknowledged that the processes were not defined.	Three team members categorically denied the existence of such processes.	One team member claimed the existence of a process, which was undocumented, thus the process was non-existence according to her. Her sentiments confirmed a declaration by another responded in the team about the existence of an undefined process.	The participants who claimed the absence of processes reported that the opinions of team members did not matter to project managers. '*Your views do not matter*', said PM_{E4}. The respondent who said processes existed claimed their views were valued by PMs. The one team member who indicated that the presence of processes was project manager-dependent, also said the consideration of their views was project manager-dependent.	**Contradictions** - The PM contradicted the three team members on the existence of processes and on the claim that views and concerns of project teams were considered in decisions by project managers.
	PM	Process existed.			Project managers in their decision-making processes valued project team views.	

A study by Hans and Mnkandla (2018b) highlight the following factors as possible sources of disagreements and contradictions between PMs and PTs:

Undocumented processes/informal processes – Some of the project team members indicated that processes were undocumented, and this could have resulted in the organisations having difficulties enforcing such processes. Some project managers might have ignored (intentionally or otherwise) the undocumented/informal processes; hence the processes were PM-dependent, as mentioned by some project team members. Some project managers may have interpreted the fact that processes were undocumented/informal as a sign that they were unimportant, and therefore saw no reason to implement such processes. This results in confusion, a factor of undesired project outcome, as mentioned by Kumar, Banga and Kaur (2016) as well as Pankratz and Basten (2013).

Non-standardised processes and policies – Some project team members claimed that whether or not there were processes to solicit views and concerns of project team members depended on the individual PM. This reveals a lack of standardisation of practices for collecting project team member views and concerns across the different units or projects of the organisation. This lack of standardisation of practices could be as a result of the organisations not having PMOs, or the PMOs not standardising the project management practice of engaging with PT members. Another alternative could be that project management offices were providing a supportive role to project stakeholders and lacked directive or controlling powers, as suggested by the PMI (Project Management Institute, 2013). The lack of standardisation of project management practices is detrimental to project success (Project Management Institute (PMI), 2017), while standardisation of project management practices is an enabler of critical success factors (Brown and Eisenhardt, 1997; Milosevic and Patanakul, 2005) and offers consistent efficient results.

Other factors which could have contributed to the confusion were identified by Hans and Mnkandla (2019b) as follows:

Poor communication – Lack of proper communication was mentioned several times by various project team members, with PT_{B2} calling it *'disoriented'*. It appears that there was no proper, consistent communication with regard to the processes for collection of project team opinions and concerns, leading to some team members saying they

existed, others saying there were no such processes, while there were also those who insisted such processes were implemented or not at the discretion of project managers. On the other hand, in the absence of proper communication, PMs applied their own interpretation of the situation. Due to poor communication*, 'authority to manage (some) project processes'* (Burke *et al.*, 2006:289) could not be exerted (***some*** is not in the original text).

Lack of team inclusion in the decision-making processes – Sixteen project team members alleged that project managers did not consider their views in the decision-making process, while all project managers maintained that the views of project teams were important in their decision-making. Project teams seemed distrustful that the decisions taken by project managers without the consideration of their views were made in their best interests. This could be identified from statements characterising PMs as *'dictatorial'* and disregarding team member views because they *'know it all'*. Furthermore, such comments from PTs seem to imply that some PMs were command and control management approach (Hans and Mnkandla, in press). The environment of mistrust caused disagreements and contradictions. This observation is supported by Pankratz and Basten (2013) who state that mistrust leads to disagreements, conflict and dissatisfaction.

Non-standardised project management leadership – The various compliance levels in project management practices by project managers could also point to the differences in project management leadership within organisations. The variance in team management within an organisation is likely to generate dissatisfaction amongst project teams. This finding is corroborated by the research of Milosevic and Patanakul (2005), who found that managers with standardised project management skillsets are more likely to engender satisfied clients and stakeholders. The skillset that should be standardised includes process skills, soft skills and technical skills (Milosevic and Patanakul, 2005; Sobek, Liker & Ward, 1998).

6.2.4 A summary of the data analysis results: 'as is' environment analysis

Subsections 6.2.1 and 6.2.2 present the data analysis results for the data collected from the project teams and project managers, respectively. The data analysis led to several findings. The following were some of the major findings of this study:

- There were no processes in place to gather the views and concerns of project teams.
- Project managers did not consider the voice of project teams in decision-making processes.
- Project managers were more task-focused than team-focused.
- Project managers were leaning more on a management *of* stakeholder approach than a management *for* stakeholders, when managing project teams.

The data analysis results were further compared and, as a result, several contradictions within and between the two groups of respondents were identified. Various possible factors, which could have given rise to the contradictions, were identified and discussed. The recognised factors are the following:

- Undocumented processes/informal processes
- Non-standardised processes and policies
- Poor communication
- Lack of team inclusion in the decision-making processes
- Non-standardised project management leadership

We contend that the abovementioned findings and practical implications provide critical insight into understanding the treatment of ICT project teams as non-key stakeholders. This study's model and the PM*Int* tool are aimed at addressing this phenomenon.

6.3 Criteria for model evaluation and validation

Rigby (1965, cited in Khazanchi, 1996) claims that models are important in the advancement of any scientific discipline. However, the question of how ICT (conceptual) models should be evaluated and validated has remained unanswered (Khazanchi, 1996). Furthermore, the challenge has been compounded by lack of agreement on what constitutes a valid model (Khazanchi, 1996).

Khazanchi (1996) suggests several criteria that a model has to pass to be considered valid and justifiable. Table 6.3 lists these criteria and indicates how this study's model has been measured against each criterion.

Table 6.3 – Criteria for assessing and validating models: Source: Khazanchi (1996)

Criterion for model evaluation/validation	How it has been met by this study's model
Plausible (Plausibility): Is the model based on past research or theories?	• The discussion in Chapter 2 pointed out that the existing stakeholder management models were not addressing the research problem that this study seeks to address. • The model developed in this study was influenced by the work of Sutterfield *et al.* (2006), as discussed in Section 4.3.
Feasible (Feasibility): Is the model workable or "operationalizable"? Open to verbal, graphical and prototypical characterisation?	• Firstly, it is both verbal and graphical – Section 4.3. • The operationalizability was assessed by: (a) The views of the experts. (b) Validation through implementation process.
Effective (Effectiveness): How effective is the model in describing the phenomenon under study? How effective is the model in addressing the phenomenon under study?	• The discussion of the model in Section 4.3 has outlined and discussed the phenomena under study. • The effectiveness of the model in addressing the phenomena was also determined by: (a) The views of the experts, as discussed in Section 6.4. (b) The validation process, as discussed in Section 6.5.
Pragmatic: The model should not logically exclude previous valid models.	The model does not exclude other models, in fact it is based on, and influenced by, other models, as discussed in Section 4.3.
Empirical: Does the model have empirical content? That is, the model must possess "empirical testability".	Not only was the model evaluated through the Delphi method, it was also validated in a real-life project environment, as discussed in Section 6.5.
Inter-subjectively certifiable: This criterion provides that the model must be "testable by different investigators" using observation, logical evaluation, or experimentation.	The model was tested and evaluated by various experts using the Delphi, method as discussed in Section 6.4. A project team also validated it, as discussed in Section 6.5.

Khazanchi (1996) acknowledges that the abovementioned criteria are not exhaustive, but are important requirements for assessing and validating models.

6.4 The data analysis results of the refinement and the evaluation process of the model and the PM*Int* tool

Following the development of both the model and the PM*Int* tool, the Delphi research method was then used to refine and evaluate both of them, as discussed in Subsection 3.5.4. Two phases of the Delphi method were used in this study, because two rounds were sufficient to determine a high level of consensus amongst the experts about the model, as well as the PM*Int* tool, and the point at which no new recommendations were offered to improve them. The decision to halt the Delphi process after two phases is in line with the studies by Grobbelaar (2006), as well as Hoermann, Schermann and Aust (2012).

Thirty five experts were chosen for participation in the refinement and the evaluation of the study's two artefacts. Okoli and Pawlowski (2004) suggest that the number of experts to be used should be between ten and 18. However, Hsu and Sandford (2012) say there is no prescribed number of experts when using the Delphi research methodology. Thirty of the 35 experts were the same five project managers and 25 project team members that were selected to participate during the 'as is' environmental analysis, as discussed in Subsection 3.5.3.1. Apart from their experience in the field of project management, these experts were readily available, since they had already participated in the study (as mentioned in Chapter 3) and they were willing to participate again, a key requirement in a Delphi methodology participation (André, Baldoquín & Acuña, 2011). The PMs had an average of 12 years of project management experience, while the PT members each had at least two years of work experience. The other five experts were academics from two South African universities, each academic with a minimum of eight years of teaching experience in the field of project management in ICT. The other criteria used to select the experts were their diversity of views and that their critical judgment of the model as people who either have direct or indirect interest in the model was itself valuable, as suggested by André *et al.* (2011) and Van Dijk (1990). Only 30 experts participated in the study, as five-project team members (from three different projects) did not respond to requests for participation.

The experts were grouped into three panels according to their careers, skills, and expertise, as discussed in Subsection 3.5.4.1. The project managers formed the first panel, while the project team members constituted the second panel. The third panel of experts was comprised of five academics. This study used telephonic interviews for data collection due to government restrictions imposed in response to the Covid-19 pandemic. Interviews are suitable for data collection when using the Delphi methodology (Van Dijk, 1990). The interview instruments were tested with three experts, one from each of the three panels, for clarity and to ascertain validity of the construct**.**

6.4.1 How was the data collected during the two Delphi phases analysed?

The data collected during the Delphi method phases was qualitative. For Phase 1, Questions 1 to 4, respondents had to select answers from a list of Likert items.

Furthermore, for each answer that a respondent selected from the Likert scale, a reason was to be given. The aim was to 'compel' the experts to provide thoughtful answers. Questions 5 and 6 were open-ended questions. As for Phase 2, the experts were to provide answers to Questions 1 to 3 by choosing from a list of Likert items, while Questions 4 and 5 were open-ended questions. They had to provide a reason for every selected Likert scale value, as was the case in Phase 1. The Likert scale items were numerically pre-coded, as shown in Table 6.4, and thus the responses became ordinal data.

Table 6.4 – Precoding of Likert scale responses

Delphi phase	Question	Likert item	Likert item code
Phase 1	Question 1	Strongly Agree	1
		Agree	2
		Somewhat Agree	3
		Neither	4
		Somewhat Disagree	5
		Disagree	6
		Strongly Disagree	7
	Question 2	Highly Feasible	1
		Feasible	2
		Neither	3
		Infeasible	4
		Highly Infeasible	5
	Question 3	Very Well	1
		Well	2
		Neither	3
		Not Well	4
		Not Well at all	5
	Question 4	Excellent	1
		Good	2
		Average	3
		Poor	4
		Very poor	5
	Question 1	Highly Feasible	1
		Feasible	2

Phase 2		Neither	3
		Infeasible	4
		Highly Infeasible	5
	Question 2	Very Well	1
		Well	2
		Neither	3
		Not Well	4
		Not Well at all	5
	Question 3	Excellent	1
		Good	2
		Average	3
		Poor	4
		Very poor	5

The data was analysed graphically and statistically. The ordinal data was analysed using descriptive statistical analysis in order to assist in the data interpretation process. Furthermore, the standard deviation was used to determine the level of consensus amongst the experts. In a normal distribution, 68% of the responses are within one standard deviation of the mean (Rumsey, 2005:178). The information in Table 6.5 was adapted from Grobbelaar (2006) and was used to establish the level of consensus reached by the experts.

Table 6.5 - Criteria for determining level of consensus

Standard deviation range	Consensus level
$0 \leq X < 1$	High level
$1 \leq X < 1.5$	Reasonable/fair level
$1.5 \leq X < 2$	Low level
$2 \leq X$	No consensus

As mentioned in the preceding discussion, for each response that a participant chose from Likert scale items, a reason had to be provided for the selected answer. The reasons, as well as the responses provided for Questions 5 and 6 of Phase 1, were in the form of unstructured qualitative data, while the reasons given for answers to Questions 1 and 2, as well as responses to Questions 4 and 5 of Phase 2, were also unstructured data.

The reasons and comments that were solicited from the experts were aimed at obtaining better understanding of the concerns and views that the participants possessed regarding the model and the PM*Int* tool. The non-complimentary comments or reasons that the researcher thought were to be given *very serious attention* were from the respondents who selected the Likert items that had codes between 3 and 5 or 7 (in the case of Question 1 of Phase 1) because these experts would have had very serious issues with the model and/or the tool, and therefore their comments would have captured their concerns. Any other non-complimentary comments that were linked to either Likert item code 1 or 2, were regarded as needing *serious attention*. A non-complimentary comment could have suggested improvements to the model or the PM*Int* tool, or could have been a question seeking clarity on the model or the tool. Furthermore, all non-complimentary responses which were provided for Questions 5 and 6 for Phase1 or Questions 4 and 5 for Phase 2, were also regarded as needing very serious attention, because the expectation was that the remarks made would have been directed at improving the model and/or the tool.

Based on the preceding discussion, categories and subcategories were created to classify the unstructured data collected during the two phases of the Delphi method. Figure 6.3 shows a diagram of the categories that were created and used for the categorisation and classification of data. This was part of the data analysis process aimed at bringing order, organisation and making sense of the unstructured data (Vosloo, 2014) so as to be able to interpret it with the aim of improving both artefacts.

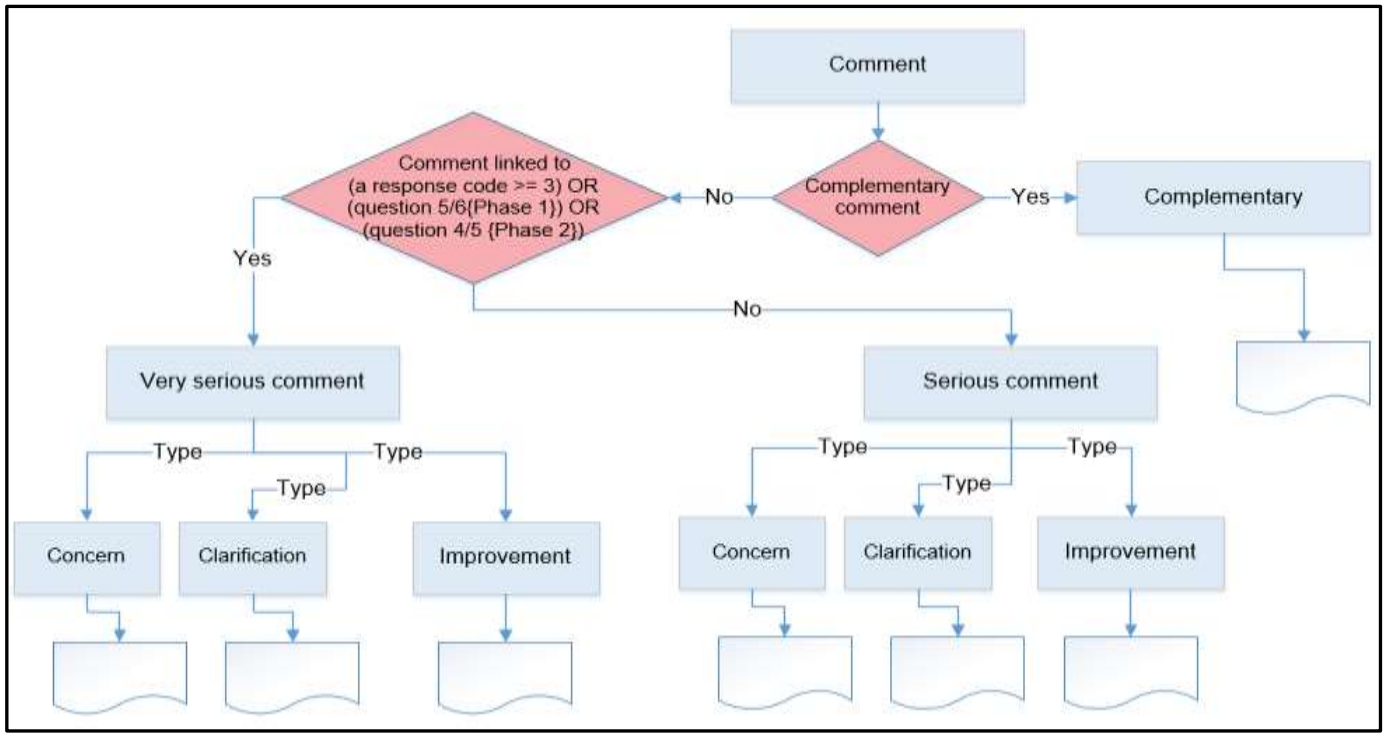


Figure 6.3 – The classification and coding of comments/reason given by experts

6.4.2 Data analysis: Delphi Phase 1

The data analysed in this subsection was collected using interview questions, which appear in Appendix D. The next subsection presents the data analysis results for Question 1.

6.4.2.1 Is the model supported by the PM*Int* tool needed by the ICT sector?

The purpose of Question 1 was to ascertain whether the ICT sector needs the model developed in this study. Figure 6.4 depicts the response of the project team members' panel. Seven project team members indicated that they *'Strongly agree(1)'* that the ICT sector needed the model, while eight PT members said they *'Agree(2)'*. The remaining two project team members were not that convinced (chose *'Somewhat agree(1)'*) that the sector was in need of the model. They mentioned that they had reservations about the model's capabilities to deal with teams that use Agile methodologies. It was explained to the experts that the model was not aligned to any specific software development methodology and should accommodate any of the existing methodologies. The explanation seemed to have been accepted by the team members concerned. Subsection 6.4.2.5 provides a discussion on how comments and recommendations by the experts were addressed. As shown by Figure 6.4, the most frequently selected answer by the panel of project team members was *'Agree(2)'*,

confirmed by the calculated mode value of 2 (*'Agree(2)'*). The standard deviation value for the team member responses was 0.373, indicating a high level of consensus amongst the experts of this panel.

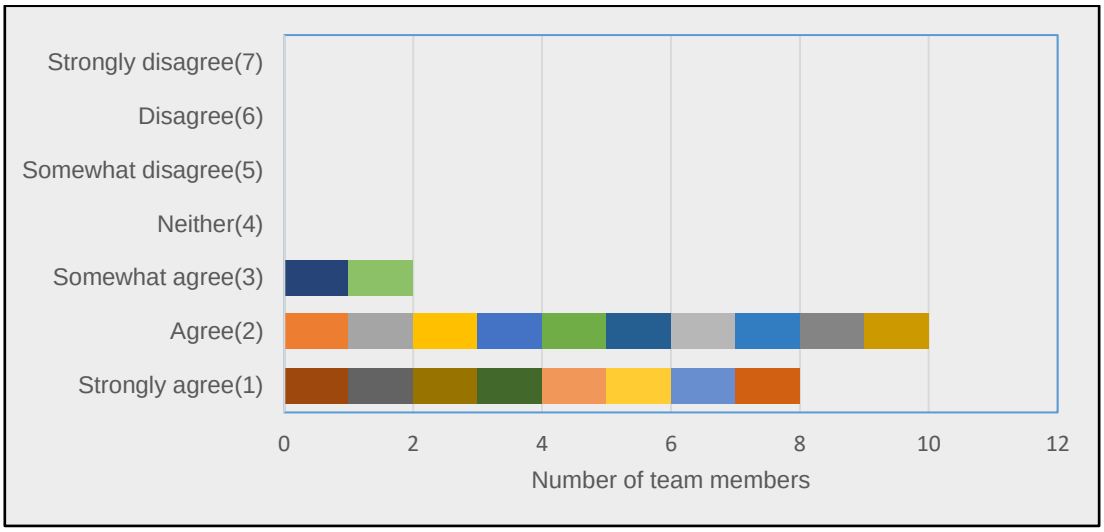


Figure 6.4 – Project team members' responses to Question 1 (Phase 1)

All the project managers were convinced that the model was definitely needed by the ICT sector, with most of them having selected the Likert item *'Agree(2)'* (mode), followed by *'Strongly agree(1)'*, as shown by Figure 6.5. The standard deviation value for this panel was 0.490, also showing a high level of consensus amongst the panel members, even though the level of agreement for this panel was slightly lower than that of the project team members.

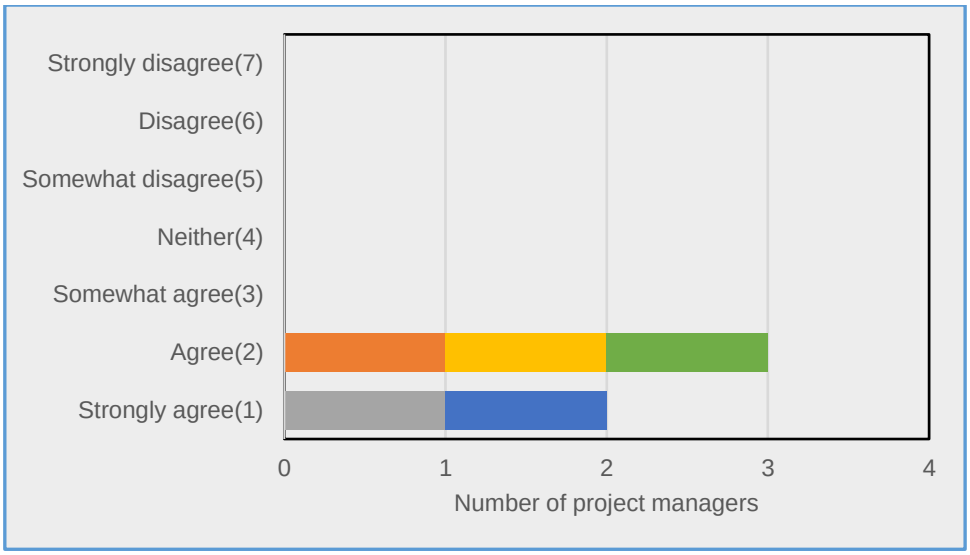


Figure 6.5 - Project managers' responses to Question 1 (Phase 1)

In accordance with the other two panels, most of the academics also felt that the model was necessary for the ICT industry. Figure 6.6 shows that three of the panel members selected *'Agree(2)'* as their answer, while each of the remaining two members chose *'Strongly agree(1)'* and *'Somewhat agree(3)'* respectively. This panel also had a high level of consensus amongst the panel members, as confirmed by the value of the standard deviation, which was 0.633, even though it was not as high as the other two panels.

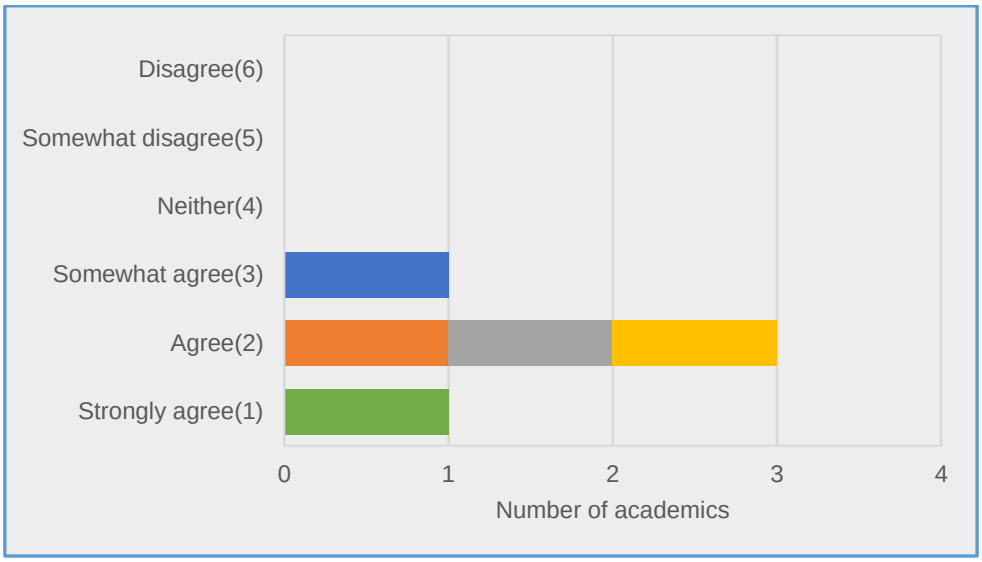


Figure 6.6 - Academics' responses to Question 1 (Phase 1)

For each panel, most of the experts indicated that the model was needed by the ICT industry. However, Table 6.6 shows that the project teams' panel had the highest level of consensus, followed by the panel of project managers, while the academics had the lowest level of consensus. It would therefore appear that the project team members felt more strongly that the tool was needed to assist ICT project managers to treat project teams as key stakeholders. This should come as no surprise, because the members of the PTs' panel formed part of the stakeholders that bear the brunt of the neglect by the project managers, and thus saw the model as something that would help address the situation.

Collectively, all the experts in the three panels chose either *'Agree(2)'* or *'Strongly agree(2)',* except for two PT members and one academic who responded with '*Somewhat agree(3)'* – see Figure 6.7. In other words, 27 of the experts stated that the model was necessary for the ICT sector, while the remaining three gave the model a

weak affirmation. The high level of consensus amongst the experts on the model needed by the ICT sector was confirmed by the standard deviation value of 0.623, as shown in Table 6.6.

Table 6.6 – Statistical response analysis per panel and all three panels collectively to Question 1 of Phase 1

	Mean	Median	Mode	Standard deviation	Level of consensus
PTs panel	2.167	2	'Agree(2)'	0.373	High
PMs panel	1.600	2	'Agree(2)'	0.490	High
Academics panel	1.750	2	'Agree(2)'	0.633	High
Collectively	1.733	2	'Agree(2)'	0.623	High

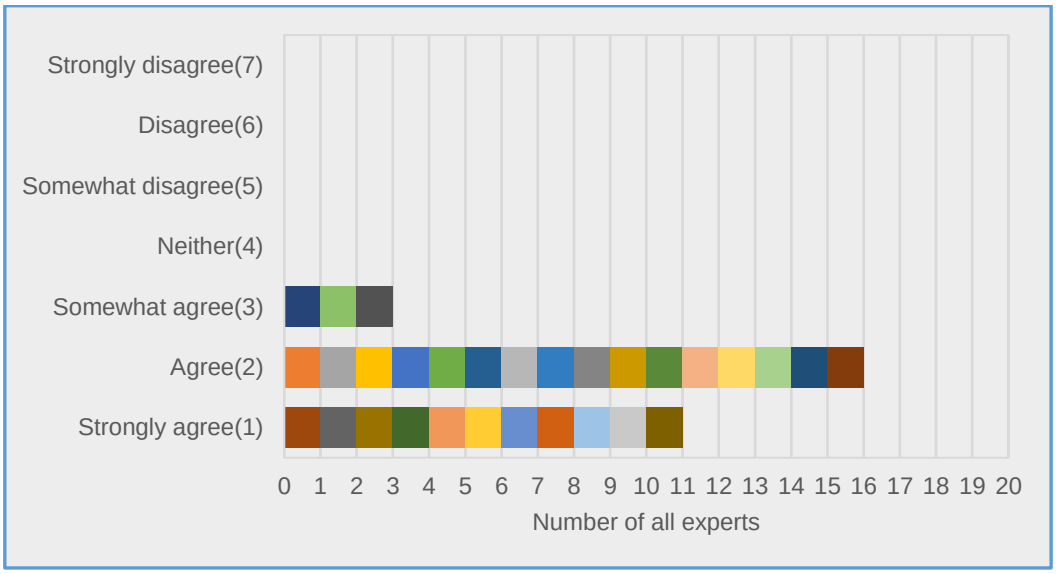


Figure 6.7 – Collective responses from all experts to Question 1 (Phase 1)

Having established *what* the experts said regarding the need of the model for the ICT sector, it was important to determine its feasible application in a real-life project environment, and this was the aim of Question 2. The next subsection discusses the data analysis results to Question 2.

6.4.2.2 How feasible is the application of the model in a real-life environment?

Figure 6.8 presents a summary of responses of the project team members. There was a pattern of consistency in the way this panel responded to the two questions, except for one project team member who gave the need for the model a weak thumbs-up in Question 1, but thought that the model was '*Highly feasible(1)*' in the real-life environment. Upon probing her reasons for selecting the '*Highly feasible(1)*' option when she was not that convinced that the model was needed by the ICT sector, the project team member cited the clarification that was provided to her by the researcher

on the issues she initially had with the model, as the reason for the change of heart. The other team member who indicated that the model was somewhat needed, maintained his position, as he chose *'Infeasible(4)'* as an answer to Question 2. The reason given for this answer was that he needed time to assess the model again in light of the discussion with the researcher resulting from the concerns raised in Question 1. The issues raised by the experts are discussed later in this subsection.

A majority of project team members responded that the application of the model in a real-life situation was *'Feasible(2)'*, while the remaining team members said that it was *' Highly feasible(1)'.* The calculated value of the standard deviation for the panel was 0.625, an indication that the panel members had a high level of agreement amongst themselves. However, the level of consensus of this panel was lower than their previous (Question 1 responses) level of consensus, as shown by Table 6.7.

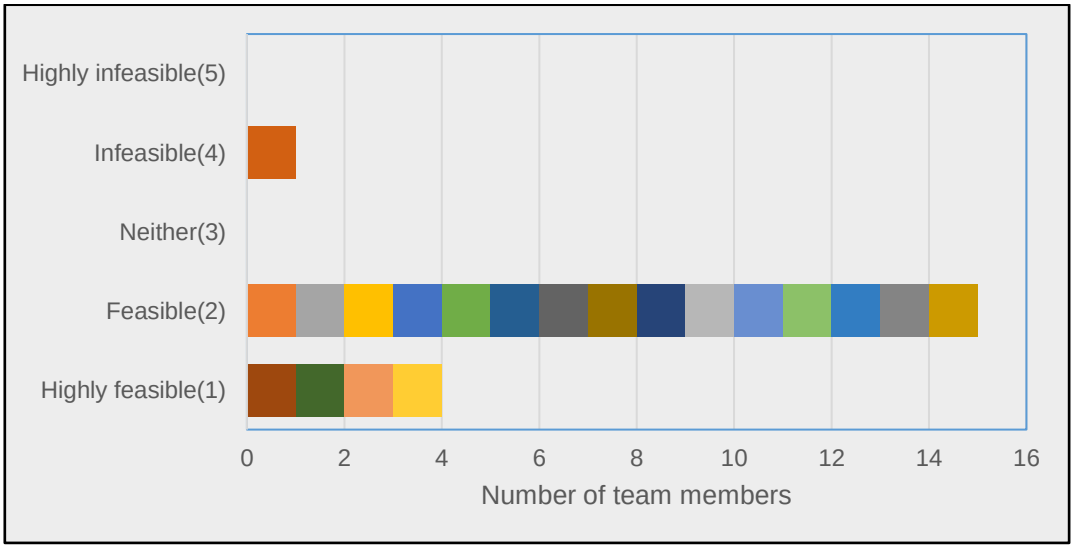


Figure 6.8 – Project team members' responses to Question 2 (Phase 1)

The panel of project managers had four PMs selecting *'Feasible(2)'* and one PM choosing *'Highly feasible(1)'*, as depicted in Figure 6.9. The answers by the panel of PMs were highly consistent with the answers to Question 1. Furthermore, project managers had a relatively high level of consensus, with the standard deviation value at 0.4, compared to the project team member group, which had 0.625. Moreover, the level of consensus by the panel of PMs was higher than their previous level of consensus for the answers to Question 1, as Table 6.7 indicates. This is an indication

that they were unanimous in their conclusion that the model's application in a real-life project environment was feasible.

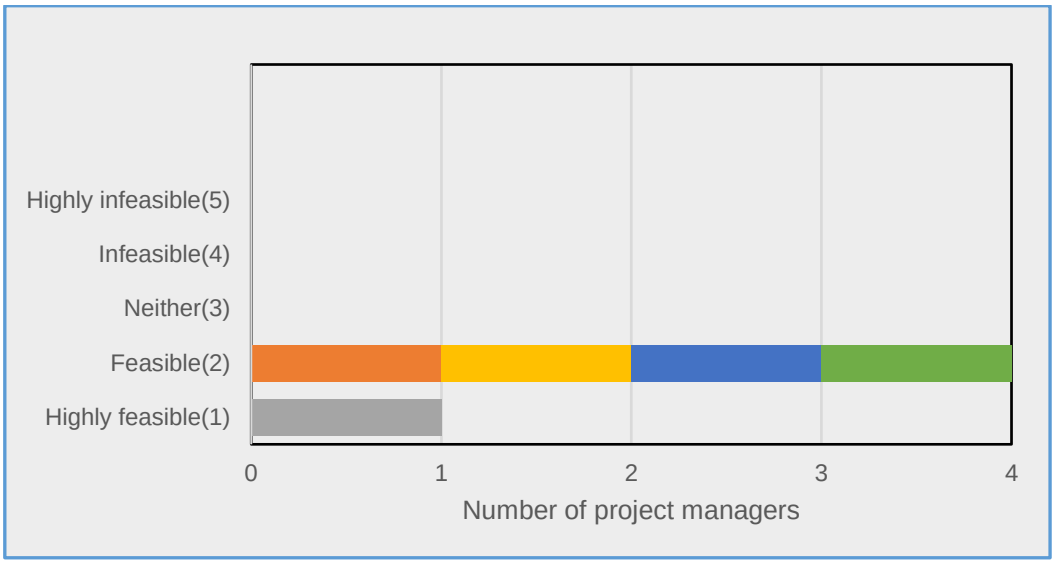


Figure 6.9 – Project managers' responses to Question 2 (Phase 1)

Figure 6.10 shows that the panel of academics had similar answers to the panel of project managers, with *'Feasible(2)'* and *'Highly feasible(1)'* selected by four and one panel member respectively, by each group. This similarity in responses also translated into both panels having a similarly high level of consensus (0.4). The academics also had an increase in the level of consensus, from 1.8 for Question 1 to 0.4 for Question 2. As with the panel for project managers, the panel was unanimous in agreeing that the application of the model was possible in a real-life project setting.

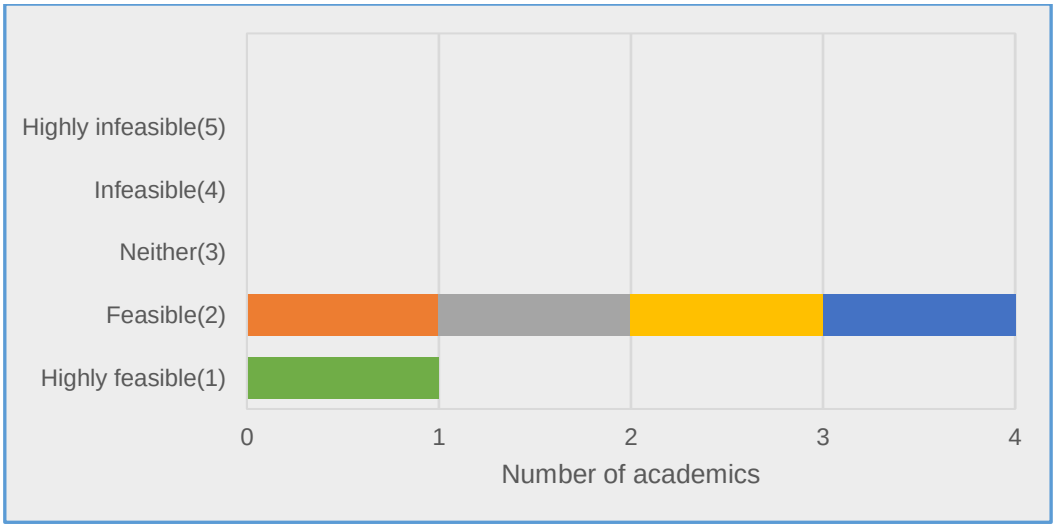


Figure 6.10 – Academics' responses to Question 2 (Phase 1)

Figure 6.11 shows that the overwhelming majority of the experts collectively agreed that the model was suitable for a real-life project environment. This almost unanimous view was also confirmed by the standard deviation value of 0.561, which indicates a high level of consensus amongst the experts. Table 6.7 indicates an increase in the level of consensus amongst the experts for Question 2, when compared to their level of consensus for Question 1.

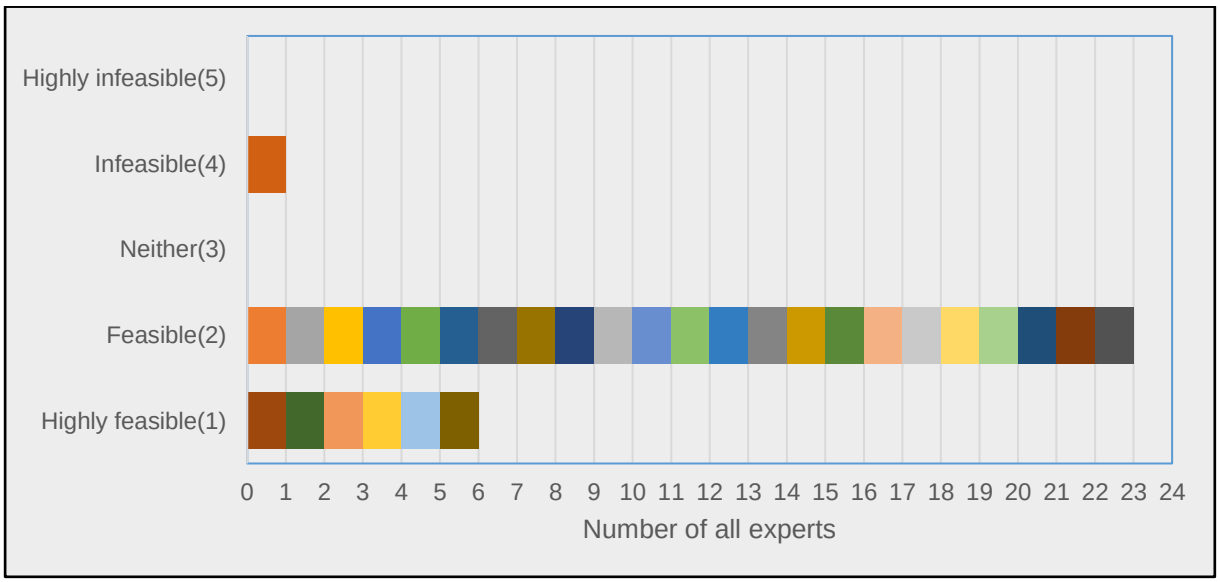


Figure 6.11 – Collective responses from all experts to Question 2 (Phase 1)

Table 6.7 – Statistical response analysis per panel and all three panels collectively to all questions thus far of Phase 1

	Phase 1									
	Question 1					Question 2				
	Mean	**Median**	**Mode**	**Std. deviation**	**Level of consensus**	**Mean**	**Median**	**Mode**	**Std. deviation**	**Level of consensus**
PTs panel	2.167	2	'Agree(2)'	0.373	High	1.900	2	'Feasible(2)'	0.625	High
PMs panel	1.600	2	'Agree(2)'	0.490	High	1.800	2	'Feasible(2)'	0.400	High
Academics panel	1.750	2	'Agree(2)'	0.633	High	1.800	2	'Feasible(2)'	0.400	High
Collectively	1.733	2	'Agree(2)'	0.623	High	1.867	2	'Feasible(2)'	0.561	High

*RED means a drop in the level of consensus compared to the previous question.
*BLUE means an increase in the level of consensus compared to the previous question.
*Black means the level of consensus did not change compared to the previous question.

6.4.2.3 How well does the model fulfil its intended purpose?

Question 3 of Phase 1 was aimed at determining how well the model met its purpose. Figure 6.12 presents a summary of the responses of the project team members. The same PT member who mentioned that the application of the model was infeasible in a real-life environment to Question 2, also indicated that the model was not fulfilling its purpose. As mentioned in the previous discussion for Question 2, the team member said he needed time to re-examine the model after the researcher clarified the issues he had with the model. Two project team members decided to 'sit on the fence' regarding the answer to this question by selecting *'Neither(3)'*. On probing the reasons for their responses, the common factor in their reasons was that only the real-life environment would determine whether the model fulfilled its purpose or not. Again, the issues raised by the panels of experts are dealt with later in this subsection. A majority (12 experts) of the PT members indicated that the model was *'Well(2)'* suited for its function, while the remaining five experts indicated it fulfilled its purpose *'Very well(1)'*. That is, 17 of the project team members confirmed that the model met its intended function, while the remaining three either said it did not or they were not sure. Even though a majority of the project team members were convinced that the model was fulfilling its purpose, there was a slight decrease in the level of consensus for this group, compared to the level of consensus for the responses to Question 2. Table 6.8 shows that the standard deviation moved from 0.625 to 0.739, indicating a drop in the level of consensus amongst the panel members.

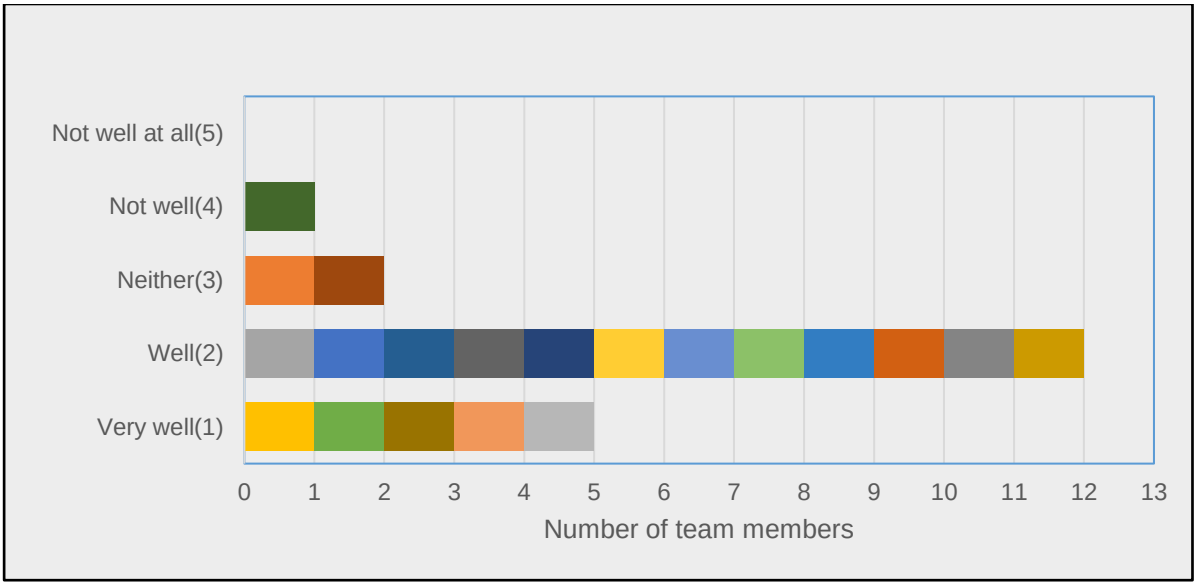


Figure 6.12 – Project team members' responses to Question 3 (Phase 1)

The panel of project managers were unanimous in stating that the model fulfilled its intended purpose *'Well(2)'*, as reflected by Figure 6.13. Their responses were not a surprise, considering that they mentioned that the model was well suited for the real-life project environment. The unanimity in their agreement was also reflected by the standard deviation value of 0, which signified a high level of consensus amongst the project managers. Moreover, there was a significant increase in the level of agreement amongst the project managers. Table 6.8 indicates that the standard deviation for the responses to the Question 2 was at 0.4, while the standard deviation for the responses to the Question 3 was at 0 for this panel. The reduction in the standard deviation value signifies an increased level of consensus amongst the panel members of this group.

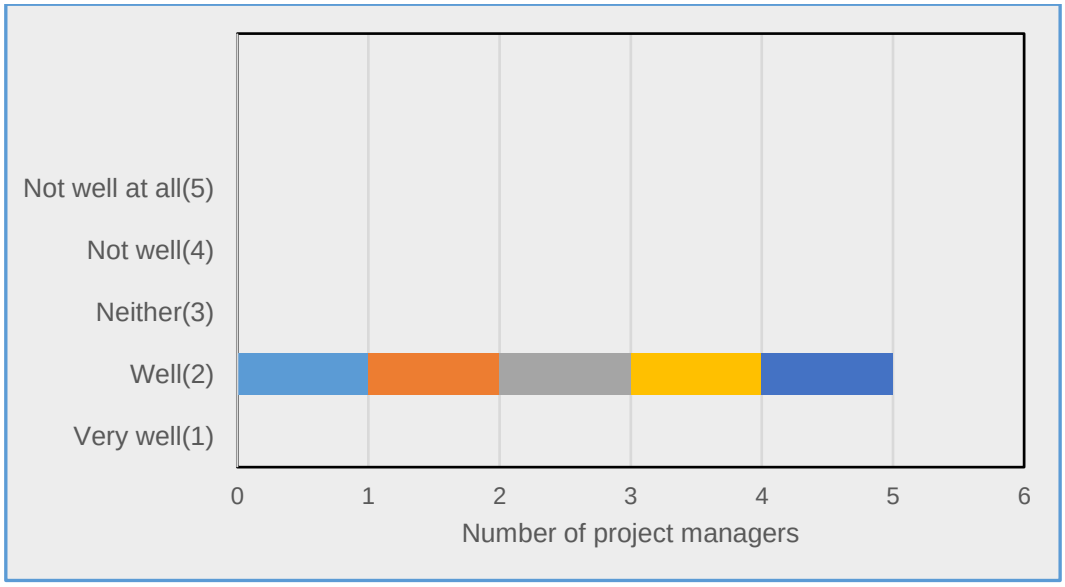


Figure 6.13 - Project managers' responses to Question 3 (Phase 1)

The answers of the academics were a carbon copy of the project managers, with all the panel members choosing *'Well(2)'*, as indicated by Figure 6.14. The results indicate that the academics were convinced that the model met its intended purpose. Again, their responses were in line with how they answered in the previous question. As was the case with the panel of project managers, the level of consensus was high amongst the members of academics as confirmed by the value of the standard of deviation (0) for the responses of these experts. As was the case with the project managers, there was a significant increase in the level of consensus amongst the academics for the responses given to Question 3, as shown in Table 6.8.

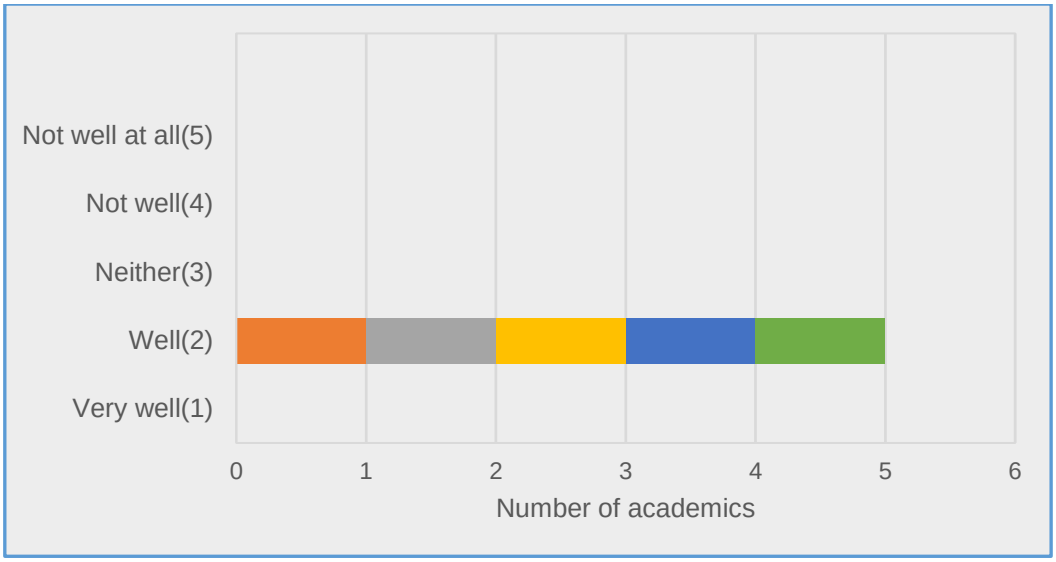


Figure 6.14 – Academics' responses to Question 3 (Phase 1)

Overall, the collective responses of the experts indicated that many of them felt that the model was fulfilling its intended purpose, as shown by Figure 6.15. Twenty seven experts said that the model was meeting its purpose *'Well(2)'*, while five experts said it was fulfilling its purpose *'Very well(1)'*. One expert said it was not fulfilling its purpose well (*'Not well(4)'*) and the remaining two expert said neither. While there was a high level of consensus in the way the experts responded to Question 3, their level of consensus was lower than their level of agreement in Question 2, as indicated in Table 6.8.

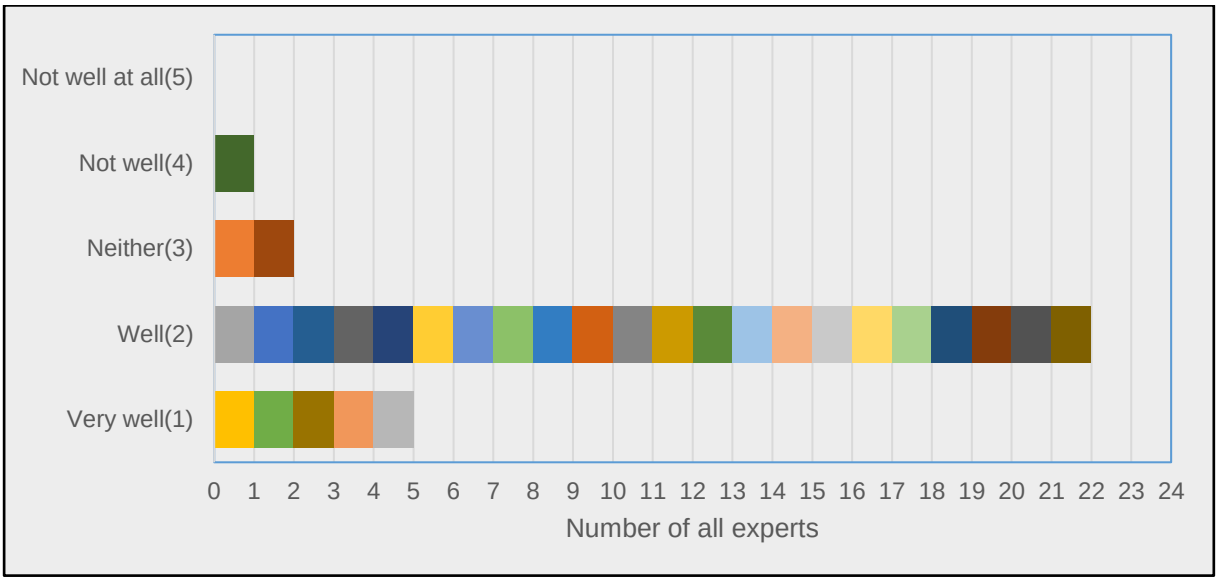


Figure 6.15 – Collective responses from all experts to Question 3 (Phase 1)

Table 6.8 – Statistical response analysis per panel and all three panels collectively to all questions thus far of Phase 1

Phase 1												
	Question 1				Question 2				Question 3			
	Mean	**Mode**	**Standard deviation**	**Level of consensus**	**Mean**	**Mode**	**Standard deviation**	**Level of consensus**	**Mean**	**Mode**	**Standard deviation**	**Level of consensus**
PTs panel	2.167	'Agree'	0.373	High	1.900	'Feasible'	0.625	High	1.95	'Well'	0.739	High
PMs panel	1.600	'Agree'	0.490	High	1.800	'Feasible'	0.400	High	2	'Well'	0	High
Academics panel	1.750	'Agree'	0.633	High	1.800	'Feasible'	0.400	High	2	'Well'	0	High
Collectively	1.733	'Agree'	0.623	High	1.867	'Feasible'	0.561	High	1.967	'Well'	0.605	High

*RED means a drop in the level of consensus compared to the previous question.
*BLUE means an increase in the level of consensus compared to the previous question.
*Black means the level of consensus did not change compared to the previous question.

6.4.2.4 How efficient is the PM*Int* tool in collecting the views of team members?

Question 4 was meant to ascertain the experts' views on how efficient the PM*Int* tool was in gathering project team members' sentiments on project-related matters, which were of interest to them. Figure 6.16 depicts the responses of the panel of project team members. 18 project team members considered the tool to have done a good (*'Good(2)'*) job in its task, but two project team members were not that impressed by the tool's performance and responded by selecting *'Average(3)'.* They cited inaccurate sentiment analysis results that the tool was occasionally producing as their reason for giving it an average mark. The researcher acknowledged their concerns but pointed out to them that the tool would produce imprecise sentiment analysis results at times, as it is generally the case with all Natural Language Processing tools, because their accuracy is not 100% (Lexalytics, 2019). They were assured that the researcher would continue searching for ways of addressing the problem. In spite of the responses of the two team members, there was a high level of consensus amongst the panel members that the tool's performance was good, and this was confirmed by the mode of *'Good(2)'* as well as the standard deviation value of 0.3, an indication that the agreement amongst the team members was high. Furthermore, the value of the standard deviation shows that this was the highest level of consensus for this panel (see Table 6.9), when compared to the level of consensus reached for the previous responses to the first three questions.

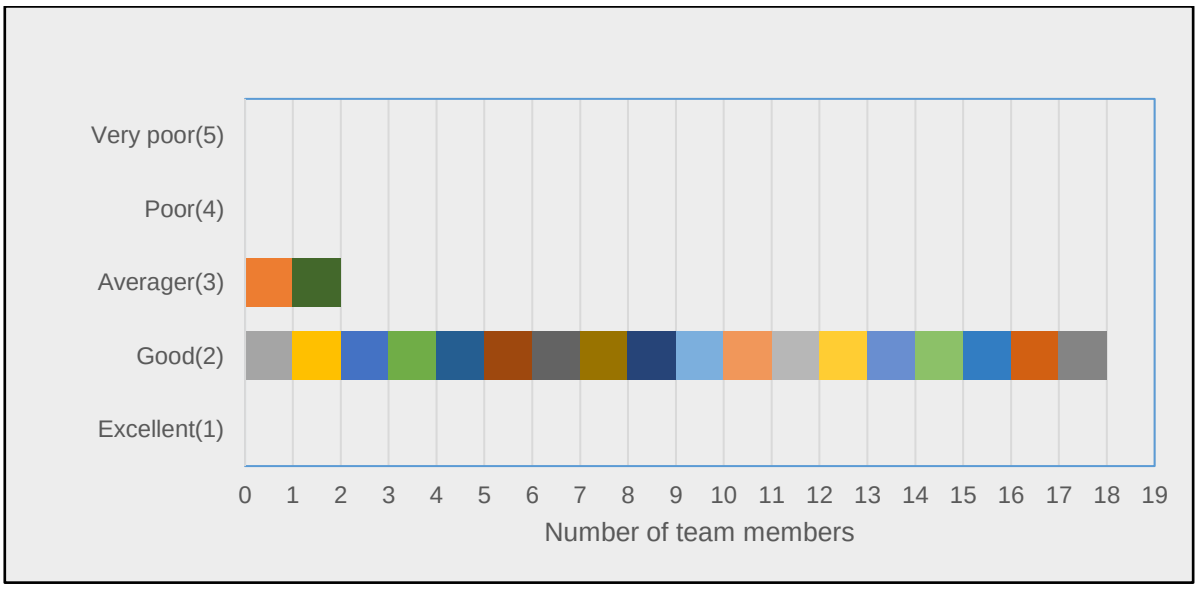


Figure 6.16 - Project team members' responses to Question 4 (Phase 1)

Two project managers also evaluated the tool's performance as average, giving similar reasons to those given by the team members, as indicated by Figure 6.17. As was the case with the two project team members, the unexpected results by the tool on certain data input was acknowledged and a similar explanation to the one given to the project team members was also advanced to the two project managers. On the other hand, the other three project managers indicated that the tool performance was above average by choosing *'Good(2)'* as their answer. The level of consensus amongst the panel members for this panel was also high, as confirmed by the standard deviation value at 0.490. The level of agreement amongst the project managers for the responses to Question 4 was higher than the level of consensus for the answers to Question 1, but lower than the level of consensus for answers to Questions 2 and 3 (see Table 6.9).

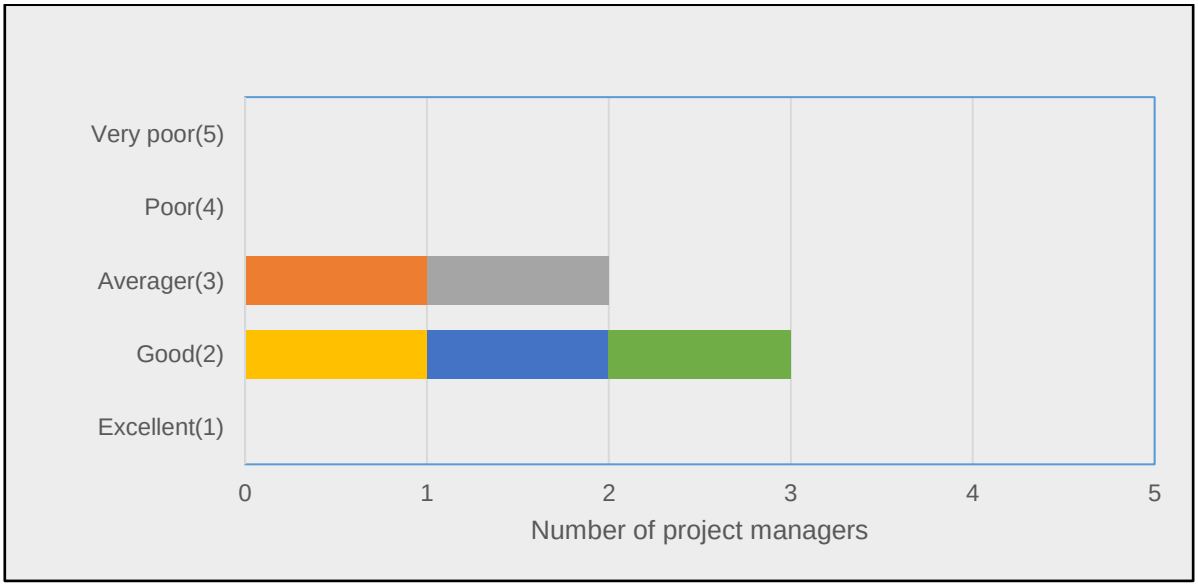


Figure 6.17 - Project managers' responses to Question 4 (Phase 1)

All the academics said the tool's performance was *'Good(2)'*, as indicated by Figure 6.18. Judging by their responses, it seems they were more understanding of the limitations of the NLP tools regarding the accuracy levels of reporting sentiments expressed in a text. Given the unanimity in their responses, it came as no surprise that the level of consensus was also high, as indicated by the standard deviation (0), and thus equalling the level of consensus reached by the group for the responses to Question 3, as shown by Table 6.9.

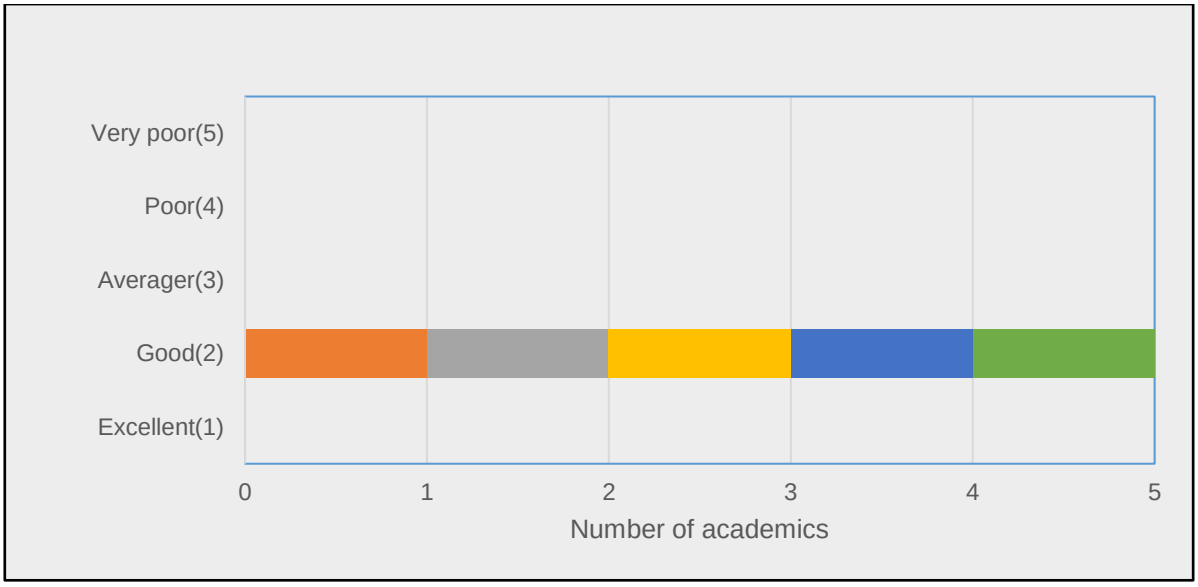


Figure 6.18 – Academics' responses to Question 4 (Phase 1)

The collective responses of all the experts are shown in Figure 6.19. As mentioned in the previous discussion, two project team members and two project managers gave the tool an average performance, whereas the remaining 26 experts were convinced that the tool's performance was (*'Good(2)'*) in carrying out its task. The value of 0.340 for the standard deviation indicates a high level of consensus amongst the group of experts, and this happens to be the highest level of consensus, when considering the level of consensus reached by the experts collectively, for the responses given to the four Questions so far, as confirmed by Table 6.9.

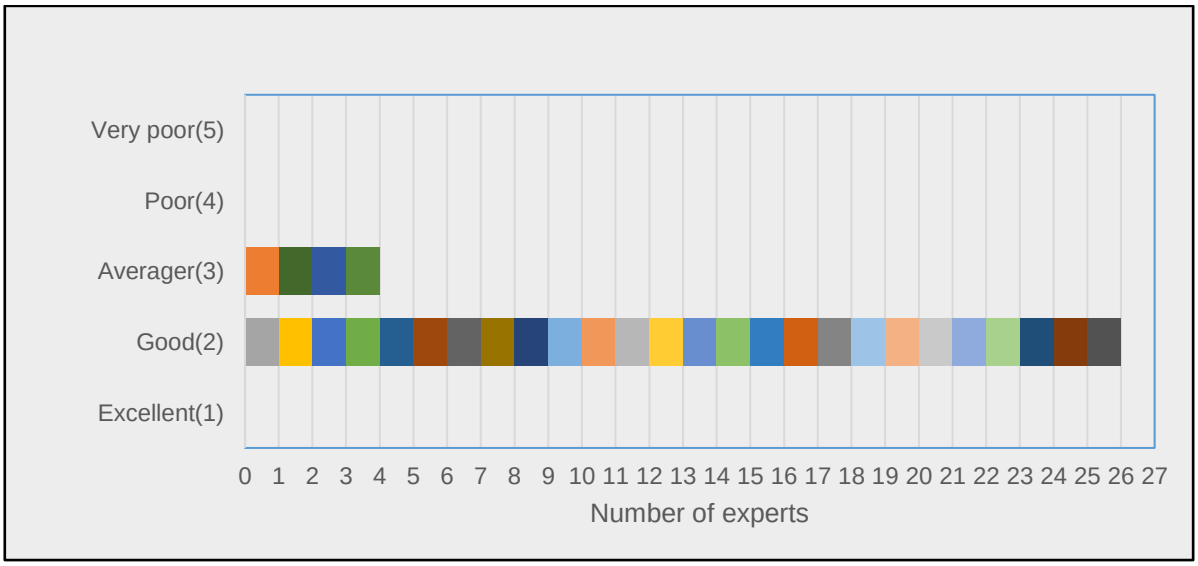


Figure 6.19 – Collective responses from all the experts to Question 4 (Phase 1)

Table 6.9 – Statistical response analysis per panel and all three panels collectively to all questions thus far of Phase 1

Phase 1												
	Question 1			Question 2			Question 3			Question 4		
	Mode	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**
PTs panel	'Agree'	0.373	High	'Feasible'	0.625	High	'Well'	0.739	High	'Good'	0.3	High
PMs panel	'Agree'	0.490	High	'Feasible'	0.4	High	'Well'	0	High	'Good'	0.490	High
Academics panel	'Agree'	0.633	High	'Feasible'	0.4	High	'Well'	0	High	'Good'	0	High
Collectively	'Agree'	0.623	High	'Feasible'	0.561	High	'Well'	0.605	High	'Good'	0.340	High

*RED means a drop in the level of consensus compared to the previous question.
*BLUE means an increase in the level of consensus compared to the previous question.
*Black means the level of consensus did not change compared to the previous question.

6.4.2.5 Improvements suggested by the experts

The aim of the Delphi process was not only to evaluate the model and the PM*Int* tool, but to improve their functionalities as well. For this reason, Questions 5 and 6 were open-ended questions aimed at requesting experts to provide recommended improvements to the model (Question 5) and the PM*Int* tool (Question 6). As mentioned before, experts were also requested to provide reasons for their selected Likert scale answers. The questions asking for reasons for the response provided, as well as Questions 5 and 6 were all open-ended questions and as such, the responses to these questions were analysed together. As discussed in Subsection 6.4.1, non-complimentary comments, which were linked to responses of Likert scale item codes between 3 and 5 or 7 were categorised under the "very serious" comments category. Any other non-complimentary comments linked to other Likert item codes were classified under the "serious" category. Moreover, all non-complimentary responses provided for Questions 5 and 6 were also classified as "very serious" comments.

Therefore, the comments and reasons from the three panellists who responded with *'Somewhat agree(3)'* in Question 1 were considered as "very serious". Furthermore, the comments (improvement suggestions) that were given by the experts as their responses to Questions 5 and 6 were also categorised under the "very serious" comments category. Table 6.10 shows all the comments that were categorised as "very serious".

Table 6.10 – Comments classified under "very serious" category (Phase 1)

#	Expert	Comment	Associated Question	Subcategory
1	PT member A	As most ICT companies have adopted ***Agile methodology***, ***how does this model address this new way of working?***	Reason for response to Question 1.	Clarification.
2	Project team member B	I agree that a model is needed, ***however this model may be challenging for Agile methodologies***.	Reason for response to Questions 1, 2, 3.	Concern.
3	PT members M and T	The model and the PM*Int* tool should be tested in a real-life ICT project environment.	Reason for response to Question 3	
4	Academic B	***How does the model handle a new PT member joining a team***? Does he/she start in Stage 1 or continue with the rest of the team members?	Reason for response to Question 1.	Clarification.
5	Project manager D	***Changing the stage sequence or order***: It may be a good idea to consider swapping Stage 2 with Stage 3 such that what is currently Stage 3 becomes Stage 2.	Question 5.	Improvement.
6	PMs D & E; PT members A & F	The PM*Int* tool ***level of inaccuracies in determining sentiments*** of team members should be addressed.	Reason for response to Question 4. Question 6	Concern & Improvement.

The following discussion explains how the author addressed each comment.

- **Comments 1 and 2**: The first two comments in Table 6.10 from project team members A and B were a question and a concern respectively and were about how the model was accommodating the Agile software development methodology. During the interviews, it was explained to the team members concerned that the model was not aligned to any particular software development methodology, but rather caters for all existing methodologies, including Agile. Every software development methodology has phases (Schwalbe, 2014:59), including Agile, as shown in Figure 6.20. At the beginning of every phase of a Sprint, for example, it would be the time to (re-)enter the processes of the model and identify all project team members associated with that phase. During that phase, all other stages of the model would be executed, as determined by the PMO in conjunction with project managers. For example, weekly Sprint review meetings could be used as the time to collect the views and concerns of team members (Stage 2 of the model). The operationalisation of the model is flexible, and is left to the PMOs, the offices that oversee and enforce project management practices, to decide on how best to implement the model. After the discussion, both the concern and the question seemed to have been addressed as both team members seemed to have been satisfied with the explanation. However, project team member B indicated that he needed time to check if indeed the model was catering to Agile teams.

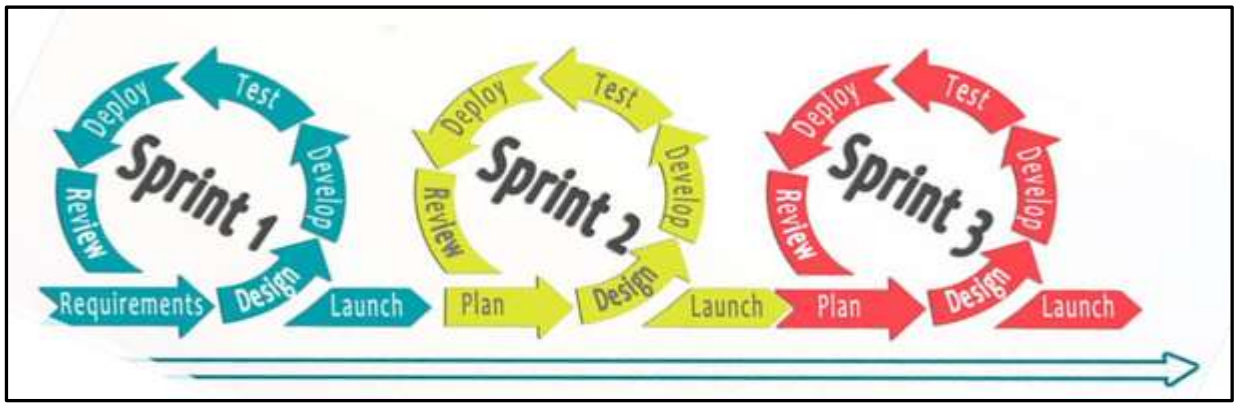


Figure 6.20 – Sprint phases (Source: SCRUMstudy, 2017)

- **Comment 3**: Team members M and T proposed that both the model and the PM*Int* tool be tested on a real-life project environment. This recommendation was in line with the author's intention of validating the model and the PM*Int* tool in a real-life project environment. The model and the tool were tested in a real-life environment and the results thereof are discussed in Section 6.5 of this chapter.
- **Comment 4**: One academic panel member wanted to know how the model handled new project team members in relation to existing team members. The explanation offered to the academic was that any new team member is identified, as Stage 1 of the model demands. After that, all other stages unfold as necessary and there is no stage that is skipped in the process. It was also stressed that the model is oriented towards ICT project teams, yet is specific to the individual team member, in that each team member's needs are identified and addressed by a PM. The account was well received by the expert.
- **Comment 5**: Project manager D suggested that Stages 2 and 3 of the model be swapped on the basis that the activities of Stage 3 should precede the ones of Stage 2. The recommendation was considered and implemented as suggested because it seemed logically correct to do so, and the model in Figure 4.1 reflects these changes.
- **Comment 6**: The last suggestion was about improving the accuracy levels of the sentiment analysis results of the PM*Int* tool. This suggestion came from four experts, two PMs and two PT members, as shown in Table 6.9. As explained before, the concerns and suggestions were acknowledged and participants were assured that the author would endeavour to address the problem. However, it was mentioned to the experts that it was generally regarded as 'acceptable' that Natural Language Processing tools were not producing 100% accurate results (Lexalytics, 2019).

The next discussion pertains to the comments categorised as serious, as listed in Table 6.11.

Table 6.11– Comments classified under "serious" category (Phase 1)

#	Expert	Comment	Associated Question	Subcategory
1	Project manager A	The model and the PM*Int* tool ***need to be tested in practice*** (real project environment).	Reason for the response to Question 1.	Improvement
2	Project team member K	***Gathering of information should be done by someone else and not by a project manager*** to protect team members from 'victimisation'.	Question 5.	Improvement
3	Project team member P	***The model should provide the amount of time*** that should be taken to get to Stage 5.	Question 5.	Improvement

- **Comment 1**: Project manager A proposed that the model be tested in a real-life environment. This recommendation was similar to Comment 3, under "very serious" comments, and was addressed accordingly.
- **Comment 2**: Project team member K felt that the model should give the set of team members views to someone other than the project managers, to guard against *'victimisation'* of PT members. The difficulty in implementing the recommendation is the fact that a project manager needs to personally know the needs of team members in order to address them effectively. Balancing the need of having PMs addressing PT members' needs and ensuring that there is no *'victimisation'* is a difficult process. The author hopes that the oversight role played by the PMO in the implementation of the model would somehow provide this balancing act, amongst other things. This explanation was offered to the project team member and seemed to have been understood.
- **Comment 3**: The suggestion made by Project team member P was that the stages of the model should have an explicit time span. It was explained to the expert that the implementation modality of the model is left to individual PMOs as the custodians of project management practices. The author thought that the inclusion of timeframes would be too prescriptive to organisations, which should be allowed to customise the implementation of the model to suit their style of operating projects. The explanation provided appeared to be well received by the team member.

Many other comments that were made by the experts were complimentary of the model, and the following are some of these:

- *"This is a very good model which can easily be applied and executed in most generic project environments."*

- *"The model is very feasible to apply in a real-life project setting."*
- *"Yes (agree) definitely needed. It would really make a big difference in helping project managers work easier with project team members …"*
- *"Having such a model to gather project teams concerns and interests would ultimately benefit projects."*
- *"The model makes it easier for PMs to interact with the project team members better, understand their needs and interest."*
- *"The project team members are the mechanism to get the project delivered. These PTs therefore have to have their needs addressed to be empowered to do carry out their responsibilities for the success of the project."*

6.4.2.6 A summary of the data analysis results of the Delphi method Phase 1

The following discussion summarises the data analysis results presented in Subsections 6.4.2.1, 6.4.2.2, 6.4.2.3, 6.4.2.4 and 6.4.2.5. The analysis of responses to Question 1 that were presented in Subsection 6.4.2.1 are summarised next.

A majority of the experts for each of the three panels indicated that the model was needed (mode = *'Agree(2)'*, for all the three panels) by the ICT industry, as shown by Table 6.6. Moreover, there was a high level of consensus amongst the panel members of each panel for their responses. However, two project team members and one academic said they were not completely convinced (selected *'Somewhat agree(3)'*) that the model was needed by the Information and Communication Technology sector. The two PT members had reservations about the model's capability to deal with Agile teams, while the academic expert wanted an explanation of how new project team members were accommodated by the model. Each concern or comment by the experts was addressed during the interview sessions with them, as discussed in the previous subsection. Collectively, a majority (27) of the experts gave a resounding confirmation for the need of the model by the ICT sector, while only three of them gave it a weak affirmation, as indicated in Figure 6.7. The standard deviation value of 0.623, as indicated in Table 6.6, also confirmed the high level of consensus amongst the experts on the model utility to the ICT sector.

With regard to Question 2, 15 PT members, four project managers and four academics all mentioned that the model was *'Feasible(2)*' for application in a real-life environment, while four PT members, one project manager and one academic said the model was

'Highly feasible(1)'. Basically, most of the panel members from each of the three panels assessed the model as feasible. On the other hand, one project team member indicated that the application of the model in a real-life situation was *'Infeasible(4)*', citing that he needed time to process the discussion the researcher had with him to address his concerns, mentioned in Question 1. Given the response of a majority in each group of panels, it was not surprising that a majority of the experts jointly reached a high-level consensus that the model was feasible for application in a real-life environment, as confirmed by both Figure 6.11 and Table 6.7.

As for Question 3, 12 project team members, all five project managers and all five academics said the model was fulfilling its purpose *'Well(2)'*, while five project team members indicated that it was meeting its purpose '*Very well(1)'*. Two project team members were undecided (selected *'Neither(3)'* as their answers), whereas the remaining project team member indicated that the model was not fulfilling its purpose well (chose *'Not well(4)'*). As with the previous two questions, most of the experts were convinced that the model was fulfilling its purpose, as confirmed by Figure 6.15. The agreement was reached with a high level of consensus amongst the experts, as indicated by Table 6.8.

In response to Question 4, 18 project team members considered the tool to have done a good (*'Good(2)'*) job in its task, but two project team members were not entirely happy with the tool's performance and thus marked it as *'Average(3)'.* Two project managers were similarly not convinced that the tool had produced an average performance, while the other three project managers said it was good. The academics were the only group of experts that seemed to have understood the limitations of the tool as a Natural Language processing tool, because they all said its performance was good. Collectively, 26 experts mentioned that the tool did well (selected *'Good(2)'*), while the remaining four said it did average work. Moreover, as shown in Table 6.9, the value of standard deviation of 0.340, indicates a high level of consensus by the members of the three panels of experts combined.

Finally, various suggestions were made by the experts, as indicated by Tables 6.10 and 6.11, to improve both the model and the tool. Some of the comments were deemed implementable, while others were not, for reasons that were mentioned in Subsection 6.4.2.5. The next subsection discusses the results of Phase 2 of the Delphi method.

6.4.3 Data analysis: Delphi Phase 2

After the model and the PM*Int* tool were refined using the feedback and suggestions made by the experts during Phase 1 of the Delphi method, both the model and the tools were made available to the expert for further evaluation and refinement. Furthermore, the responses and comments from all the experts were also made available to all the participants. The responses by the researcher to each comment that was made by the experts were also given to the experts. Interview questions were generated using the feedback from the experts from the previous phase (see Appendix E), and as a result, only the last five questions of Phase 1 constituted the interview questions for this round. In other words, the first question of the previous phase was considered unnecessary. The next subsection presents the data analysis results of the responses to the first question of this phase.

6.4.3.1 How feasible is the application of the model in a real-life environment?

This question (Question 1 of Phase 2) was the same as Question 2 of Phase 1. The question was intended to establish the views of the experts about the feasibility of the model in a real-life project environment. Figure 6.21 shows how the panel for PT members responded to the question during Phase 2. The team member who said the model was *'Infeasible(4)'* for a real-life environment in Phase 1 reviewed his decision in this phase to *'Feasible(2)'*. There are three possible reasons which could have contributed to his change of heart, the discussion between the interviewer and the member in Phase 1 during the interview, the responses and comments of other experts, or the revised model. The reason for speculation on the possible cause for change in answers is because many of the experts did not really say much on the basis of their choice of answers. The two team members who had selected *'Feasible(2)'* as their initial answer to this question in the previous phase chose *'Highly feasible(1)'* in this phase. Again, the possible cause for this change of position could be explained as before. Similar to Phase 1, a majority of project team members said the model was feasible for use in the real-life environment; although the level of consensus was higher in this phase than it was for the same question in the previous phase, as indicated by Table 6.12. The high level of consensus may be attributed to the two team members who changed their answers from *'Feasible(2)'* to *'Highly feasible(1)'* in this phase, as well as the team member who chose *'Feasible(2)'* instead of *'Infeasible(4)'* during Phase 1.

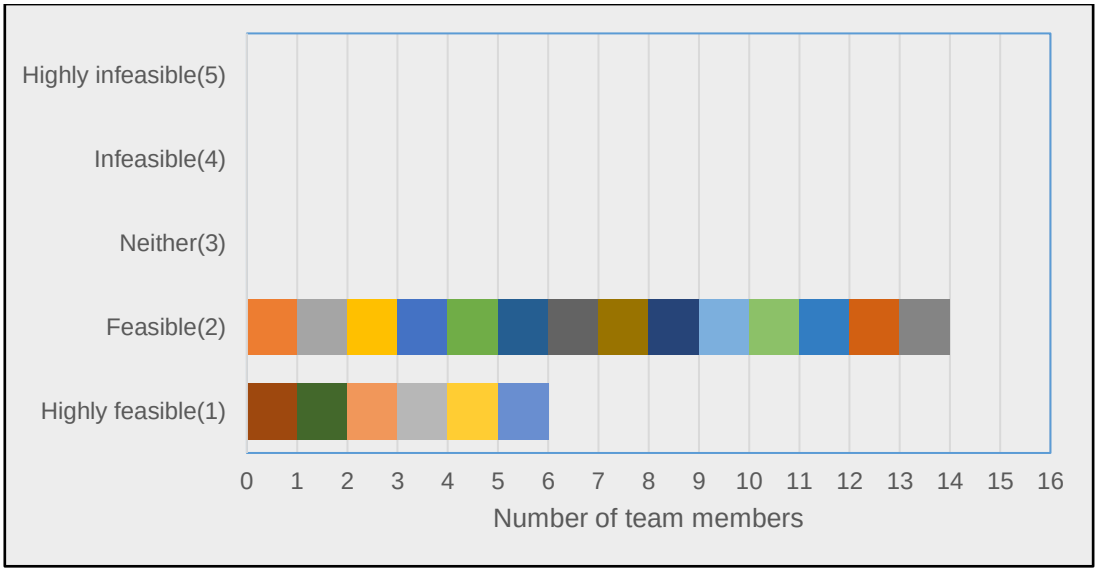


Figure 6.21 – Team members' responses to Question 1 (Phase 2)

One project manager was convinced in this phase that the model was *'Highly feasible(1)'*, unlike in the previous round, where she said it was merely *'Feasible(2)'*. The decision by the PM to answer differently in this round could also be attributed to the reasons given previously. The other four project managers answered in the same way as they did in Phase 1, as shown by Figure 6.22. Table 6.12 shows that there was a slight decrease in the standard deviation (from 0.4 to 0.5) for the PMs' responses for this question, implying a decline in the level of consensus amongst the panel members. The change in the answering patterns by the single project manager could be given as a possible reason for the drop in the level of agreement by the panel.

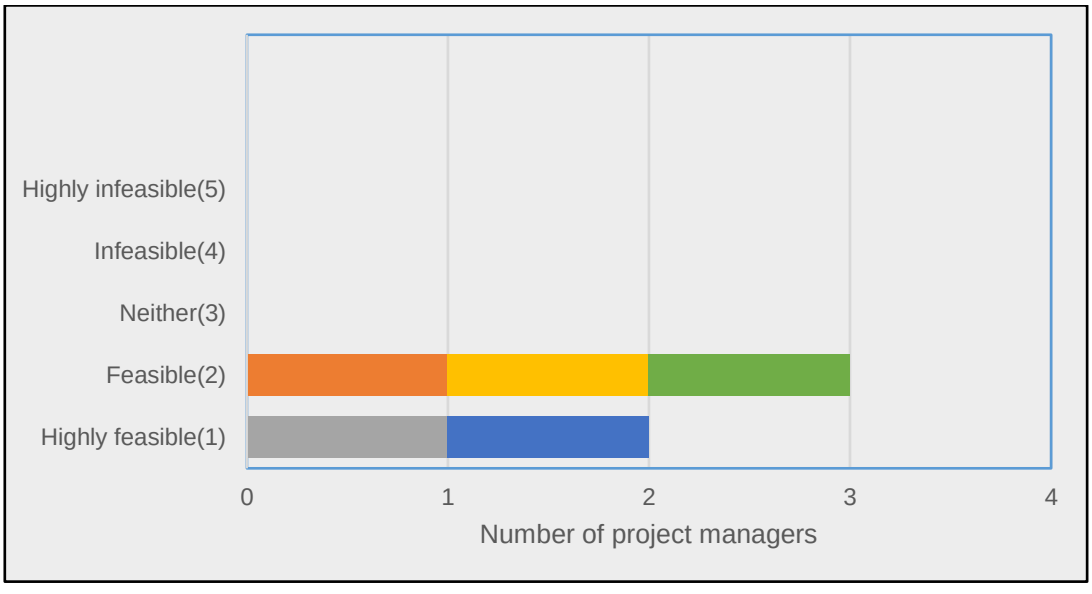


Figure 6.22 – Project managers' responses to Question 1 (Phase 2)

The academics' panel is the only one that was highly consistent in their answering patterns, as they answered in the same way as in the previous phase. Figure 6.23 indicates that all panel members unanimously said the model was *'Feasible(2)'* for use in real-life situations. The consistency in response also meant that the level of consensus remained the same as in previous round for the same question, and Table 6.12 confirms this.

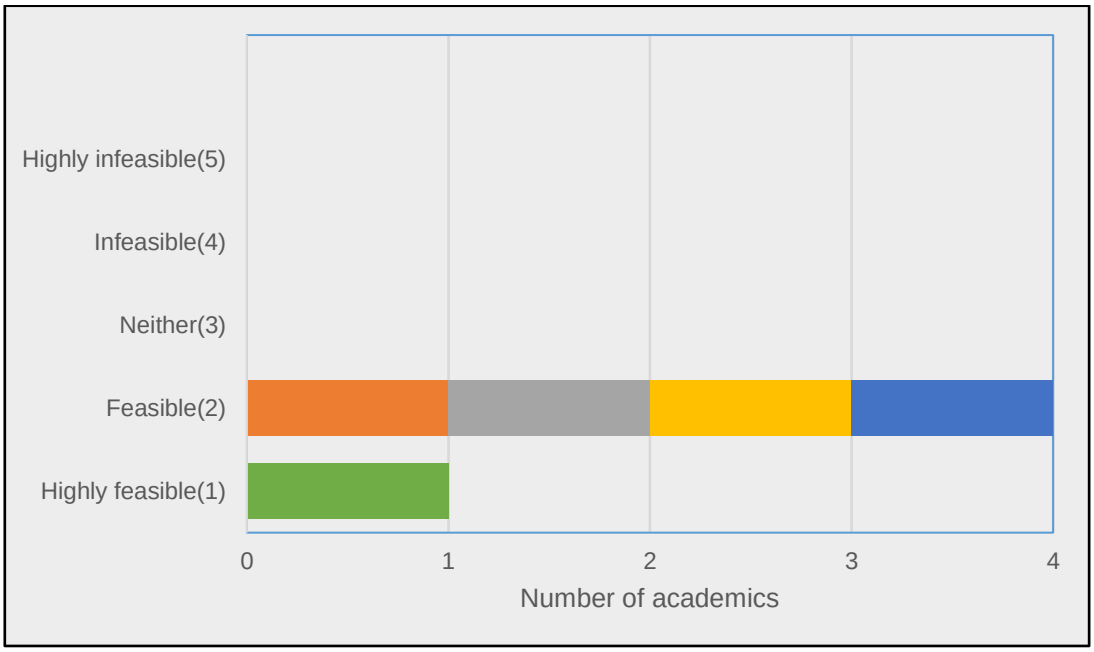


Figure 6.23 – Academics' response to Question 1 (Phase 2)

When considering responses by all the experts combined, twenty-one of them stated that the model was *'Feasible(2)'*, whereas nine experts indicated that the model was *'Highly feasible(1)'* for real-life project environments, as shown by Figure 6.24. The noticeable change here is that more experts changed their previous responses from *'Feasible(2)'* to *'Highly feasible(1)'*. Moreover, there was also a change in answers, from 'Infeasible*(4)'* to *'Feasible(2)'*, by one project team member, as discussed at the beginning of this subsection. The plausible reasons for the experts having high confidence in the model's feasibility for use in the real-life project environment could again be attributed to the responses given by the researcher to the comments made by the experts in the previous phase, or the responses and comments of other experts or the revised model. The change in the choice of answers, especially by the PT member who changed from 'Infeasible*(4)'* to *'Feasible(2)'* caused a marginal increase in the level of consensus amongst the experts, as indicated in Table 6.12.

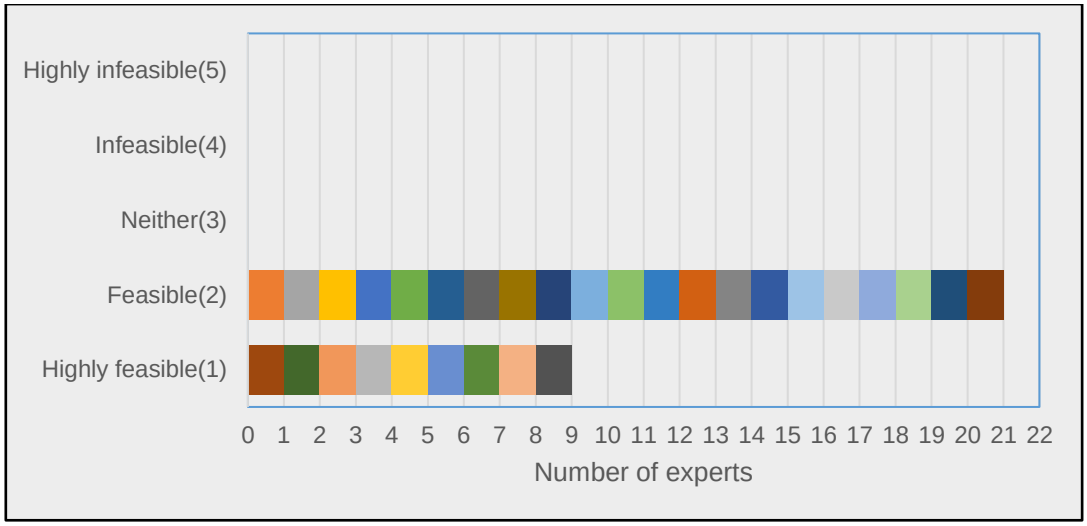


Figure 6.24 – Collective responses from all experts to Question 1 (Phase 2)

Table 6.12 – Statistical response analysis per panel and collectively to indicated questions of Phases 1 and 2

	Phase 1			Phase 2		
	Question 2			Question 1		
	Mode	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**
PTs panel	'Feasible'	0.625	High	'Feasible'	0.465	High
PMs panel	'Feasible'	0.4	High	'Feasible'	0.5	High
Academics panel	'Feasible'	0.4	High	'Feasible'	0.4	High
Experts Collectively	'Feasible'	0.561	High	'Feasible'	0.458	High

*RED means a drop in the level of consensus compared to the same question in Phase 1.
*BLUE means an increase in the level of consensus compared to the same question in Phase 1.
*Black means the level of consensus did not change compared to the same question in Phase 1.

6.4.3.2 How well does the model fulfil its intended purpose?

Figure 6.25 provides a summary of responses from the panel for project team members. The two team members who indicated that the model was *'Neither(3)'* fulfilling its purpose or failing to do so, as well as the team member who said the model was not meeting its purpose (*'Not well(4)'*) changed their responses in this round to *'Well(2)'*. Based on their reasons for their change in response, their decisions seemed to have been influenced either by the answers of other panel members or the revised model itself. Other project team members were unmoved by the revised model or the answers of other panel members, and selected the same answers as in the previous phase. This realignment of answers by the three project team members caused the level of consensus by this panel to increase slightly, as the value of standard deviation moved from 0.739 in the previous round to 0.433 in this round for this question, as shown by Table 6.13. In short, all project team members either said the model was fulfilling its purpose well or very well.

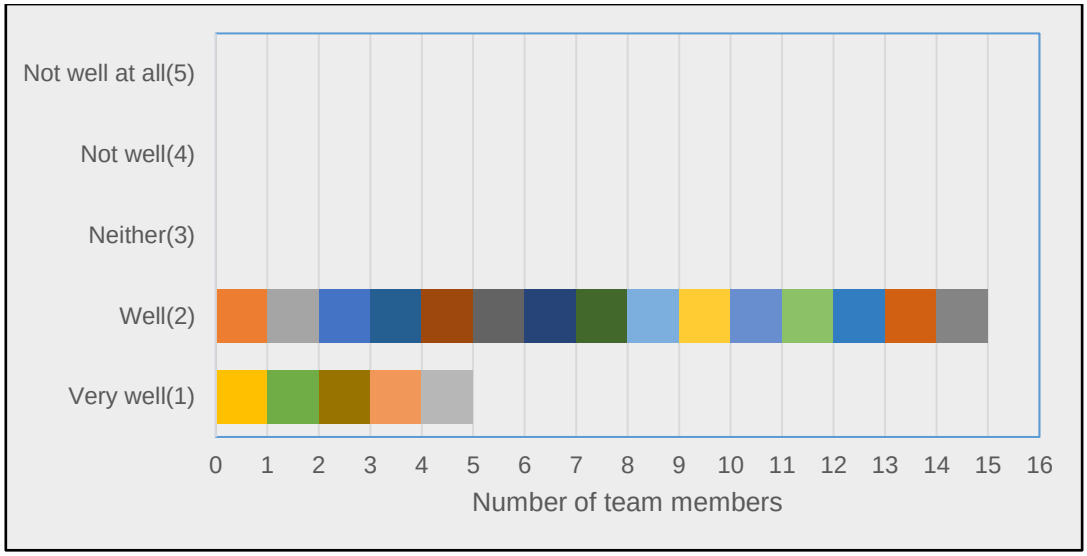


Figure 6.25 – Team members' responses to Question 2 (Phase 2)

Four project managers gave similar answers, namely, that the model fulfilled its purpose well, as the responses in Phase 1. Figure 6.26 shows that the fifth member of the project manager panel indicated that the model performed its purpose *'Very well(1)'* as opposed to her initial response of *'Well(2)'* in the previous round. A possible explanation for the expert altering her initial answer is either the revised model or certain responses from the other two panels, but not likely from the answers of her fellow panel members because their answers were similar. The alterations of the answers by one project manager slightly lowered the level of consensus, from 0 to 0.4 (see Table 6.13), for the project managers' panel for this question.

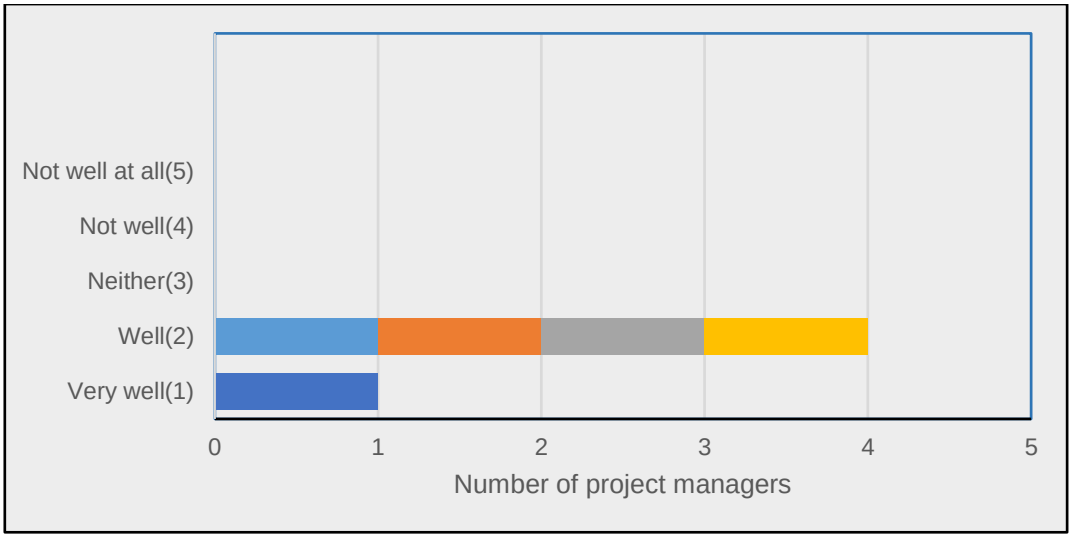


Figure 6.26 – Project managers' responses to Question 2 (Phase 2)

The academics' panel was the only panel of experts, which did not change any response that was provided in the previous phase, as depicted in Figure 6.27. This implies that neither the revised model nor the responses of experts from the other two panels persuaded the academics to alter their positions. As there was no change in answers, this means the level of consensus for this question remains the same as the previous round, namely 0.

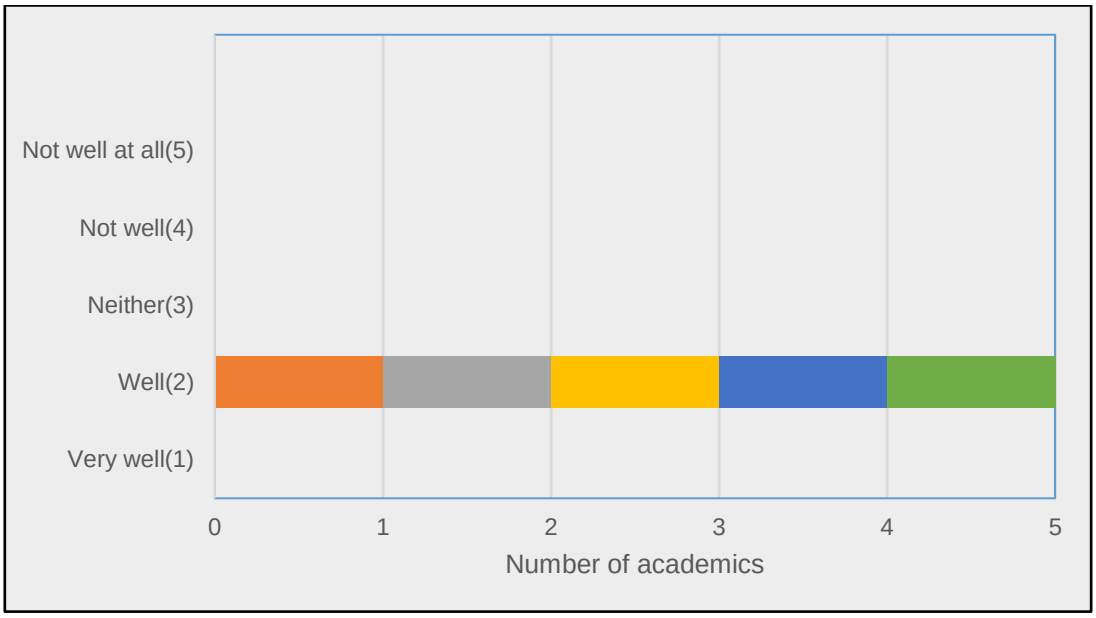


Figure 6.27 – Academics' response to Question 2 (Phase 2)

The overall statistical values for the combined responses of the three panels to this question show a high level of consensus, with a standard deviation of 0.4, a slight improvement from the previous value of 0.605, as shown in Table 6.13. The value of the mode being *'Well(2)'* shows that the three groups combined maintained their assessment of the model as being well-suited for a real-life project environment. Figure 6.28 shows that 24 experts mentioned that the model was *'Well(2)'* suited for a real-life situation, while the other six panellists said it was *'Very well(1)'* suited.

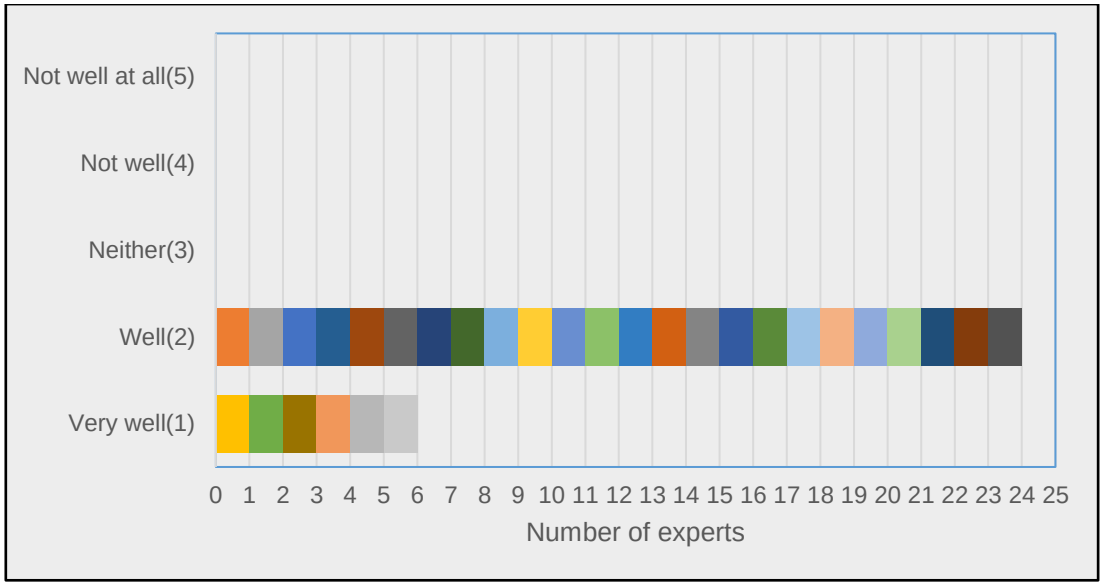


Figure 6.28 - Collective responses from all experts to Question 2 (Phase 2)

Table 6.13 – Statistical response analysis, per panel and collectively, to indicated questions of Phases 1 and 2

		Question 2			Question 3		
Phase 1		**Mode**	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**
	PTs panel	'Feasible'	0.625	High	'Well'	0.739	High
	PMs panel	'Feasible'	0.400	High	'Well'	0	High
	Academics panel	'Feasible'	0.400	High	'Well'	0	High
	Collectively	'Feasible'	0.561	High	'Well'	0.605	High
Phase 2		**Question 1**			**Question 2**		
		Mode	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**
	PTs panel	'Feasible'	0.465	High	'Well'	0.433	High
	PMs panel	'Feasible'	0.5	High	'Well'	0.4	High
	Academics panel	'Feasible'	0.4	High	'Well'	0	High
	Collectively	'Feasible'	0.458	High	'Well'	0.4	High

*RED means a drop in the level of consensus compared to the same question in Phase 1.
*BLUE means an increase in the level of consensus compared to the same question in Phase 1.
*Black means the level of consensus did not change compared to the same question in Phase 1.

The next section presents the analysis of responses of the experts to Question 4.

6.4.3.3 How efficient is the PM*Int* tool in collecting the views of team members?

Responding to Question 4, 19 project team panel members indicated that the tool was "good" in the collection of project team members' views, whereas one project team member maintained her position that the tool was simply average in its task performance. Her reason for sticking with her response was that the tool was producing inaccurate sentiment analysis results for certain inputs, as mentioned in the previous round. However, the other team member who also said the PM*Int* tool performed at an

average level in Phase 1, changed his view in this phase and joined the team members who claimed that the tool did a good job. From his explanation for the change of answers, it would appear that the explanation given by the researcher on the limitations of NLP tools persuaded him to switch responses. The rest of the project team members remained unwavering from their initial responses, as indicated by Figure 6.29. The movement made by one team member from choosing *'Average(3)'* as a response to selecting *'Good(2)'* resulted in a marginal increase in the level of consensus by this group, as indicated by Table 6.14. The group almost unanimously said the performance of the tool in collecting PT members' views was *'Good(2)'*.

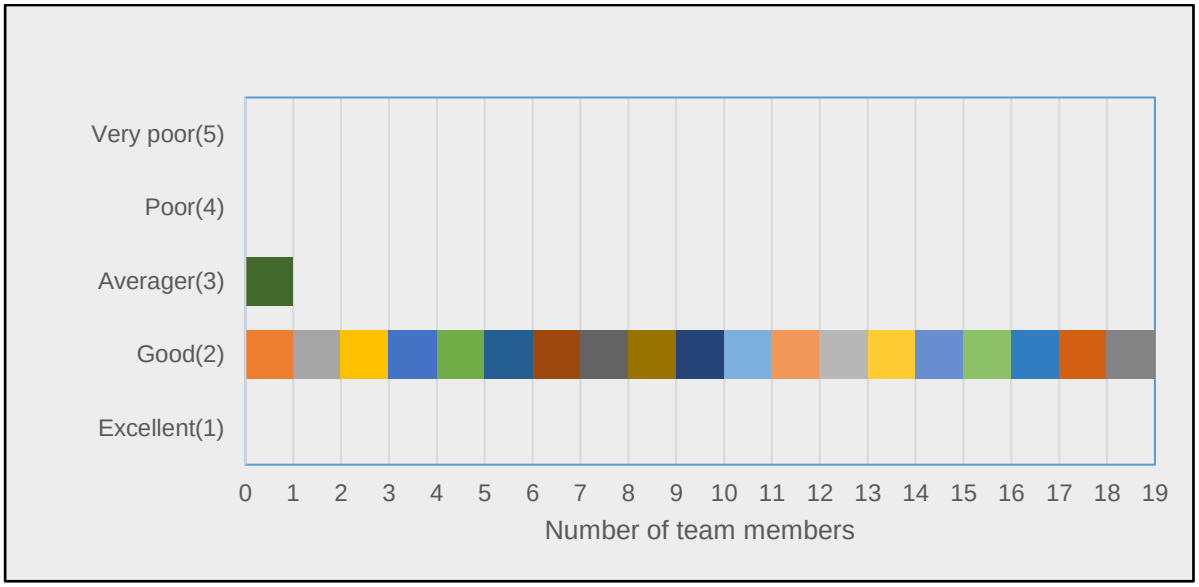


Figure 6.29 – Team members' responses to Question 3 (Phase 2)

The responses of project managers for this question were similar to their responses of the same question in the previous round, as depicted by Figure 6.30. This basically means that two project managers insisted that the tool was performing at an average level, whereas three project managers were convinced its performance was good. As with one project team member, the two project managers somehow remained unmoved by the responses of other experts, as well as the explanation given by the researcher regarding Natural Language Processing tools' inability to reach 100% accuracy levels. The similarity of answers of the project managers in the two rounds meant the level of consensus was also unchanged, and remained at 0.489, as shown by Table 6.14.

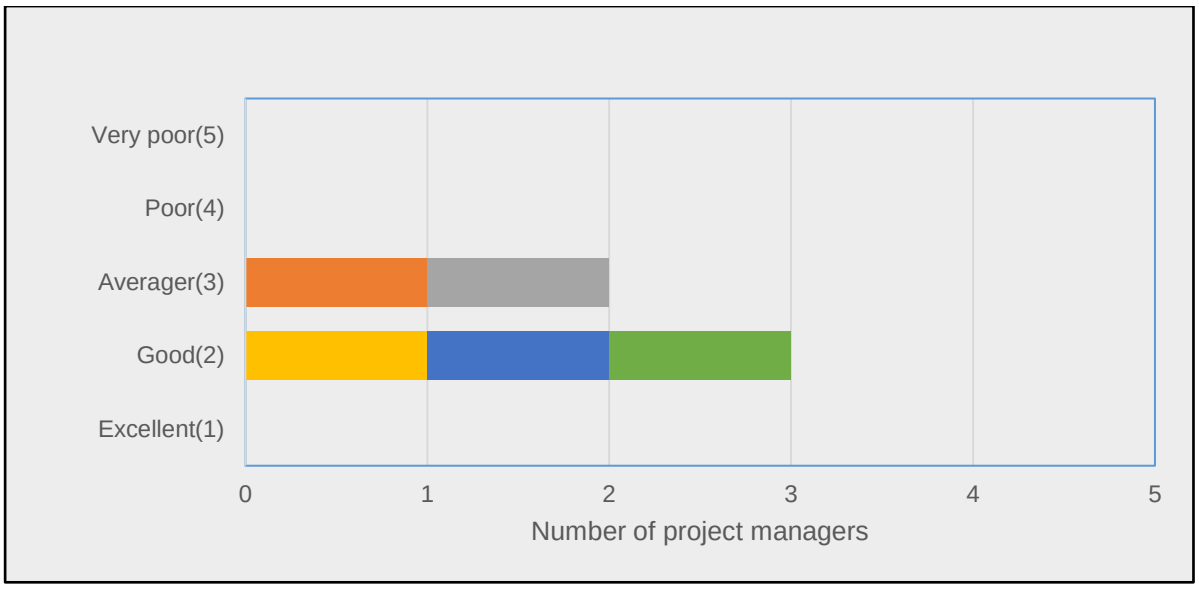


Figure 6.30 – Project managers' responses to Question 3 (Phase 2)

Figure 6.31 shows that all academics indicated that the PM*Int* tool was above average on its performance in the collection of PT members' views. The response results are similar to their answers in Phase 1 for the same question. This means the academics were not swayed by the responses of the other four experts on the other panels who gave the tool's performance an "average" score. As mentioned before, the academics seemed to be more understanding of the imprecision of sentiment analysis tools. The unchanged answers resulted in the level of consensus by this group being unaltered from the previous round.

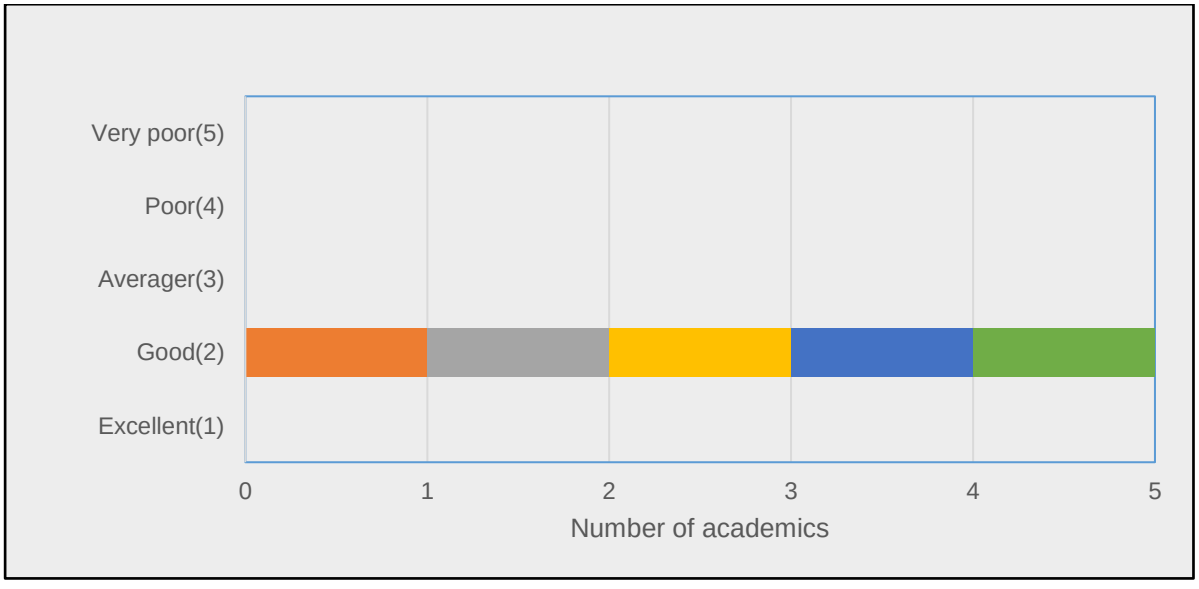


Figure 6.31 – Academics' responses to Question 3 (Phase 2)

The only change from the collective responses of the experts from the previous round is the project team member who changed his answer from *'Average(3)'* to *'Good(2)'*, resulting in a total of 27 experts who said the tool's performance was '*Good(2)'*, and three experts who claimed that the performance was *'Average(3)'*, as indicated by Figure 6.32. Moreover, the change in the choice of answers slightly increased the level of consensus, as shown by Table 6.14.

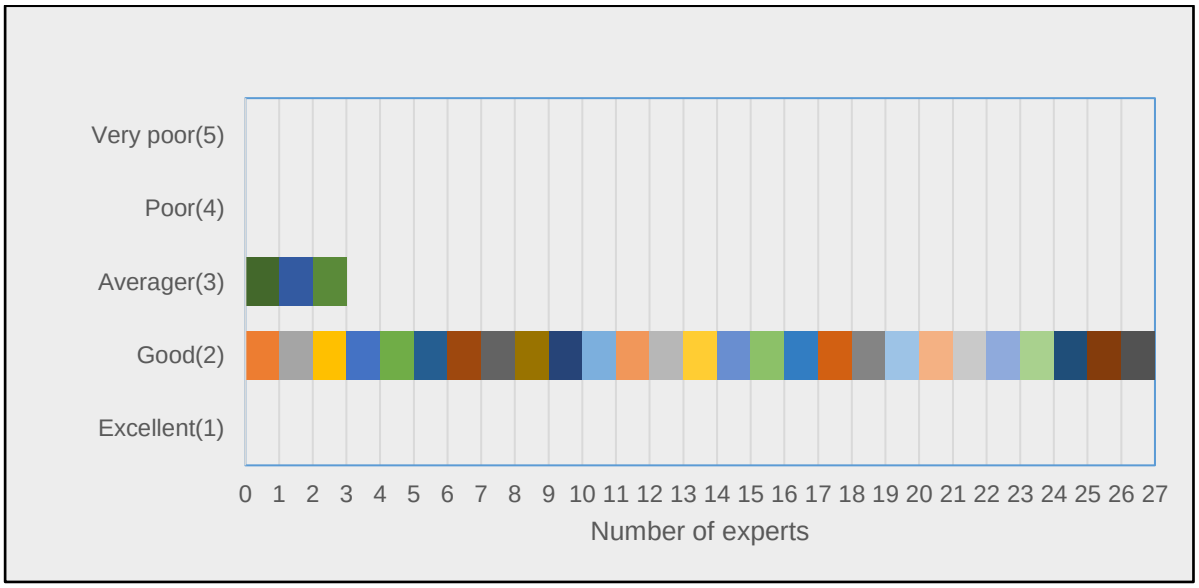


Figure 6.32 – Collective responses from all experts to Question 3 (Phase 2)

Table 6.14 – Statistical response analysis per panel and collectively to indicated questions of Phases 1 and 2

		Question 2			Question 3			Question 4		
		Mode	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**
Phase 1	PT's panel	'Feasible'	0.625	High	'Well'	0.739	High	'Good'	0.300	High
	PM's panel	'Feasible'	0.4	High	'Well'	0	High	'Good'	0.490	High
	Academics' panel	'Feasible'	0.4	High	'Well'	0	High	'Good'	0	High
	Collectively	'Feasible'	0.561	High	'Well'	0.605	High	'Good'	0.340	High
		Question 1			**Question 2**			**Question 3**		
		Mode	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**	**Mode**	**Standard deviation**	**Level of consensus**
Phase 2	PT's panel	'Feasible'	0.465	High	'Well'	0.433	High	'Good'	0.218	High
	PM's panel	'Feasible'	0.5	High	'Well'	0.4	High	'Good'	0.490	High
	Academics' panel	'Feasible'	0.4	High	'Well'	0	High	'Good'	0	High
	Collectively	'Feasible'	0.458	High	'Well'	0.4	High	'Good'	0.3	High

*RED means a drop in the level of consensus compared to the same question in Phase 1.
*BLUE means an increase in the level of consensus compared to the same question in Phase 1.
*Black means the level of consensus did not change compared to the same question in Phase 1.

6.4.3.4 Suggestions for improvement from the experts

In this subsection comments from experts were identified and analysed, following the data classification and analysis process outlined in Subsection 6.4.1. Table 6.15 lists three comments from experts that were classified as very serious comments in this round. The next discussion is about how the very serious comments were attended to.

Comments 1: The first comment was also expressed in the previous round by the same experts, and therefore was not a new comment in this phase. These comments were made by the experts who graded the PM*Int* tool performance as "average" based on its imprecision in discerning expressed sentiments at times. Despite the explanation given to the experts in the previous phase, they maintained the need to have the tool improved to address the problem. As explained in Subsection 6.4.2.5, under comment number 6, the author acknowledged that the problem would be something to be attended to going forward.

Comments 2: The comment relates to what the expert would like to have as part of future improvements of the model. The suggestion was noted, as it is a noble one, which sought to have as many stages of the model automated or semi-automated as much as possible, as was the case with Stage 3, where the PM*Int* tool assists in the collection of the views and comments of PT members. The author took note of the suggestion and committed to consider it for future improvements of the model.

Comments 3: Comment number 3 was seeking clarification on what the PMO would do with the feedback during Stages 5 and 6. The feedback should assist the PMO to identify areas of improvement in the engagement process between a PM and the project team. Furthermore, it also should be used to discover best practices, which should be shared and standardised for the entire organisation.

Table 6.15 – Comments classified under very serious category (Phase 2)

#	Expert	Comment	Associated Question	Subcategory
1	PMs D & E; PT member A	The PM*Int* tool ***level of accuracy in determining the sentiments*** of project team members should be addressed.	Reason for response to Question 3 Question 5	Concern & Improvement
2	Project manager C	Maybe, ***in future developments, have more of the stages of the model automated*** to alleviate administrative work for PMs.	Question 4	Concern
3	PT member K	***What does the PMO do with the feedback received*** from stages 5 and 6 (post assessment and review)?	Question 4	Clarification

The only comment classified under the “serious” category for Phase 2 is listed in Table 6.16. The comment raised a concern that the model was adding to PMs’ administrative tasks. Indeed, this might be the case. However, it is a needed trade-off that organisations need to make, considering the number of grave challenges that are brought about by the lack of attention paid to needs and views of project team members that the model wants to address. Some of these challenges include project failure, high turnover of ICT professionals, low team morale, etc. Therefore, unfortunately it is a necessary additional ‘burden’ that needs to be taken up in order to address some of the challenges. Automation of the stages (or some of them) of the model, as discussed in Phase 1, might lighten the administrative load created by the use of the model.

Table 6.16 – Comments classified under serious category (Phase 2)

#	Expert	Comment	Associated Question	Subcategory
1	Project manager C	The model might just add administrative workload on project managers.	Reason for response to Question 2	Concern

Various members of the three panels made a number of complimentary comments, some of which are listed here:

- *“The model is aligned to common management job and its activities, thus becoming natural to the scope of management. Does not require additional costly effort, seamlessly fitting in well with project management activities.”*
- *“The model is practical and addresses the current gap in the attendance of ICT project team members.”*
- *“It does bring about focused and deliberate attention in a systematic and organised manner to the needs of PT members, affording each member a hearing from project managers. This ensures bringing about PT members feeling included, and indeed being included in the project in many respects, other than just ordinarily as workers, but importantly as valued stakeholders.”*
- *“With the changes brought in from previous round, I think it fulfils its role.”*
- *“This model is highly feasible and applicable in a real-life project. I like that it can be easily adopted and become part of any PMO or Project team culture. The engagement process is something I would include in the team's Project charter, (to ensure consistent application of the fundamental principle/s of the model).”*

- *"Satisfied with the amendments to the model, and with the explanations provided on feedback from the first interviews."*
- *"The revised model through tracking project teams` interest and concerns, provides a feedback loop to PMs' management of projects, which makes the model very adaptive in nature which is what is required to keep up with the fluidity of real-life projects."*
- *"The project team members are central to the implementation of the model."*
- *"I don't see any other improvement needed."*

6.4.3.5 A summary of the data analysis results of the Delphi method Phase 2

In this phase there were three Likert scale questions, namely, Questions 1 to 3. These questions were the same as Questions 2 to 4 of Phase 1. This subsection presents a summary of data analysis results, which were discussed in Subsections 6.4.3.1, 6.4.3.2, 6.4.3.3 and 6.4.3.4.

As a response to Question 1, all project team members either said the model was *'Feasible(2)'* or *'Highly feasible(2)'* for a real-life environment, as indicated by Figure 6.21. The conspicuous change in the results is a project team member who mentioned that the model was *'Feasible(2)'* in this round when he said it was not in the previous round. At the same time, two project team members changed their answers from *'Feasible(2)'* to *'Highly feasible(1)'* in Phase 2. The change in answers caused an improvement in the level of consensus by this group for the same question, as shown by Table 6.8. Three and two panel members for project managers stated that the model was *'Feasible(2)'* and *'Highly feasible(2)'*, respectively, for a real-life environment. The only change from the previous round's answers was a switch in answers, from *'Feasible(2)'* to *'Highly feasible(2)'* in round 2 by one project manager. This change resulted in a slight drop in the level of consensus by the members of the panel of project managers. The panel of academics was the only group that did not have a movement in responses, because their answers for the two phases were identical, as confirmed by Figures 6.10 and 6.23, as well as the levels of consensus given in Table 6.12. Collectively, 21 experts said the model was *'Feasible(2)'*, and nine of them indicated that it was *'Highly feasible(2)'* for a real-life environment. One major difference between the collective results of the two phases was the expert (a project team member) who claimed that the model was *'Infeasible(4)'* in round 1, but changed the answer in the

second round to *'Highly feasible(2)'.* This change had an impact on the level of consensus, as it marginally improved, as indicated by Table 6.12.

Fifteen project team members claimed that the model fulfilled its purpose well, whereas five experts in the group said it fulfilled it very well. Basically, the panel members unanimously said the model fulfilled its intended purpose, as Figure 6.25 shows. In contrast to Phase 1, one project team member said the model did not fulfil its purpose, while two project team members mentioned that it neither fulfilled its purpose nor failed to fulfil it. The change in answers resulted in an increase in the level of consensus amongst the experts in this group, as shown by Table 6.13. As indicated in Figure 6.26, four project managers said the model fulfilled the purpose well and one reported that it did so very well in Phase 2, while in Phase 1 all project managers claimed that the model met its purpose as intended. The change in answering patterns by one project manager decreased the level of consensus in this round for this group, as confirmed by Table 6.13. The panel of academics was the only group that did not have any changes from the answers of the previous phase. When considered as a collective, 24 experts mentioned that the model was *'Well(2)'*, suited for a real-life environment, while the other six experts indicated that it was in fact *'Very well(1)'* suited. Compared to the level of consensus for the same question in the previous phase, Table 6.13 shows that the experts, collectively, had a slightly higher level of consensus in this phase.

While 19 project team members claimed that the PM*Int* tool was efficient in collecting views and concerns of team members, one panel member posited that the tool was in fact average in doing so. In Phase 1, two project team members said the tool performed an average job. Despite the response by this team member, there was a marginal increase in the level of consensus amongst the group members, as shown in Table 6.12. In the case of project managers and academics, their respective responses were unchanged and were similar to their answers in Phase 1. Two project managers indicated that the tool was lacklustre in its performance; however, three PMs were satisfied with the tool's performance and said it was good. The panel of academics was the only one whose members were all satisfied with the PM*Int* tool's work standard, because they all chose that it was *'Good(2)'* as their answer. For both project managers and academics, the level of consensus was unaltered. Figure 6.32 shows joint responses of all the experts. Twenty-seven respondents said the tool did a

'Good(2)' job, whereas the remaining three participants indicated that it did *'Average(3)'* work. Table 6.14 indicates that there was a marginal improvement in the level of consensus amongst the experts for the responses to this question in Phase 2, compared to the same question in the previous phase.

There were three comments that were categorised under the "very serious" category. The first one was a recurring comment, which was made and addressed in Phase 1. The second comment was a proposal for future improvement of the model, which the expert thought would alleviate the administrative work brought about by the introduction of the model. The last comment was seeking clarity on what was intended by the feedback given to the PMO in Stages 5 and 6 of the model. On the other hand, there was only one comment made under the "serious" category, and that was expressing a concern about the additional administrative workload that the introduction of the model would cause for project managers. All the comments were addressed accordingly in Subsection 6.4.3.4.

6.4.4 A summary of data analysis results of the refinement and evaluation process of the model and the PM*Int* tool

From the discussion of the data analysis results of the two phases of the Delphi method, as presented in Subsections 6.4.2 and 6.4.3, a majority of the experts from all three panels as well as a majority of the experts combined, indicated that:

- The model, supported by the PM*Int* tool, was needed by the ICT sector.
- The model was feasible for a real-life situation.
- The model fulfilled its intended purpose.
- The PM*Int* tool performed well in the collection of PTs' views and concerns.

The level of consensus was maintained (remained high) or was slightly increased for the panels of project team members and academics in the responses to the questions that were asked in both phases of the Delphi method (see Table 6.14). However, for the panel of project managers, there was a marginal decrease in the level of consensus for the responses to Question 2 (which was Question 1 in Phase 2) and Question 3 (which was Question 2 in Phase 2). For details, see Table 6.14. Even though there was a drop in the level of consensus in this case, a high level of consensus was still maintained. On the other hand, collectively, there was a slight increase in the level of

consensus for the responses to all the questions asked in both phases, as Table 6.14 indicates.

The following ICT model assessment criteria proposed by Khazanchi (1996) were indicated to have been met by the Delphi method analysis results:

- The responses of the experts in Subsection 6.4.2.2 showed that the model was feasible in a real-life environment, thus meeting the *feasibility* test criterion.
- The responses of the experts from Subsection 6.4.2.3 also indicated that the model was effective in fulfilling its purpose, and this therefore meets the *effectiveness* criterion.
- The two-stage Delphi method evaluation process, which the model was subjected to, has confirmed that the model is *inter-subjectively certifiable*.

The next section presents the data analysis results for the data collected following the validation process for both the model and the PM*Int* tool.

6.5 The data analysis results for the validation process of the model and the PM*Int* tool

One of the recommendations from the experts was to have the model and the PM*Int* tool validated in a real-life project environment. This recommendation is in line with the proposal made by Khazanchi (1996) with regard to validation of ICT models. The same author states that a model should be assessed for feasibility, effectiveness, and be empirical and inter-subjectively certifiable, as discussed in Subsection 3.5.5 and Section 6.3. Furthermore, following the expert-driven evaluation process, the model and the tool needed to be subjected to evidence-based validation and testing in an ICT project environment, as suggested by Scott-Young and Samson (2008).

Project for Team C, one of the five projects, which were selected for participation in this study, was used to validate the model and the tool. According to the data analysis results for the 'as is' environmental analysis, Team C was the only team where all project team members indicated that there were no processes to collect project teams' views and concerns. Based on this, the researcher considered the team as a good candidate for assessing the model and the tool in fulfilling their intended purpose. The team was developing a mobile application for a client of the organisation, and the project was scheduled to be completed in 18 months, and they were on the 11th month

at the time of the request for the validation of the model and the tool. The organisation to which the team belonged was a small-medium size company, with 28 employees, including 17 software engineers, three team leaders/project managers and one programme manager, who the project managers were reporting to. The organisation did not have a project management office; instead, the programme manager was responsible for project management practices and policies in the organisation. The request to use the abovementioned team to validate the model and the tool was granted, though the programme manager declined to be of assistance in the process, citing understaffing as a reason. Agile and Waterfall software development methodologies were the main approaches used by the project teams in the organisation. Team C was using Agile methodology for the project.

The project manager informed the researcher that the model and the tool was going to be validated using the development (programming) team, which had four team members. The fifth team member, who participated in the previous stages of this study, was a quality engineer, and therefore did not take part in the validation process. During the validation process, the team was developing the back-end system of the mobile application and the Sprint was going to last for three weeks. At the end of the validation period, which was three weeks, the project manager and the team members were interviewed, using the questions that appear in Appendix F. The interviews with the team members lasted about 25 minutes, while the interview with the manager lasted approximately 50 minutes.

6.5.1 The data analysis results of the validation process of the model and the PM*Int* tool

This section discusses the data analysis results of the data collected after the validation of both the model and the PM*Int* tool. The next subsection describes the process followed in analysing the data, which was collected following the validation process of the model and the tool.

6.5.1.1 How was the collected data analysed?

The data was collected from participants using semi-structured telephonic interviews, due to Covid-19 pandemic restrictions. The first three questions were in a Likert scale format, while the last three were open-ended questions. The last question of the six questions was directed to the project manager only. The Likert scale questions were

the same as the ones asked in the second phase of the Delphi method carried out in Subsection 6.4.3. As was the case for the two phases of the Delphi method, the respondents were requested to provide reasons for their choice of answers to the Likert scale questions. Since the data collected after the validation process was similar to the data collected during the two phases of the Delphi method, the same analysis process followed in analysing the data collected in the phases of the Delphi method (as described in Subsection 6.4.1) was used to analyse the data collected during this stage.

6.5.1.2 How feasible is the application of the model in a real-life environment?

The responses of the four team members are shown in Figure 6.33. One team member indicated that the model was *'Highly feasible(1)'*, whereas the three other members said the model was *'Feasible(2)'* for a real-life project environment. Their answers were found to be similar to the way the team members responded to the same question during Phase 2 of the Delphi method, discussed in Subsection 6.4.3.1.

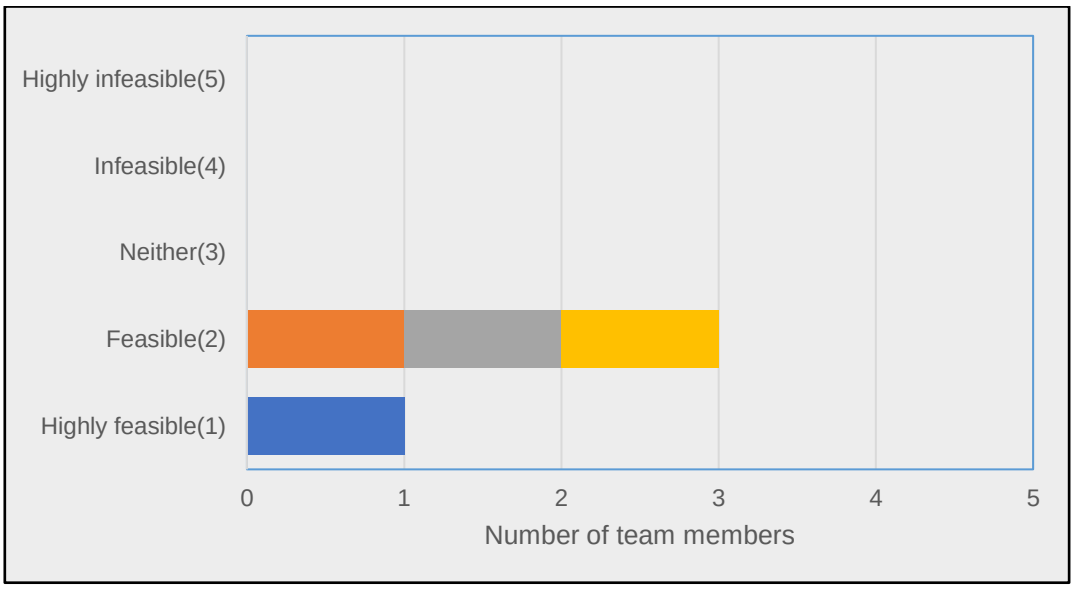


Figure 6.33 – Responses of project team members to Question 1 (Validation)

The project manager reported that the model was *'Feasible(2)'* for a real-life project environment. The response was also consistent with the responses given during Phase 2 of the Delphi method.

The answers from the project team members and the project manager indicated a high level of agreement amongst the participants that the model was feasible for a real-life

situation. The standard deviation value (0.4) of the responses of the participants also confirms that there was a high level of consensus amongst the participants about the feasibility of the model in a real-life project environment.

6.5.1.3 How well does the model fulfil its intended purpose?

Figure 6.34 shows that all project team members said the model fulfilled its purpose *'Well(2)'*. Once again, the team members' responses were in line with their previous responses to the same question in Phase 2 of the Delphi method.

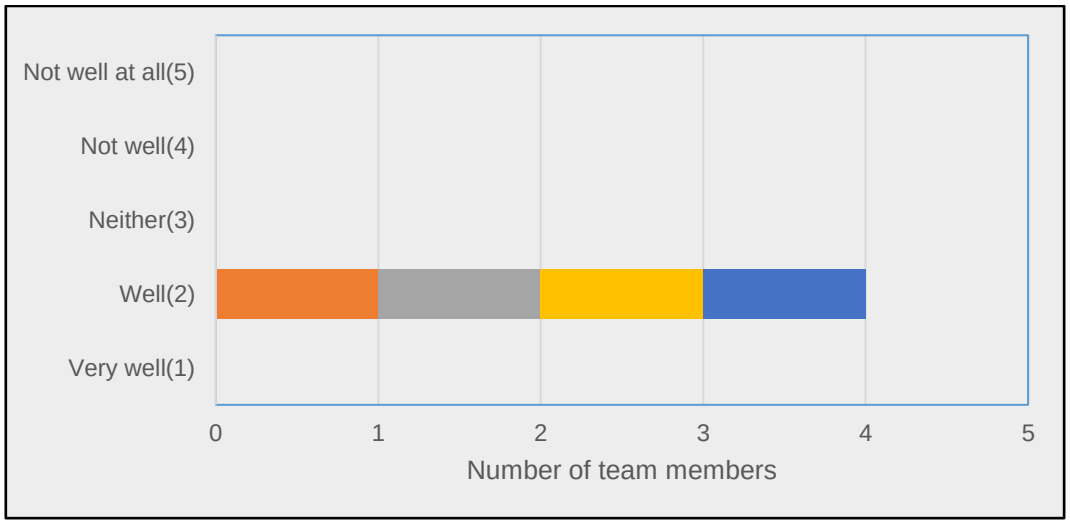


Figure 6.34 – Responses of project team members to Question 2 (Validation)

Similarly, the project manager said the model met its purpose *'Well(2)'*, thus corroborating what the team members said. The team manager's response was the same as his previous one to the same question in Phase 2 of the Delphi method.

There was a very high level of consensus amongst the participants about the model's capability to fulfil its purpose, as the value of 0 for the standard deviation shows.

6.5.1.4 How efficient is the PM*Int* tool in collecting the views of team members?

All project team members indicated that the PM*Int* tool performed its task of collecting the views and concerns of team members *'Good(2)'*, as indicated by Figure 6.35. The responses of the team members were identical to their previous responses given to the same question in Phase 2 of the Delphi method.

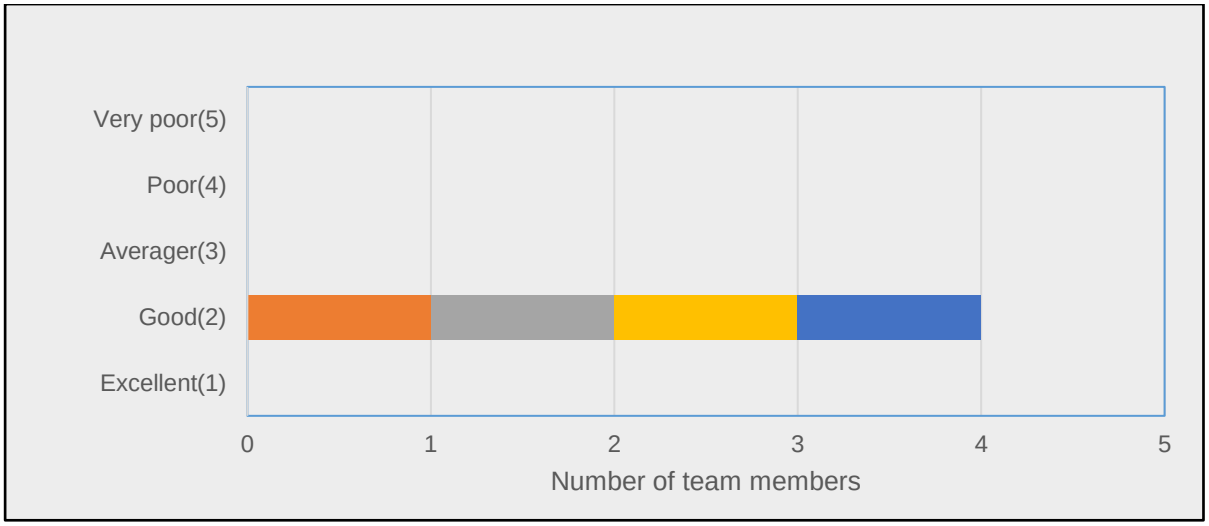


Figure 6.35 – Responses of project team members to Question 3 (Validation)

The project manager stated that the tool's performance was *'Average (3)'*. The project manager's response was not surprising, considering that he responded the same way to the same question in Phase 2 of the Delphi method. He also gave similar reasons as for the previous ones in Phase 2, indicating occasional erroneous sentiment analysis of input text. Despite the response of the project manager, the level of consensus amongst the respondents about the tool's performance was still high, as confirmed by the standard deviation value of 0.4. Nevertheless, the concerns by the project manager are valid, as inaccurate results by the tool may cause a misreading of a team member's concerns and views on a project.

6.5.1.5 Suggested improvements by the validation team

Questions 4 and 5 were meant to solicit suggestions for improving the model and the PM*Int* tool, respectively. The suggested improvements from the participants were identified and analysed according to the data classification and analysis process outlined in Subsection 6.4.1. Only one improvement suggestion was made, and unsurprisingly it was about the tool's sentiment analysis capabilities. The comment was about addressing the inaccurate sentiment analysis results that the tool occasionally produced. The suggestion was similar to the one made during Phase 2 of the Delphi method (comment number 1 in Table 6.15). As indicated when the suggestion was made during the Delphi method, the researcher committed to finding ways of improving the accuracy levels of the tool when it comes to assessing sentiments of a given text. The rest of the comments made were complimentary.

Question 6, which was directed to the project manager, was aimed at understanding at what periods of the project phase(s) the different stages of the model were applied. The following subsection discusses the feedback that was received from the project manager regarding the question.

6.5.1.6 The application of the model during the project phase(s)

The team was using an Agile development approach, as mentioned at the beginning of this section. The model and the tool were validated during a three-week Sprint for developing a back-end system for the mobile application. The following discussion outlines when the different stages of the model were applied.

The project manager (Scrum master, as the manager took on the role of Scrum master under the Agile methodology) stated that they used the following process groups in their Scrum process (the issues mentioned here are not exhaustive):

- *Initiation process* – Team members to be involved in the current Sprint would be identified, as well as their roles. The decision on the length of the Sprint would be finalised here.
- *Planning process* – A Sprint backlog would be determined. A release backlog would be created. Daily Scrum plan would form part of the planning.
- *Execution process* – Daily tasks would be accomplished.
- *Monitoring and Controlling* – In daily or weekly Sprint meetings issues that cause hindrances and delays would be identified and resolved.
- *Closing process* – Reflection on the completed Sprint product would take place. Lessons-learned would be noted and documented.

The abovementioned processes were carried out during the development phase of the Sprint.

Stage 1: The initial identification of the project team members happened during the Sprint initiation process meeting. The Scrum master created a project team register, which formed part of the internal stakeholder register. One of the requirements of this stage is the classification of the project team members based on their salience, as discussed in Chapter 4. The Scrum master indicated that he did not create classes of team members, but rather considered all the team members as important internal stakeholders. The Scrum master's approach of treating stakeholders as 'equals' is in

line with the recommendation by Freeman *et al.* (2007) who argue that stakeholders should be served equally, and counsel against creating groups of stakeholders which are given more attention than others. This coheres with Aagaard *et al.* (2016) who posit that the treatment given to project team members should not be determined by their perceived power. From what the Scrum master said, it would appear that he was aligned more to managing for stakeholders than managing of stakeholders.

Stage 2: This stage requires the selection of engagement strategies for each of the project team members. Since the team members were with the organisation and the team for a minimum of two years, the selection of engagement strategies for individual team members was somewhat easy, according to the Scrum master. He emphasised that various engagement strategies were used, which ranged from one-to-one meetings to electronic communication between him and individual team members. The Scrum master admitted that the use of informal engagement was not common in his communication with team members. He said the dominant engagement strategy was face-to-face meetings (virtual and physical) because non-verbal communication was important to him for the proper discernment of feelings and emotions. *"At times words can't express one's deep-seated feelings, only non-verbal expressions can"*, he emphasised. According to him, the PM*Int* tool assisted in discerning and summarising the emotions from electronic communication, even though it was not accurate at times. The Scrum master said he had weekly engagements with each PT member, where *'issues were frankly discussed'*. He said the engagement varied from face-to-face to virtual meetings.

Stage 3: The collection of team members' views and concerns were varied, as the engagement strategies were also diverse. According to the Scrum master, the collection of views and concerns of team members was not a *'formal thing'*, but the collection was a *'standing item'* in his weekly individual engagement with team members. It was in these meetings where team members were encouraged to voice their issues, and feedback on previous issues was provided (if not previously covered). He said team members' concerns did not have to wait for such meetings but, could be raised at any time, as team members had '*free access'* to him, hence he said the communication concerning their issues was not *'formal'*, but were handled with seriousness, as there were no issues that were considered small and trivial. He

indicated that the weekly or even daily Sprint meetings were also used to gather project teams' concerns and views.

Stage 4: The views and concerns were addressed as promptly as possible, as and when they arose. The Scrum master said he ensured that before the next weekly engagement with a team member, feedback would have been provided. If not possible, a communication would be sent to the team member concerned. This strategy demonstrated, he said, his commitment to the team members' issues and in return, he expected their *'hundred percent commitment'* to their project assignments. He said that the strategy seemed to be yielding positive results, since he noticed team members going the *'extra mile'* in their work. Since commitment is a critical success factor for ICT projects (Nyandongo, 2018), therefore it is important to get commitment from project teams.

Stage 5: The Scrum master mentioned that the monitoring and controlling of engagement strategies was a weekly process for him, where the effectiveness of individual strategies would be judged by: (i) his ability to get team members to openly voice their views and concerns to him; (ii) his ability to effectively provide feedback to individual team members. He did indicate that different issues require different engagement strategies – no single strategy is *'a silver bullet',* he claimed. The varying of engagement strategy as the need dictated proved to be successful for him. He also mentioned that the commitment that he received from his team members was also testimony to the effectiveness of his engagement strategies. As was indicated before, the organisation did not have a formal PMO, the office of the programme manager was carrying out the duties of the PMO office to a limited degree. The programme manager's office declined to participate in the validation process of the model and the PM*Int* tool and, therefore, the role that should have been played by the PMO in the implementation of the model could not be validated here. However, the feedback given by the team members during the interviews seemed to corroborate the engagement strategies of the Scrum master.

Stage 6: The non-participation of the office of the programme manager made it impossible to validate the effectiveness of this stage. The researcher hopes that future studies will enable the validation of this stage of the model, as well as the general oversight that the PMO should provide in the implementation of the model.

From the preceding discussion of this section, the following conclusions about the implementation of the model may be drawn:

- The responses of the validation team in Subsection 6.5.1.2, as well as the implementation of the model in a real-life project environment, has shown that the model is feasible ('operationalizable') and 'testable' in a real-life environment, thus meeting the *feasibility*, *empirical* and *inter-subjectively certifiable* criteria set out by Khazanchi (1996).
- The validation team was also unanimous in claiming that the model was effective in fulfilling its purpose, as the data analysis results in Subsection 6.5.1.3 confirm, and this met the *effectiveness* criterion.
- The validation process showed that the model can be tested by a group (a team of individuals) and therefore satisfied the *inter-subjectively certifiable* criterion specified by Khazanchi (1996).
- The analysis results of Subsection 6.5.1.4 indicate that the PM*Int* tool collects project team members' views and concerns well, except for its occasional inaccurate results.
- The use of different engagement strategies as demanded by circumstances proved to be effective, as the Scrum master attested. This is in line with claims by Oakley (2007) and Yang (2014), who state that various engagement techniques should be utilised, as there is no single method that is suitable for every circumstance.
- The PM*Int* tool does help project managers to understand team members' sentiments and emotions better, as confirmed by the Scrum master, who indicated that the tool enabled him to discern project teams' sentiments and emotions. This finding is in line with Fisher's (2011) argument that it is crucial for PMs to recognise the *feelings* and *emotions* of team members, and that this understanding will enable them to predict possible future actions of their PTs much better.
- The collection of project team members became a focal point (was a standing and planned issue) in the plan of the Scrum master, where the project team's views were to be collected weekly. Furthermore, commitment was made to provide feedback at least on a weekly basis, where possible, on the raised issues. In return, the team members committed themselves through their

performance. The reciprocation act indicates and confirms the dependency of the team member on the Scrum master and vice versa. This finding confirms what other previous studies, such as Aga *et al.* (2016), Caruso and Wolfe (2004), Dibbern *et al.* (2004) as well as Hans and Mnkandla (2019b) have established with regard to this social exchange theory. Moreover, the fact that the Scrum master was able, through the help of the model, to focus on the views and concerns (made the collection of project team issues 'a standing item'), indicates that the tool does assist project managers to pay attention to project teams' needs, thus treating them as key project stakeholders.

- The model is applicable in the real-life environment. More specifically, the model is applicable in the Agile environment, thus dispelling the 'concerns' raised by the two experts (team members) during Phase 1 of the Delphi method, that the model may not accommodate Agile projects.

6.5.1.7 A summary of the data analysis results of the validation process

Both the Scrum master and his project team confirmed that the model was feasible in a real-life project environment, and this claim corroborates what the Delphi method experts said. The validation team further indicated that the model met its purpose as intended, once more confirming what the results of the Delphi method indicated. Furthermore, as the experts reported, the project team members and the Scrum master stated that the PM*Int* tool gathered the views and concerns of team members well. The only concern that was raised by the validation team was the inaccurate sentiment analysis results that the PM*Int* tool produced with certain text inputs. The concern was similar to the one expressed by some of the experts during the refinement and evaluation process of the model and the tool.

The model and the tool were applied at various stages of the software development processes, as discussed in Subsection 6.5.1.6. The initial identification of individual project team members was carried out during the Sprint initiating process meeting. The Scrum master relied on different engagement strategies for communication with his team members. He made it a point that views and concerns of his team were collected weekly and provided feedback on the raised issues as soon as possible (within a week, where possible). The commitment from the Scrum master to address the concerns of

his team resulted in reciprocity by his team members through giving maximum effort to their work.

A number of findings and conclusions were made from the data analysis results of the validation process. The results indicate that the four assessment criteria given by Khazanchi (1996), namely, feasibility, effectiveness, empirical and being inter-subjectively certifiable were met. The deduction was also made that the model enabled the project managers to focus on team members' needs and thus treat them as key project stakeholders.

6.6 Summary

This chapter started by presenting a summary of data analysis results for 'as is' environmental analysis. The results of data analysis for the data collected from project team members were presented, followed by the data analysis results for the data gathered from project managers.

The data analysis results for the data collected from the PT members revealed that:

- There were no processes to collect the views and concerns of project teams in the South African ICT sector. This finding could not be related to any previous studies, as the researcher could not find any related studies to confirm or refute this finding.
- As a result of the finding given in the previous bullet-point, the views and opinions of project teams did not play any role in the decision-making processes by project managers. The finding by this study confirmed what has been established by the researcher from the literature review carried out in this study.
- Project managers were more task-focused than team-focused.
- Project managers were found to be leaning more on a management of stakeholder approach than management for stakeholders, when managing project teams. This discovery is in line with a finding from a recent study by Aagaard *et al.* (2016), which found that project managers who participated in the study were more inclined to using a managing of stakeholder approach than a managing for stakeholder method.

When the data analysis results were compared to those for project managers, there were a number of contradictions that emerged. Possible factors, which could have caused these contradictions were identified and discussed. The identified factors included undocumented processes/informal processes, non-standardised processes and policies, poor communication, lack of team inclusion in the decision-making processes, and non-standardised project management leadership. It was argued that the findings gave further justification for the development of this study's model and the PM*Int* tool.

Following the presentation of the data analysis results for the 'as is' environmental analysis, the data analysis results for the Delphi method were discussed, and the following findings were established:

- Most of the experts said the model was needed by the ICT sector.
- Most experts deemed the model feasible for a real-life project environment.
- Many of the experts considered the model to have fulfilled its intended purpose.
- Most of the experts said that the PM*Int* tool collected the views and concerns of PTs well, even though some pointed out occasional inaccuracies in its output. The experts pointed out that this needed attention.
- The results of the Delphi method satisfied three of the six ICT model assessment criteria given by Khazanchi (1996), and these are feasibility, effectiveness and being inter-subjectively certifiable.

Since a high level of consensus was reached amongst the experts, and no further suggestions for the improvement of both the model and the PM*Int* tool were forthcoming, the Delphi method was halted after two phases. The decision to stop the Delphi process was in line with previous studies, which also stopped the Delphi process after two rounds.

Lastly, the chapter discussed the results of the data analysis for the validation process of the model and the PM*Int* tool. According to the results, the validation team indicated that:

- The model was feasible in a real-life project environment, a claim that confirmed what the Delphi method experts mentioned.

- The model served its intended purpose, once more confirming what the experts said. Furthermore, as the experts reported, the project team members and the Scrum master stated that the model was effective in fulfilling its purpose.
- The PM*Int* tool collected the views and concerns of team members well, and this was also in line with what was said by the experts. The only concern that was raised by the validation team was the inaccurate sentiment analysis results that the tool produced with certain text inputs. The concern was similar to the one expressed by some of the experts during the refinement and evaluation process of the model and the tool.

Several findings and conclusions were drawn from the data analysis results concerning the validation process. It was indicated that four assessment criteria, namely, feasibility, effectiveness, empirical and being inter-subjectively certifiable (Khazanchi, 1996) for validating ICT models were met by the validation process. Based on the data analysis results, a deduction was made that the model enabled the project managers to focus on team members' needs and thus treat them as key project stakeholders.

CHAPTER 7: DISCUSSION OF THE RESEARCH RESULTS, CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter discusses the research results, their implications, and the recommendations for addressing some of the issues of concern that emerged from the findings. Moreover, the research results are discussed in relation to this study's research questions and objectives. A conclusion section presents a summary of what this study has covered and achieved based on its research results and findings. The contributions made by the research study, as well as its limitations, are presented by this chapter. A discussion on possible future work concludes the chapter.

7.2 The discussion of the 'as is' environmental data analysis results

The results of the 'as is' environmental data analysis were presented in Section 4.2 of Chapter 4 and were further summarised in Section 6.2 of the previous chapter. The relevance of the 'as is' environmental analysis was the empirical findings of the treatment of the ICT project teams in the South African context. The empirical evidence served as an input to the development of both the model and the PM*Int* tool designed in this study. The next subsections examine the analysis results of the responses given by the respondents to the interview questions posed to them.

7.2.1 Processes to solicit views and concerns of project teams

It was established (in Subsection 6.2.1.1) that a majority of team members said that there were no processes in place to collect their views and opinions, thus implying that PMs seemed not to pay attention to the views and concerns of PTs. This empirical finding is consistent with the findings of previous studies by Bourne (2011), Development Review Management (1997), Hans and Mnkandla (2019a) as well as Pecherskaya *et al.* (2015). Moreover, the implications are that project managers seem not to *'acquire genuine knowledge of the feelings'* of their teams, as alleged by Fisher (2011:998) and are unaware of the needs of their teams, appearing to show no open care for them, and thus lacking consideration of behaviour aimed at satisfying project team members' needs (Burke *et al.*, 2006; Haselberger, 2016).

Some team members claimed that the processes were project manager-dependent, meaning some implemented the processes while others did not. According to Hans

and Mnkandla (2018b), the non-compliance of some of the project managers with the processes could have emanated from two factors, namely, undocumented processes and non-standardised processes. A detailed discussion of these two factors is presented in Subsection 7.2.7.

7.2.1.1 Subsequent recommendations on processes for solicitation of views

The study recommends that organisations should have unambiguous processes in place for collection of views and concerns of project team members. Paying attention to the needs of project teams is not optional, but an imperative. Otherwise, poor management of project teams will perpetually result in failed projects due to decreased reliability, commitment and motivation of individual team members, as Kerr (1989) warns. The findings and the implications further strengthen the need for the model and PM*Int* tool, which have been developed by the study.

7.2.2 Strategies used to gather project teams' views and concerns

Some project team members claimed that there were processes in place to gather the views and opinions of project teams. Such team members, together with those who indicated that the existence of processes was PM-dependent, were asked to explain how project managers collected their views. The responses showed that meetings were the main tool used for gathering project teams' views. Some team members were discontented with the use of one approach, and indicated preference for other methods, for example, a one-to-one approach. The results indicated that project managers seemed to rely on a single approach of engagement with their project teams, and that was group (team) meetings. Judging by the comments made by some project team members, the reliance on one method might have excluded or disadvantaged other team members who preferred informal or other methods. This finding is in accord with the findings of a research study by Fisher (2011), which established that some team members preferred informal conversations with their project managers.

7.2.2.1 Subsequent recommendations on strategies

Project managers should find suitable engagement strategies, which are tailor-made for individual team members. This accords with what Mnkandla (2013) advocates, which is that project managers should thoroughly consider the teams' preferred communication tools and techniques, in order to avoid undue problems. Furthermore, engagement and communication techniques should be varied according to the

situations and context. This recommendation is consistent with the advice given by Yang (2014), who says there is no one-size-fits-all when it comes to communication strategies and techniques.

7.2.3 The type of information gathered from project teams

All project team members who claimed that there were processes in place to acknowledge their views and concerns, indicated that the type of information collected by project managers pertained to work schedules, progress and challenges encountered in accomplishing assigned tasks. The type of information sought by PMs would seem to be more task-oriented than person(team)-oriented – more about accomplishing tasks (Burke *et al.*, 2006), and thus seemingly more inclined to management *of* stakeholders (a management approach that pushes for an organisation's interests) than management *for* stakeholders (a management approach that considers the interests of all stakeholders). The finding corroborates the findings by Aagaard *et al.* (2016), who established that project managers were using the management *of* stakeholders approach more than the management *for* stakeholders approach. With the type of information that project managers gather it is unlikely that they could better understand the *feelings* and *emotions* of their project team members, as recommended by Fisher (2011).

7.2.3.1 Subsequent recommendations on type of information

According to Freeman, Harrison and Wicks (2007) the type of stakeholder management approach used by project managers is not sustainable for organisations, since employees' interests are sacrificed for meeting the needs of shareholders and other stakeholders. Project managers are expected to strike a balance between focusing on technical and people aspects of the projects, and there should be no either/or approach. This view is also supported by Adair (1984, cited in Wateridge 1996), who calls for a balanced approach in handling project tasks and teams' needs. However, Wateridge (1996) claims that research advocates for a team-oriented approach in delivering successful projects. However, a number of researchers, such as, Freeman, Harrison and Wicks (2007), Freeman, Velamuri and Moriarty (2006) and Aagaard *et al.* (2016) seem to agree with this study's call for a balancing act, where the needs of all stakeholders are attended to in order to create value for both shareholders and stakeholders (Freeman, Harrison & Wicks, 2007) and thereby

satisfying the needs of many, if not all, stakeholders simultaneously (Freeman, Velamuri & Moriarty, 2006). Project managers should have more of a “soft-touch” (caring attitude) in dealing with their project teams. Part of the feedback solicited from team members should relate to the “soft issues”, such as whether a team member is developing a new set of skills as planned. Procaccino and Verner (2006) agree with this proposal, and state that support for project team members’ personal aspirations results in a motivated and productive individual; because team members define project success, partly, in terms of their personal growth (Procaccino and Verner, 2002) and fulfilment of their learning, growth and career needs (McLeod *et al.*, 2012; Turner *et al.*, 2008).

7.2.4 Consideration of project teams’ views in decision-making

A majority of project team members said that project managers disregarded their views and concerns in the decision-making, with some team members claiming that their views were supressed deliberately. This would seem to confirm the observation made earlier (in Subsection 7.2.1) of the PMs paying little or no attention to project teams’ views and concerns, thus implying that project managers do not treat project team members as key stakeholders, as established in a recent study by Hans and Mnkandla (2018a). This finding is consistent with Yang's (2014) and Hans and Mnkandla's (2018a) assertions that the voices of some project stakeholders, team members in this context, are still not heard by many project managers. In a recent study by Nyandongo (2018), team participation in decision-making was considered a critical success factor in the South African ICT industry. A research study by Procaccino, Verner and Lorenzet (2006) also listed inclusion of software teams in decision-making as a critical success factor. Therefore, the lack of inclusion of teams’ voices in the decision-making process would seem to neglect one of the key project success factors in the sector. Furthermore, non-consideration of project teams’ inputs and insights seems not to be valued by project managers, contrary to the recommendations of Salas, Burke and Stagl (2004).

7.2.4.1 Subsequent recommendations on consideration of PTs’ views

Kaliprasad (2006) identifies project teams’ participation in decision-making as a critical staff retention strategy in South Africa, while Hoch and Dulebohn (2013) and Martin *et al.* (2018) consider it as a motivating factor that leads to teams taking responsibility for

their work performance. According to Coakes and Elliman (1999), the significance of involving project teams in the decision-making results in teams giving project managers their unwavering project support. All of these studies point to the importance of consideration of project teams' views and opinions in decision-making by project managers.

7.2.5 Improvements to processes for gathering project teams' views and concerns

The team members mentioned two issues that they considered needed serious attention. They are: selective application of processes due to non-standardised processes and poor communication between project managers and their project teams. These two issues are discussed in detail in Subsection 7.2.7.

7.2.6 An ideal process for gathering the views and concerns of project teams

An ideal process for several team members would be the one that enabled efficient communication amongst project stakeholders, again emphasising poor communication as a problematic factor in projects. One team member commented that an ideal tool should support informal collection of views and opinions of project teams, thus supporting the recommendation made earlier, in Subsection 7.2.1, that project managers should use various methods to solicit project teams' views and concerns and not rely on a single technique. The PM*Int* tool assists project managers to gather project team views informally.

The responses of project managers contradicted a number of answers that were given by their team members, as indicated in Subsection 6.2.3, and summarised in Table 6.2. The contradicting answers emerged not only between the two groups of respondents, that is, project managers and team members, but amongst the team members, too. The next subsection revisits the factors that might have led to the contradictions and disagreements, with the aim of providing possible recommendations for addressing them.

7.2.7 Possible factors which may have led to contradicting responses

Several possible factors, which could have led to the contradictions, were identified, and are discussed in the subsequent subsections.

7.2.7.1 Undocumented processes/informal processes

Some project team members indicated that processes were undocumented, and this could have resulted in the organisations having difficulties enforcing such processes with PMs and PT members. This implies that people used their own interpretation of what the processes meant and how they were to be applied (Hans and Mnkandla, 2018b; 2019b). Confusion ensued as a result, where some stakeholders thought the processes existed while others thought otherwise. Kumar, Banga and Kaur (2016), as well as Pankratz and Basten (2013), warn that such a situation could lead to unintended project outcomes.

7.2.7.1.1 Subsequent recommendations on undocumented processes

In their study, which identified some of the factors presented in Subsection 6.2.3, Hans and Mnkandla (2018b) urge companies to formalise and document their project management processes and methodologies to avoid different interpretations attached to these, due to them being informal and undocumented. This would ensure, they argue, a consistent and uniform compliance to the organisation's project management processes. As discussed in Subsection 2.5.4, the role of the project management office is central to the formalisation, documentation, and enforcement of project management processes. Therefore, establishment of a PMO is critical in the realisation of this recommendation.

7.2.7.2 Non-standardised processes and policies

Some project team members claimed that the existence of processes to solicit views and concerns of team members was PM-dependent. The claims pointed to a possible lack of standardisation of project management practices with respect collecting teams' views and concerns across different project environments within the organisations. According to the Project Management Institute (2017), the lack of standardisation of project management practices has an undesirable impact on project success, while standardisation of project management practices enables project-critical success factors (Brown and Eisenhardt, 1997; Milosevic and Patanakul, 2005) and offers consistent and efficient results. Furthermore, Hans and Mnkandla (2018b) note that non-standardisation of project management practices and processes has far-reaching implications, including non-compliance by internal stakeholders resulting in following the practices (as observed from the five case study projects which participated in this

study), challenges in enforcing compliance and inability to hold non-complying parties accountable. Based on the abovementioned implications from various sources, the logical question therefore would be: to what extent does the non-standardisation of project management practices and processes contribute to project failures in the South African ICT sector?

7.2.7.2.1 Subsequent recommendations on non-standardised processes

Good project management practices will only become a reality and an organisational philosophy when such practices have been standardised throughout the organisation (Hans and Mnkandla, 2018b). The standardisation of project management practices and processes would not only achieve uniform application of such practices within an organisation, but would also ensure that project managers share a proven successful common project management practice roadmap in delivering projects (Schwalbe, 2015:16). The application of standardised software project management practices and their enforcement is crucial in obtaining intended results (Nidumolu, 1996). Moreover, application of standardised project management practices would assist in detecting what works and what does not, where and why there are flaws, thus helping in devising solutions to eliminate the flaws and increasing the chances for project success.

7.2.7.3 Poor communication

Different project team members identified poor communication as an issue, with PT_{B2} calling it '*disoriented'*. It appears that there was no proper communication with regard to the processes for collection of project team opinions and concerns, leading to some team members and project managers saying they existed, while others claimed they did not. This determination confirms a recent finding by Nyandongo (2018), where poor communication was identified as one of the factors troubling the South African ICT industry. It would appear that, in the absence of proper communication, project managers applied their own discretion in observing or ignoring the undocumented processes and practices. Effective communication has been identified as one of the critical success factors for software projects (Chiyangwa and Mnkandla, 2017; Nyandongo, 2018; Marnewick and Labuschagne, 2009; Procaccino *et al.*, 2006), while poor communication is a major contributor to project failures (Karlsen, 2002; Salas, Burke and Stagl, 2004).

7.2.7.3.1 Subsequent recommendations on poor communication

Effective communication is the heart and soul of good project management, an assertion supported by Aga *et al.* (2016), Hans and Mnkandla (2018b) and Marnewick and Labuschagne (2009). Given that software teams involve human beings from different disciplines, this makes communication even more critical for the accomplishment of high-level team performance and ultimately project success (Crowder, Robinson, Hughes & Sim, 2012). Good project communication management is needed for proper decision-making (Mnkandla, 2013) and to ensure proper levels of communication amongst team members (Patrashkova-Volzdoska, McComb, Green & Compton, 2003). The preceding discussion indicates the importance of effective communication in ICT projects, and therefore organisations should take heed and address communication problems if they intend to improve their project success rate. The quality and the level of communication should be assessed and measured regularly with the aim of improvement.

7.2.7.4 Lack of team inclusion in the decision-making processes

As discussed in Subsection 7.2.4, a majority of project team members reported that project managers did not consider their views in the decision-making process, while all project managers maintained that the views of project teams were important in their decision-making. Based on the comments made by a majority of team members, it appears that the exclusion of the teams' views from the decisions taken by project managers created an environment of mistrust between the project teams and project managers. For example, some team members said that project managers were *'dictatorial'* and disregarded teams' views because they *'know it all'*. The environment of mistrust could have led to disagreements and contradictions because project teams were not involved in the decisions that were taken by managers on issues of interest to them. This observation is supported by Pankratz and Basten (2013), who state that mistrust leads to disagreements, conflict and dissatisfaction.

7.2.7.4.1 Subsequent recommendations on PT inclusion in the decision-making

Over and above the recommendations made in Subsection 7.2.4, here are some of the suggestions and rationales for the inclusion of project teams in the decision-making processes. With many organisations adopting the Agile project management methodologies (Mnkandla, 2013), where project teams are more self-organising, it is

therefore imperative for PMs not only to learn to include project teams in their decision-making processes, but also to delegate decision-making powers to the teams. In order for project managers to receive the full support of stakeholders, PMs should involve project teams as key stakeholders in the decisions which affect their project interests (Coakes and Elliman, 1999). Inclusion of teams in decision-making processes by project managers strengthens the trust relationship between project teams and their project managers (da Cunha *et al.*, 2016) and this is a catalyst for running successful projects (Wateridge, 1996). Moreover, project managers should be receptive to differing opinions from their project teams (Morrison, Brown & Smit, 2006).

7.2.7.5 Non-standardised project management leadership

The different compliance levels in project management practices by project managers could also point to the differences in project management leadership within the organisations. The variance in team management and leadership within an organization is more likely to lead to comparison and dissatisfaction amongst project teams under different project managers. This finding is corroborated by the research work of Milosevic and Patanakul (2005), which found that project managers with standardised project management skillsets are more likely to satisfy clients and other stakeholders. Since project management leadership is a vital factor in project success (Scott-Young and Samson, 2008), then standardising it across projects within an organisation would seem not to be a far-fetched proposal.

7.2.7.5.1 Subsequent recommendations on non-standardised leadership

If project management is to be a tool for integration of diverse functions in an organisation and an enabler of efficiency, as alluded to by Cicmil, Hodgson, Lindgren and Packendorff (2009), then standardisation of project management practices, leadership included, should be foundational. The standardised leadership practices should form part of ‘an integrated toolbox’ of a ‘streamlined project delivery process’ as well as part of mentoring programmes for upcoming PMs in a successful organisation (Schwalbe 2014:16). The skillset that should be standardised includes the following elements: process skills, soft skills (e.g. project management leadership skills), technical skills, etc. (Milosevic and Patanakul, 2005; Sobek, Liker & Ward, 1998). As organisations mentor and grow their own project leaders (Schwalbe, 2014:16), the training programmes should contain common leadership qualities, which

an organisation expects from its future project managers, thereby standardising project management leadership, which would ensure consistency and uniformity in the running of its projects. The use of expert systems for coaching and mentoring PMs as suggested by Hans and Mnkandla (2014b) could be one way to effect the standardisation of project management leadership in organisations. As mentioned in Subsection 2.5.4, standardisation is not meant to turn project managers into robots, but to make sure that successful project management practices are shared by all project leaders in the organisation. Through this, an organisation would be in a position to leverage and capitalise on its collective project management capabilities.

7.3 The discussion of the refinement and evaluation results of the model and the PM*Int* tool

This section discusses the data analysis results of the model and the PM*Int* tool refinement and evaluation process presented in Subsections 6.4.2 and 6.4.3.

7.3.1 The need for the model in the ICT industry

The experts were asked if the ICT industry was in need of the model, which was developed by this study. There was a high level of consensus amongst the experts that the model was necessary for the industry. A lack of understanding of how the model handled Agile projects generated a lack of conviction of the model's necessity and utility on the part of three of the experts, however. What came as somewhat a surprise to the researcher was the lack of resistance from project managers, given that the model is aimed at addressing their poor treatment of project teams. One project manager raised a concern, however, about the increased workload that the implementation of the model may bring. Other than that, it would therefore appear that project managers are admitting that their treatment of project teams as non-key stakeholders needs to be addressed, and that the model is a solution to the problem.

7.3.2 The feasibility of the model for a real-life project environment

During both rounds of the Delphi process, a majority of the experts indicated that the model was suitable in a real-life project environment. In the first round, one expert said the model was infeasible, while the rest of the experts conclusively claimed it was, in fact, feasible for a real-life project situation. In the second round, on the other hand, all the experts indicated that the model was feasible for a real-life project environment. Even though all the experts were convinced that the model was suitable for a real-life

environment, some experts thought it needed to be tested in a real-life project environment for it to be given a confident yes. Their proposal is consistent with a measurement criterion by Khazanchi (1996), which requires that ICT models be validated in a real-life situation.

7.3.3 The fulfilment of the model's intended purpose

In the second phase of the Delphi method, all 30 experts agreed that the model definitely fulfilled its purpose, while in the first phase 27 of them indicated it did, with two of the remaining three experts undecided and the last one claiming it did not fulfil its purpose, as discussed in Subsections 6.4.2.3 and 6.4.3.2. What the results imply is that the model does assist project managers to focus on the needs and concerns of their project teams, thus treating them as key stakeholders (Hans and Mnkandla, 2021). However, even though the model received a resounding yes, the real and ultimate test for it needed to be evidence-based, as proposed by Scott-Young and Samson (2008), as alluded to in the previous subsection. The expert opinion-based assessment of the model was the first step towards real-life user and industry-oriented testing of the model, which is discussed in Section 7.3.

7.3.4 The efficiency of the PM*Int* tool in collecting the views of team members

27 experts in the second phase of the Delphi method said the tool was efficient in its task of collecting the views and concerns of PTs, compared to 26 in the first phase. According to these results, the PM*Int* tool did a good job in collecting the views of the team members in support of the model, even though there were some concerns about the accuracy of its results, as discussed in Subsections 6.4.2.5 and 6.4.3.4.

7.3.5 Proposed improvements to the model and the PM*Int* tool

The two phases of the Delphi process that the model and the PM*Int* tool went through were meant to refine and evaluate them. The experts made some suggestions, which were aimed at improving the two artefacts, as discussed in Subsections 6.4.2.5 and 6.4.3.4. All proposed improvements were, in one way or another, addressed by the researcher, as mentioned in the abovementioned subsections.

7.3.6 Assessment criteria satisfied by the evaluation process of the model

The following ICT model assessment criteria, which were proposed by Khazanchi (1996) were satisfied by the Delphi method analysis results:

- The *feasibility* test criterion – The responses of the experts in Subsection 6.4.2.2 showed that the model was feasible in a real-life environment.
- The *effectiveness* criterion – The experts also claimed that the model was effective in fulfilling its purpose (see Subsection 6.4.2.3).
- The *inter-subjectively certifiable* criterion – The two-stage Delphi method evaluation process which the model was subjected to has confirmed that the model is "testable by different" experts using logical evaluation.

The other evaluation and validation criteria suggested by Khazanchi (1996) were achieved by the validation process of the model, the analysis results of which are discussed in the next subsection.

7.4 The discussion of the data analysis results of the validation process

Following the suggestions made by some of the experts that the model be tested in a real-life project environment, and in line with Khazanchi's (1996) proposed assessment criteria for ICT models, the model and the PM*Int* tool were validated using one of the ICT projects which were selected to participate in this study. The data analysis results of the validation process were presented in Section 6.5.

7.4.1 The feasibility of the model in a real-life project environment

Both the project manager and his project team indicated that the model was feasible in a real-life environment, as confirmed by the interview analysis results of Subsection 6.5.1.2. The results were consistent with the evaluation process results from the experts (see Subsections 6.4.2.2, 6.4.3.2).

7.4.2 The fulfilment of the model's intended purpose

Once more, the project manager and the team members unanimously said that the model fulfilled its purpose well (see Subsection 6.5.1.3), thus corroborating what the experts said.

7.4.3 The efficiency of the PM*Int* tool in collecting the views of team members

All team members said that the PM*Int* tool was good in collecting the views and concerns of project teams; however, the project manager unimpressed with the tool, and indicated that it performed averagely. The rating of the tool's performance by the validation team was similar to the ratings given by the team of experts. As discussed in Subsections 6.4.2.5, 6.4.3.4 and 6.5.1.5, the experts and the project manager of the

validation team suggested that the tool's sentiment analysis capabilities should be improved, as it produced inaccurate results at times. The researcher committed to finding ways to address the problem, as mentioned before.

From the data analysis results of the validation process, the following determinations may be drawn:

- The validation of the model in a real-life project environment and the responses of the validation team in Subsections 6.5.1.2, 6.5.1.3 and 6.5.1.6 have demonstrated that the model is implementable and is therefore *effective*, *feasible* ('operationalizable'/'testable'), *empirical* and *inter-subjectively certifiable* (tested by a team) as required by Khazanchi (1996).
- Moreover, the fact that the Scrum master was able, through the help of the model, to focus on the views and concerns (made the collection of project team issues 'a standing item'), indicates that the tool does assist project managers to pay attention to project teams' needs, thus treating them as key project stakeholders.
- The model is applicable in the real-life environment. More specifically, the model is applicable in the Agile environment, thus dispelling the 'concerns' raised by the two experts (team members) during Phase 1 of the Delphi method, that the model may not accommodate Agile projects.
- The analysis results of Subsection 6.5.1.4 showed that the PM*Int* tool collects project team members' views and concerns well, thus playing a key supporting role for the model.
- The PM*Int* tool does help project managers to discern the team members' sentiments and emotions better, as confirmed by the Scrum master, who indicated that the tool enabled him to understand project teams' sentiments and emotions. This finding is in line with Fisher's (2011) recommendation that it is crucial for PMs to recognise the *feelings* and *emotions* of team members and that this understanding will enable them to predict possible future actions of their PTs much better.

The preceding discussion of the evaluation and the validation process results confirmed that the model met all the assessment criteria laid out by Khazanchi (1996), which a sound ICT model is expected to satisfy.

7.5 The discussion of the research results in relation to this study's research questions and objectives

The discussion in this section relates the research results to the research questions and objectives of the study that were presented in Chapter 1.

7.5.1 Answers to research questions

In Section 1.4, the following research questions that this study sought to answer were identified:

1. *How can a model supported by a project management intelligence (*PM*Int) tool assist ICT project managers to pay necessary attention to project team issues and thus treat them as key project stakeholders?*
2. *Does the use of the proposed model supported by a* PM*Int tool improve the attention given to the needs and interests of project teams as key stakeholders by project managers?*

The model, aimed at assisting ICT project managers to pay the necessary attention to project team issues and hence treat them as key project stakeholders, was designed in Chapter 4, while the PM*Int* tool was designed and developed in Chapter 5 of this research study. Both artefacts were then refined, evaluated (through expert-based opinions) and validated (using evidence-based testing on a real-life project) and the results of the processes were presented and discussed in Chapter 6 and Chapter 7, respectively. The model was evaluated and validated in accordance with the assessment criteria recommended by Khazanchi (1996), as discussed in Section 6.3.

The results of the evaluation were discussed in Subsections 7.3.1, 7.3.2, 7.3.3 and 7.3.4), while the results of the validation process were synthesised in Subsections 7.4.1, 7.4.2 and 7.4.3). They revealed the following findings:

(a) The model was needed by the ICT industry and has an important role to play in terms of its purpose, as also established by Hans and Mnkandla (2021).
(b) The model was suitable and implementable in a real-life project environment.
(c) The model met its intended purpose. Moreover, the model assisted the Scrum master to pay attention to the needs and concerns of the project team.
(d) The PM*Int* tool was able to collect the views and concerns of team members fairly well. The PM*Int* tool assisted in discerning emotions and feelings of team

members from electronic communication, apart from occasional inaccurate results.

The research findings given in (c) and (d) provide an answer to the first research question. It was noted in Section 6.5 that the project team (Team C), which was chosen to validate the model and the PM*Int* tool was the only team whose members all claimed that there were no processes in place for collecting project teams' views and concerns, therefore implying that their project manager was not paying attention to their needs. The responses of the team members following the validation process imply that the model did improve the attention given to their needs by the Scrum master (project manager), thus answering the second research question of this study.

The sum of the evidence discussed in the preceding sections regarding the evaluation and validation of both the model and the PM*Int* tool suggests that the model, supported by the PM*Int* tool, does assist project managers in paying attention to the views and concerns of project teams, thus treating them as key stakeholders.

7.5.2 Fulfilment of the study's research objectives

The study set out to achieve the following research objectives, as outlined in Section 1.6:

1. To design and develop a model aimed at assisting ICT project managers to pay the necessary attention to project teams, and thus treat them as one of the key stakeholder groups.
2. To design and develop a PM*Int* tool to support the model proposed by this study.
3. To refine the model and the PM*Int* tool.
4. To measure the effectiveness of the designed model and the PM*Int* tool using the Delphi experts, as well as a real-life project.

The first and second objectives were met in Chapter 4 and Chapter 5, respectively, while the third and the fourth objectives were both achieved in Chapter 6.

7.6 Conclusion

The neglect and the lack of regard for software project teams as key stakeholders, except on paper (Hans and Mnkandla, 2019a), by software project managers and the project management literature, prompted this research. Chapter 1 and Chapter 2

revealed that the attention of project managers was on the needs of the stakeholder groups, which were considered economically powerful, while the needs and concerns of the project teams remained neglected. Moreover, the 'as is' environmental analysis results presented earlier in this chapter also revealed a similar trend of cold-shoulder treatment of PTs by project managers. Considering the evidence gathered from the literature, the empirical data and the review comments received from a journal paper and conference paper reviewers, it appeared that software project teams were *firstly* treated as merely qualified software engineers, and *secondly, if possible*, then their 'tag' of being project stakeholders was considered.

The treatment of project teams as non-key stakeholders has occurred despite the litany of empirical evidence from various research studies, such as André *et al.* (2011), Bourne and Walker (2005), Cooke-Davies (2002), Hans and Mnkandla (2018a), Kerr (1989) and Acuña, Gómez, Hannay, Juristo and Pfahl (2015), indicating the vital role of project teams in the success of projects in the software sector. Some researchers including, Aagaard *et al.* (2016), Drucker (2002), Freeman *et al.* (2006, 2007) and Wateridge (1996) have even warned about the unsustainability of the continuous trade-off of PTs' stake in projects and focusing on few project stakeholders by project managers. Rather, PMs should continuously balance and integrate complex competing needs and objectives of various stakeholders (Freeman and McVea, 2001).

A review of project stakeholder management literature showed that the limitations of the current stakeholder management tools constrained them from addressing the neglect of PTs, hence the study proposed and developed a model and a project management intelligence tool aimed at assisting software project managers to treat project teams as key stakeholders by attending to their concerns and needs. The model has six stages, which were outlined in Section 4.3. The purpose of Stage 3 of the model is to collect the views and concerns of project team members using appropriate strategies that were chosen in Stage 2. In addition to the model, the researcher developed a PM*Int* tool whose main aim is to assist in the informal collection of views and concerns (during Stage 2 of the model) of team members and then perform sentiment analysis on the collected data. It is envisaged that the PMI*nt* tool will play a critical role in the establishment of the needs of project teams under the 'new normal', which has been brought about by the Covid-19 pandemic. One of the unique

features of the model is the primary role played by the PMO in the implementation and enforcement of the model's processes. The inclusion of the PMO was based on one of the findings from the 'as is' environmental analysis, that there was inconsistent and varying application of processes for the gathering of project teams' views and concerns.

Following their development, both artefacts were subjected to a two-phase expert-based refinement and evaluation process. After this process, both the model and the PM*Int* tool were further put through empirically-based validation processes. The model was evaluated and validated in accordance with ICT model assessment criteria proposed by Khazanchi (1996), as was mentioned in the previous subsections. The interview data analysis results of the two processes from the participants revealed the resounding welcome and support for the use of both artefacts, even though some participants highlighted inaccuracies from the tool's output. In conclusion, Mnkandla 2008:155) states, *"On the part of the software development organization people should be given more value than processes"*. And this is what the model is intended for – for software project teams to be valued and treated as key stakeholders, because the perpetual neglect of their project interests will culminate in *"individuals whose reliability and motivation has decreased"* (Kerr, 1989:10), thus resulting in unintended project outcomes.

7.7 The contribution of this study

The following discussion presents the contributions, which this study has made to the project management body of knowledge.

7.7.1 Theoretically and empirically-based model

Based on the identified gap in the project management literature (stakeholder management to be precise), as discussed in Section 2.6, the study developed a comprehensive, theoretically-grounded and empirically-based model, aimed at assisting software project managers to treat project teams as key stakeholders, as they ought to. This contribution is in line with a call by Eskerod *et al.* (2016) for a new and revised way of managing project stakeholders, software project teams included. It is a contribution, which further addresses a concern expressed by several researchers, amongst them Aaltonen and Kujala (2010), Eskerod *et al.* (2016), Eskerod, Huemann and Savage (2016) and Freeman, Harrison and Wicks (2007), that project managers

give more attention to the stakeholders who are perceived to be wielding more economic power at the expense of those who are (thought) to possess less economic muscle, such as project teams. The model gives a stakeholder voice to one of the most marginalised groups of project stakeholders in the ICT industry.

7.7.2 Standardisation of project teams' views and concerns collection

The model and the PM*Int* tool standardise the elicitation of project teams' views and concerns and the addressing of these by project managers across an organisation. As mentioned in Subsection 7.7.2, the data analysis results of the 'as is' environmental analysis showed that the gathering of project teams' views was not standardised in some project environments. Therefore, the implementation of the model through the project management office seeks to engender standardisation and enforce this process across project environments in an organisation, and such standardisation would contribute positively to project success, as discussed in Subsection 2.5.4.

7.7.3 A tool for informal collection of project teams' views and concerns

Under the 'new normal' brought about by the Covid-19 pandemic, project teams working remotely has become a reality. Therefore, the need for a manager to understand the feelings and emotions of members under these conditions has become more important than ever. The PM*Int* tool designed by this study, as discussed in Chapter 5 under Section 5.2, provides project managers with these informal discernment capabilities, which should enable them to anticipate likely future behaviours of their team members better. The tool makes use of the Stanford CORENLP sentiment analysis tool (a Stanford University natural language processing toolkit) as discussed in Subsections 5.3.1 and 5.3.2. The PM*Int* tool provides the following functionalities and capabilities, which extended the Stanford CORENLP sentiment analysis tool's functionality:

- Calculates the *overall* sentiment of a text using a formula developed in Chapter 5, Subsection 5.3.2.3 (see pages 109 – 114).
- Provides visualisation of the results on a graphical form, as discussed in Chapter 5, Subsection 5.3.2.3 (see pages 114 and 115).
- Provides a GUI to enable PMs to use three types of input (keyboard input, text file, emails) for text to establish PT members' sentiments – see Subsections 5.3.1 (page 98), 5.3.2.1 (page 102) and 5.3.3 (page 127). Furthermore, the GUI enables

a PM to select a specific source input for text (for example, a text file (a letter) or email(s) received from a PT member) to be processed to determine a team member's sentiments.

7.8 Limitations of the study

The case study-based research approach used by this study limits the generalisability of the findings of this study, but at the same time, some of its findings were consistent with previous research findings. The lack of generalisation of some of the study's findings presents fertile ground for future research. The effectiveness of the role of the PMO in the model could not be evaluated in this study due to the reasons specified in Subsection 6.5.1.6.

7.9 Future work

Both the model and the PM*Int* tool were validated using one agile project, and therefore the use of more project teams to validate the artefacts could perhaps provide different and interesting results. A suggestion from one of the Delphi experts was to automate the model to ease the administrative workload brought about by the model usage, and this therefore could be a possible future research piece. Another possible future research undertaking relates to the integration of the automated model with the PM*Int* tool to offer a unique seamless tool for managing project teams as key stakeholders.

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APPENDICES

Appendix A: Ethics clearance certificate

UNISA university of south africa

UNISA COLLEGE OF SCIENCE, ENGINEERING AND TECHNOLOGY'S (CSET) RESEARCH AND ETHICS COMMITTEE

2 May 2017

Ref #: 027/WH/2017/CSET_SOC
Name: Robert Hans
Student #: 30565715

Dear Robert Hans

Decision: Ethics Approval for three years (Humans involved)

Researcher: Robert Hans
PO Box 372, Pretoria, 0001
hansr@tut.ac.za, +27 83 384 2608

Supervisor (s): Prof E. Mnkandla
mnkane@unisa.ac.za, +27 11 670 9059

Proposal: The impact of Project Management Intelligence tools on enhancing human resources project management decisions - A case study of the ICT sector in South Africa.

Qualification: PhD

Thank you for the application for research ethics clearance by the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee for the above mentioned research. Ethics approval is granted for a period of three years from 2 May 2017 to 2 May 2020.

1. The researcher will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should

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be communicated in writing to the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.

3. 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.
4. 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 require additional ethics clearance.

Note:

The reference number 027/WH/2017/CSET_SOC should be clearly indicated on all forms of communication with the intended research participants, as well as with the Unisa College of Science, Engineering and Technology's (CSET) Research and Ethics Committee

Yours sincerely

Adèle da Veiga

Dr. A Da Veiga

Chair: Ethics Sub-Committee School of Computing, CSET

Prof I. Osunmakinde

Director: School of Computing, CSET

Prof B. Mamba

Executive Dean: College of Science, Engineering and Technology (CSET)

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Appendix B: Interview questions for 'as is' environmental analysis –

Interview questions to a Project Manager

NAME: _____ **COMPANY NAME:** _____

1. Is there a process in place to gather team members' views and concerns regarding a project?

   Yes: ☐ (*Continue with next question 2*) No: ☐ (*Go to Question 6*).

2. **{This question is dependent on the answer given above (if there is a process in place to get team members' views and concerns)}**

   If there is a process, how is the information regarding team members' concerns and views pertaining a project obtained or gathered?

3. **{This question is dependent on the answer given above (if there is a process in place to get team members' views and concerns)}**

   Please explain what type of information is gathered?

4. **{This question is dependent on the answer given above (if there is a process in place to get team members' views and concerns)}**

   Is the information received used in the decision-making process, if so, how (elaborate)?

5. **{This question is dependent on the answer given in Q1 above (if there is a process in place to get team members' views and concerns)}**

   a. **Has** the process of gathering such information ***enabled*** / ***not enabled*** you to take better decisions regarding your project team members?

      Yes: ☐ No: ☐

   b. **How** has the new information ***enabled*** / ***not enabled*** {*choose the correct one depending on the answer in question (a) above*} you to take better decisions regarding your project team members?

   c. **What improvements** would you propose to be made on the current process for gathering information from team members?

6. **{ONLY ASK THIS QUESTION IF QUESTION 4 WAS NOT ASKED AND THE ANSWER TO QUESTION 1 WAS NO}**

   What would be your ideal process for gathering team members' views and concerns regarding what is happening in a project?

_____

Appendix C: Interview questions for 'as is' environmental analysis – Interview questions to a Project Team Member

NAME: _____ **COMPANY NAME:** _____

1. Is there a process in place to gather team members' views and concerns regarding a project?

   Yes: ☐ (*Continue with next question 2*) No: ☐ (*Go to Question 6*).

2. **{This question is dependent on the answer given above (if there is a process in place to get team members' views and concerns)}**

   If there is a process, how is the information regarding team members' concerns and views pertaining a project obtained or gathered?

3. **{This question is dependent on the answer given above (if there is a process in place to get team members' views and concerns)}**

   Please explain what type of information is gathered?

4. **{This question is dependent on the answer given above (if there is a process in place to get team members' views and concerns)}**

   Are you aware as to whether the collected information from team members is used in the decision-making process by the project manager? If you are aware, please elaborate.

   Yes: ☐ (*Please elaborate*) No: ☐

5. **{This question is dependent on the answer given in Q1 above (if there is a process in place to get team members' views and concerns)}**

   What improvements would you propose to be made on the current process for gathering information from team members?

6. **{ONLY ASK THIS QUESTION IF QUESTION 4 WAS NOT ASKED AND THE ANSWER TO QUESTION 1 WAS NO}**

   What would be your ideal process for gathering team members' views and concerns regarding what is happening in a project?

_____

Appendix D: Phase One Delphi Interview Questions

Expert name: _____ Panel:_____

Interview date:_____ Expert symbol:_____

1. Is the model supported by the PM*Int* tool needed by the ICT sector?

   Indicate your answer by selecting one of the following:

   (a) Strongly agree (1). ☐
   (b) Agree (2). ☐
   (c) Somewhat agree (3). ☐
   (d) Neither (4). ☐
   (e) Somewhat disagree (5). ☐
   (f) Disagree (6). ☐
   (g) Strongly disagree (7). ☐

   Please explain your answer selected answer above.

2. How feasible is the application of the model in a real-life project environment?

   Indicate your answer by selecting one of the following:

   (h) Highly feasible (1). ☐
   (i) Feasible (2). ☐
   (j) Neither (3). ☐
   (k) Infeasible (4). ☐
   (l) Highly infeasible (5). ☐

   (i) Please explain your selected answer above.

3. How well does the model fulfil its intended purpose?

   Indicate your answer by selecting one of the following:

   (a) Very well (1). ☐
   (b) Well (2). ☐
   (c) Neither (3). ☐
   (d) Not well (4). ☐
   (e) Not well at all (5). ☐

   Please explain your selected answer above.

4. How efficient is the PM*Int* tool in collecting the views and concerns of PTs?

   Indicate your answer by selecting one of the following:

   (a) Excellent (1). ☐

   (b) Good (2). ☐

   (c) Average (3). ☐

   (d) Poor (4). ☐

   (e) Very poor (5). ☐

   Please explain your selected answer above.

5. **What improvements** would you propose be made to the model?

6. **What improvements** would you propose be made to the PM*Int* tool?

Appendix E: Phase Two Delphi Interview Questions

Expert name: _____ Panel:_____

Interview date:_____ Expert symbol:_____

1. How feasible is the application of the model in a real-life project environment?

   Indicate your answer by selecting one of the following:

   (a) Highly feasible (1). ☐

   (b) Feasible (2). ☐

   (c) Neither (3). ☐

   (d) Infeasible (4). ☐

   (e) Highly infeasible (5). ☐

   (i) Please explain your selected answer above.

2. How well does the model fulfil its intended purpose?

   Indicate your answer by selecting one of the following:

   (a) Very well (1). ☐

   (b) Well (2). ☐

   (c) Neither (3). ☐

   (d) Not well (4). ☐

   (e) Not well at all (5). ☐

   Please explain your selected answer above.

3. How efficient is the PM*Int* tool in collecting the views and concerns of PTs?

   Indicate your answer by selecting one of the following:

   (a) Excellent (1). ☐

   (b) Good (2). ☐

   (c) Average (3). ☐

   (d) Poor (4). ☐

   (e) Very poor (5). ☐

   Please explain your selected answer above.

4. **What improvements** would you propose be made to the model?

5. **What improvements** would you propose be made to the PM*Int* tool?

_____

Appendix F: Validation process Interview Questions

Participant name:_____ Interview date: _____

1. How feasible is the application of the model in a real-life project environment?

   Indicate your answer by selecting one of the following:

   (a) Highly feasible (1). ☐

   (b) Feasible (2). ☐

   (c) Neither (3). ☐

   (d) Infeasible (4). ☐

   (e) Highly infeasible (5). ☐

   Please explain your selected answer above.

2. How well does the model fulfil its intended purpose?

   Indicate your answer by selecting one of the following:

   (a) Very well (1). ☐

   (b) Well (2). ☐

   (c) Neither (3). ☐

   (d) Not well (4). ☐

   (e) Not well at all (5). ☐

   Please explain your selected answer above.

3. How efficient is the PM*Int* tool in collecting the views and concerns of PTs?

   Indicate your answer by selecting one of the following:

   (a) Excellent (1). ☐

   (b) Good (2). ☐

   (c) Average (3). ☐

   (d) Poor (4). ☐

   (e) Very poor (5). ☐

   Please explain your selected answer above.

4. **What improvements** would you propose be made to the model?

5. **What improvements** would you propose be made to the PM*Int* tool?

6. {**NB: This question is only for the PM/Scrum master**} Could you please explain how were the different stages of the model implemented during the phase of the project?

Appendix G: A proof of professional language editing

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Certificate of Authenticity

CERTIFICATE: COA060920RH

06 September 2020

To Whom It May Concern

This is to certify that "**A MODEL FOR ASSISTING SOFTWARE PROJECT MANAGERS TO TREAT PROJECT TEAMS AS KEY STAKEHOLDERS: A CASE STUDY OF THE SOUTH AFRICAN SOFTWARE INDUSTRY**" by Robert Toyo Hans for the degree of DOCTOR OF PHILOSOPHY in Computer Science at the University of South Africa has been professionally edited by Dr. Laura Budler Kleinhans of ChickPea Proofreading and Editing Services for Students and Professionals.

Document:

Job Number	Document title
120820(RH)	**A MODEL FOR ASSISTING SOFTWARE PROJECT MANAGERS TO TREAT PROJECT TEAMS AS KEY STAKEHOLDERS: A CASE STUDY OF THE SOUTH AFRICAN SOFTWARE INDUSTRY**

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Appendix H: A Turnitin similarity report