A bibliometrics study of the research impact of the National Research Foundation-rated researchers in the North West University, South Africa (2006 - 2017)

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A bibliometrics study of the research impact of the National Research Foundation-rated researchers in the North West University, South Africa (2006 - 2017)

I declare that the above dissertation is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references. I further declare that I submitted the dissertation to originality checking software and that it falls within the accepted requirements for originality. I further declare that I have not previously submitted this work, or part of it, for examination at UNISA for another qualification or at any other higher education institution.

Siviwe Bangani **24/06/2019**

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SIGNATURE DATE

Dedication

This thesis is dedicated to my late sister, Sister Nontlahla "Mamie" Bangani (below) who departed from this clod on 05 March 2018. Rest in Peace Mafungwashe, MaNyawuza, MaFaku, Thahla kaNdayeni, Ziqelekazi, Hlamba Ngobubende amanzi ekhona. *Nathi siyeza* (we will also come to join you). This thesis is also dedicated to the memory of my late grandparents: Brandy "Msil'empuku" Bangani and Marhibela Bangani. It is true that "*ukuzala kuzolula*" (to bear a child has many benefits).

10/04/1983 – 05/03/2018

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Abstract

One of the key activities undertaken by the National Research Foundation of South Africa is to rate researchers in public universities and various research institutes. The NRF rating system is a valuable tool to benchmark the quantity, quality and impact of South African researchers with international peers. Public universities in South Africa have been the main beneficiaries and enablers of the NRF rating system with their strategies explicitly stating an increase in the ratings of researchers as one of the main strategies. There is general belief in the country's universities that having a high concentration of NRF-rated researchers enhances the prestige and ranking of the institutions. Universities, therefore, are in a constant competition to attract, produce, recruit and retain rated researchers. Despite these strategies, there is a paucity of studies in South Africa that are conducted to determine the impact of these researchers at the various institutions.

This quantitative study sought to establish the research impact of the NRF-rated researchers' output at the North-West University from 2006 to 2017. Specifically, this study strove to establish the research output, and the academic and societal impact of the research output of rated researchers at North-West University. It used the altmetrics and bibliometrics methods. Various tools, including the three main bibliographic databases (Google Scholar (GS), Web-of-Science (WoS) and Scopus) and two academic social media platforms (ResearchGate (RG) and Mendeley) were used to collect data. The citations in the three bibliographic databases were used as proxy for academic impact while reads and readerships in RG and Mendeley were used to determine societal impact of the rated researchers. The Statistical Package for the Social Sciences (SPSS), particularly the Spearman's Correlation Analysis, was used to test the relationship between citations in the three bibliographic databases and reads and readerships in the two academic social media platforms. The main findings of this study confirm that the majority of NWU's rated researchers' output emanated from GS (8276), followed by Scopus (5536) and then WoS (5003). GS output had 108 279 citations, output in Scopus had 71 137 citations while those in WoS had 60 174 citations. In terms of penetration of academic social media, there were 6 026 research outputs in RG which were read 676 919 times and 5 850 in Mendeley with 142 621 readerships. There were weak but strong correlations between RG and all three bibliographic databases' citations. The relationship between the three bibliographic databases' citations and Mendeley readerships was found to be stronger.

Keywords

Bibliometrics, altmetrics, NRF ratings, Web-of-Science, Scopus, Google Scholar, ResearchGate reads, Mendeley readership, citations, research impact, research evaluation, journals, productivity, South Africa, Universities, North-West University

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List of Abbreviations and Acronyms

Abbreviation/Acronym	Meaning
CAT	Cumulative Advantage Theory
CHE	Potchefstroom University for Christian Higher Education
CSIR	Council for Scientific and Industrial Research
DHET	Department of Higher Education and Training
DOI	Digital Object Identifier
FAO	Food and Agriculture Organization
FRD	Foundation for Research Development
GDP	Gross Domestic Product
GS	Google Scholar
H-index	Hirsch Index
IBSS	International Bibliography of Social Science
MJSS	Mediterranean Journal of Social Sciences
NDP	National Development Plan
NGO	Non-Governmental Organisation
NRF	National Research Foundation
NWU	North-West University
ORCID	Open Researcher and Contributor ID
PoP	Publish or Perish
RG	ResearchGate
ScieLO	Scientific Electronic Library Online
SFI	Science Foundation Ireland
SPSS	Statistical Package for the Social Sciences
UN	United Nations
UNISA	University of South Africa
WoS	Web-of-Science

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Appendix A: Certificate of language editing

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Appendix C: List of rated researchers at NWU (2006 – 2017)

Appendix D: List of common journal titles in GS, Scopus and WoS

Chapter 1: Introduction and background to the study

1.1 Background and Introduction

Research is a rigorous and systematic process of enquiry that is aimed at generating, preserving, augmenting, and improving knowledge (Simpson and Gevers, 2016). It leads to a better understanding of nature and society (Leedy and Ormrod, 2015; Simpson and Gevers, 2016). Without conducting research, the development of humanity would remain stagnant as no new knowledge or new products would be discovered or invented (Sooryamoorthy, 2018).

Research involves a number of activities, including the analysis, reporting, sharing, publishing, and dissemination of information in the form of research output (South Africa, 2014). Research output refers to the published outcome of research, including conference papers, journals, patents, books, book chapters, theses and dissertations (Department of Higher Education and Training (DHET), 2015a). The evaluation of the impact of research is one of the major activities of research. This is because governments and funders are concerned with return on investment on their funding of research.

Research evaluation is a major undertaking for international organisations (European Commission, 2010), national governments (South Africa, 2016), universities (Jones and Cleere, 2014), research agencies (Science Foundation Ireland, 2013), and Non-Governmental Organisations (Rousseau, Egghe & Guns, 2018). There are several reasons why the evaluation of research is important: it provides universities with a basis to benchmark with other institutions, decide which academics to rank or promote, and provide targeted training and development to the researchers (Rotich and Onyancha, 2017; Rousseau *et al.*, 2018). Funders and rating agencies use research evaluation to decide on projects that deserve funding, and researchers who deserve more funds than others, and researchers who should achieve what rating (National Research Foundation, 2017a).

At a researcher level, research evaluation assists researchers in benchmarking themselves with their peers, improve their reputation, and achieve higher status, or rank, or affirm an already high status or rank (Rotich and Onyancha, 2017; Rousseau *et al.*, 2018). Governments evaluate research in order to determine whether or not the priorities of the

country are realised, gain insights into the success or failure of policies, benchmark with other countries, and get evidence to make informed decisions (Sooryamoorthy, 2018). By evaluating research, researchers are able to demonstrate the impact of research on the society, academy, culture, political environment, technology, health, environment, public policy and services, economy and commerce, and professional services (Jones and Cleere, 2014).

Research impact is the measurement of how useful a research has been to other researchers, institutions, regions, countries, or globally (Jones and Cleere, 2014: 19). Research can have an impact at various levels including the academy, society, health, business and commerce, policy, environment, and culture (Science Foundation Ireland (SFI), 2015: 38-53). In research terms, societal impact refers to a demonstrable contribution that scholarly research makes to society and the economy (Economic and Social Research Council, 2017). Academic impact, on the other hand, is the contribution of research to the advancement of academia, including the influence on research theory, research methods and research output (Jones and Cleere, 2014: 17). Research evaluation embraces the activities undertaken to determine the quantity and quality of scholarly research output (Rousseau *et al.*, 2018). According to Fedderke (2013), the most common method of evaluating research and researchers is the peer review mechanism which relies on the judgment and assessment of experts within a field of study. Fedderke (2013) points out that due to its secrecy and difficulty to replicate, this method is accused of bias and its proneness to manipulation. Fedderke (2013) adds that in order to complement the peer review mechanism, other research evaluation measures such as the bibliometrics and, lately, altmetrics are also employed.

Thomson Reuters (2008) defines bibliometrics as the quantitative measurement or counting of publications and analysis of citations in order to determine the impact of research, researchers, publications, and institutions. The development of social media networks has opened more platforms for researchers to communicate and measure the impact of their research. It has paved way for assessing research impact beyond the bounds of academia using altmetrics indicators. Among the popular altmetrics indicators used to evaluate research are ReasearchGate (RG) reads and Mendeley readership. RG reads count the number of times a document hosted by RG has been read by RG members and non-

members while Mendeley readership counts the number of times a document has been saved by researchers who are Mendeley members into their Mendeley profiles.

Generally, altmetrics concerns itself with tracking societal impact of academic research using these social media indicators (Roemer and Borchardt, 2015:100). That way, altmetrics attempt to capture the impact of research through non-traditional means (Yu, Wu, Alhalabi, Kao, & Wu, 2016:1002). Contrary to what the concept denotes, altmetrics are not an alternative set of metrics to bibliometrics. Rather, they can be used to complement bibliometrics with the latter tracking academic impact while the former tracks societal impact of scholarly publications (Byl, Carson, Feltracco, Gooch, Gordon, Kenyon, Muirhead, Seskar-Hencic, MacDonald, Özsu & Stirling, 2016; Bangani, 2018). More attention is given to bibliometrics and altmetrics under the literature review in Chapter two of this study.

1.2 Contextual setting

Contextual framework refers to the circumstances within which a research is conducted, including the environment, space, time and institution (Badenhorst, 2007:19). This section is dived into three parts, which are: (1) the overview of research in South Africa, (2) the NRF rating system in South Africa, and (3) the North-West University.

1.2.1 Overview of research in South Africa

South Africa is home to 26 universities whose main objectives are teaching, learning, research, and community engagement (Mckenna, 2016; Simpson and Gevers, 2016; Favish and Simpson, 2016). As a result, research forms an integral part of the academics' key performance areas at all the 26 universities. The majority of research in the country is produced by universities (South Africa and Human Sciences Research Council, 2016). Other research is generated in the private sector, parastatals, and NGO's (South Africa and Human Sciences Research Council, 2016). South Africa ranks as the top country in Africa in terms of research output, even though it produces less than 1% of the world's research (Sooryamoorthy, 2018). In order to improve the quantity and quality of research, the Department of Higher Education and Training pre-selects a list of journals and conference proceedings for public university researchers from the Web-of-Science (WoS), Scopus, Scientific Electronic Library Online (ScieLO), International Bibliography of Social

Science (IBSS), and the Norwegian List. Other South African journals are selected by a panel of experts appointed by the DHET and the list is called the DHET list of Approved South African Journals. Articles published in journals that are not on the prescribed lists are not considered for subsidy by the government.

Academics in South Africa are expected to publish at least 1.25 articles per academic a year in journals appearing on this accredited list (Schulze, 2008, Maphalla, 2013). Universities, however, may require their researchers to publish more than the minimum units required by government. The number of research output from South Africa has been on the increase since 2004. There were 12 363.81 research units in 2012 which is almost a hundred percent increase from 2004 where 6 660.24 units were published (Simpson and Gevers, 2016). The government of South Africa is the biggest funder of research in the country through the National Research Foundation, and the other science councils and institutes. The South African government spends more that R29-billion or 0.77% of its GDP on research in the hope that it could realise return on investment (Pandor, 2017). The government recognises that in order to achieve its goals, there is a need for more investment in research but also efficient use of the current infrastructure and resources.

Research plays a central role in enabling the country to achieve the goals of the National Development Plan (NDP) (South Africa, 2012). Government expects that research could assist it to deal with adverse trends such as poverty, inequality, crime and corruption, global warming, poor economic conditions, scarcity of water, greenhouse gas emissions, and unemployment (South Africa, 2012). The National Plan for Higher Education in South Africa (South Africa, 2001) identified several strategies to stimulate research in the country, which were set to:

- increase postgraduate output
- increase research output
- sustain the existing research capacity and strengths
- create sustainable centres of excellence and niche areas in institutions that demonstrate capacity to host them
- facilitate research collaborations, especially in the Southern African region

- promote better co-ordination and co-operation between different research institutions which would ultimately lead to the development of a national research strategy.

Another method of stimulating the quantity and quality of research in South Africa is through the rating of researchers by the NRF based on the quantity and impact of their recent research output (Morell, 2015). The NRF rating system ranks researchers in five broad categories which are: A, B, C, P or Y with A being the highest rank (UNISA, 2016). The conviction of the NRF is that the higher the rating that a researcher achieves, the better the quality and impact of their research (Fedderke and Goldschmidt, 2015).

Researchers are expected to generate positive innovations and solutions that address the country's problems as the society and government are keen to identify the impact of research on the national priorities. The total number of all researchers, including those based in the private sector and doctoral and post-doctoral candidates, stood at 48 479 by 2015 (South Africa and Human Sciences Research Council, 2016). The majority of those researchers came from the higher education sector (38 381), followed by business (6 262), science councils (1 988), government (1 343), and NGOs (506). Webbstock and Sehoole (2016) point out that there were 2 174 professors and 1 860 associate professors, and 4 521 senior lecturers in South African universities by 2016. These researchers are expected to undertake the bulk of the research in the country. South Africa's research environment faces challenges due to underfunding and the ageing cohort of established researchers (Webbstock and Sehoole, 2016). The average age of a South African researcher by 2012 was 59 years old (News24, 2012). According to UNISA (2016), the country ranked the lowest in terms of research expenditure as a percentage of the Gross Domestic Product, when compared to eleven other countries globally. Only 0.71% of the country's GDP was spent on public universities, compared to some of the biggest contributors to research, as shown in Figure 1 below:

Figure 1: Low levels of research funding in South Africa

Universities South Africa, 2016

Pandor (2017) maintains that the government is set to increase the expenditure on research to 1% of the GDP by 2020. Due to the socio-economic challenges and financial constraints experienced by the country, it is seminal for researchers in the country to demonstrate value for money of their research through constant evaluation of their output (NRF, 2007).

1.2.2 The NRF rating system in South Africa

The NRF traces its history back to 1984 when the NRF was still part of the Council for Scientific and Industrial Research (CSIR). Then it was called the Foundation for Research Development (FRD). In the same year, the system of rating of scientific researchers was introduced in order to counter the perceptions that research funding was "spread too thinly" (Morell, 2015). The rating system then was based on quality and impact of research outcomes (Cozzens, Gevers, Letlape, Marrett, Posel & Webb, 2005). Initially, the ratings were meant for researchers in the natural sciences. It was only in 2002 that the ratings were extended to the humanities and social sciences (Morell, 2015). In 1990, the FRD weaned itself from the CSIR and merged with the Centre for Science Development in 1999 (NRF, 2007). This heralded the birth of the NRF. The NRF is a national research support agency established by an Act of Parliament of South Africa (South Africa, 1998). According to Section 3 of the NRF Act 23 of 1998, the main objectives of the NRF are carved to:

- Support and promote research through funding
- Facilitate the creation of knowledge in all fields
- Contribute to the improvement of quality of life of South Africans through research.

The NRF rating mechanism is institutionally defined as the assessment of a researcher's academic work based on the quality and impact of their recent research output (Morell, 2015). The NRF rating system is a hierarchal system that categorises researchers according to different classifications based on their research quality and impact (Wingfield, 2014). The NRF (2017) provides the complete definitions of NRF rating categories as best presented in Table 1:

Table 1: Definition of NRF rating categories

Category	**Definition**	**Sub-category**	**Description**
A	Researchers who are unequivocally recognised by their peers as leading international scholars in their field for the high quality and impact of their recent research output.	A1	A researcher in this group is recognised by all reviewers as a leading scholar in his/her field internationally for the high quality and wide impact (i.e. beyond a narrow field of specialisation) of his/her recent research output.
		A2	A researcher in this group is recognised by the overwhelming majority of reviewers as a leading scholar in his/her field internationally for the high quality and impact (either wide or confined) of his/her recent research output
B	Researchers who enjoy considerable international recognition by their peers for the high quality and impact of their recent research output.	B1	All reviewers are firmly convinced that the applicant enjoys considerable international recognition for the high quality and impact of his/her recent research output, with some of them indicating that he/she is a leading international scholar in the field.
		B2	All or the overwhelming majority of reviewers are firmly convinced that the applicant enjoys considerable international recognition for the high quality and impact of his/her recent research output.
		B3	Most of the reviewers are convinced that the applicant enjoys considerable international recognition for the high quality and impact of his/her recent research output.

C		C1	All of the reviewers are firmly convinced that the applicant is an established researcher as described and who, on the basis of the high quality and impact of his/her recent research is regarded by: Some reviewers as already enjoying considerable international recognition; OR The overriding of reviewers as being a scholar who has attained a sound/solid international standing in their field, but not yet considerable international recognition; OR The overriding majority of reviewers as being a scholar whose work focuses mainly on local and/or regional issues and who as a scholar at a nationally leading level has substantially advanced knowledge and understanding in the field by contributing to new thinking, a new direction and/or a new paradigm.*
		C2	All of the reviewers are firmly convinced that the applicant is an established researcher as described. The applicant may, but need not, enjoy some international recognition for the quality and impact of his/her recent research output.
		C3	Most of the reviewers concur that the applicant is an established researcher (as described).
P	Young researchers (normally younger than 35 years of age), who have held the doctorate or equivalent qualification for less		Researchers in this group are recognised by all or the overwhelming majority of reviewers as having demonstrated the potential of becoming future international leaders in their field on the basis of

	than five years at the time of application and who, on the basis of exceptional potential demonstrated in their published doctoral work and/or their research output in their early post-doctoral careers are considered likely to become future international leaders in their field.		exceptional research performance and output from their doctoral and/or early post-doctoral research careers.
Y	Young researchers (40 years or younger), who have held the doctorate or equivalent qualification for less than five years at the time of application, and who are recognised as having the potential to establish themselves as researchers within a five-year period after evaluation, based on their performance and productivity of quality research output during their doctoral studies and/or early post-doctoral careers. .	Y1	A young researcher (within 5 years from PhD) who is recognised by all reviewers as having the potential (demonstrated by research products) to establish him/herself as a researcher with some of them indicating that he/she has the potential to become a future leader in his/her field. OR A young researcher (within 5 years from PhD) who is recognised by all or the overwhelming majority of reviewers as having the potential to establish him/herself as a researcher of considerable international standing on the basis of the quality and impact of his/her recent research output
		Y2	A researcher in this group is recognised by all or the overwhelming majority of reviewers as having the potential to establish himself/herself as a researcher (demonstrated by recent research products).

**This definition is restricted to those researchers whose area of research prevents (or precludes) them from meeting the requirements of either definition 1 or definition 2.*

Another category that appears prominently in this study is the L-rating which was discontinued in 2010 after the dissolution of the committee on L ratings (Fedderke, 2013).

However, researchers with this rating continued to be recognised as such until such time that the rating expired. L-rated researchers were those researchers who came from less research intensive universities, women, black and researchers who were previously established as researchers and have returned to a research environment (Fedderke, 2013).

For purposes of this study, sub-categories are not considered. For example C1, C2, and C3-rated researchers are treated as one category falling within the C rating category.

1.2.2 North-West University

NWU came about as a result of a merger between two distinct academic institutions which were the University of North West (formerly University of Bophuthatswana), and the Potchefstroom University for Christian Higher Education (CHE). The merger also incorporated students and staff, not facilities, from the Sebokeng Campus of Vista University (South Africa, 2005). As a result, the North-West University has footprints in two provinces of South Africa: the North-West and Gauteng Provinces. The Mafikeng Campus and Potchefstroom Campus are based in the North-West Province while the smaller Vaal Campus is based in Gauteng (South Africa, 2017). The reason for the merger was, inter alia, to "build research capacity" of the merged institution. Thus the North-West University was transformed from a tuition/learner based institution with some research to an institution where teaching/learning and research and innovation are balanced (South Africa, 2002).

Research forms a central pillar of the NWU strategy. The NWU research strategy aims to place the University among the top 5 institutions in the country in terms of research productivity and impact. The University had 3 192 instructional and academic staff members (NWU, 2016a). There were 51% members of academic staff with PhDs and the University aims to increase this number to 65% by 2025 (NWU, 2017). There are five academic ranks for lecturers and researchers, which are junior lecturer, lecturer, senior lecturer, associate professor, and professor. In addition, there is a position of a research professor in each faculty who is expected to drive the research agenda of the eight faculties of the university, which are Economic and Management Sciences, Education, Engineering, Health Sciences, Humanities, Law, Natural and Agricultural Sciences, and Theology. In addition to the eight faculties are four research centres of excellence which are: Centre of Excellence for Nutrition, Centre for Space Research, Centre for Excellence for

Pharmaceutical Sciences, and Hypertension in Africa Research Team. The NWU has ten research units, which are: Unit for Language and Literature in the South African Context, Unit for Business Mathematics and Informatics, Unit for Environmental Sciences and Management, Unit for Reformational Theology and the Development of the South African Society; Research Unit for Law, Justice and Sustainability; Unit for Energy and Technology Systems; Africa Unit for Trans-disciplinary Health Research; Workwell: Research Unit for Economic and Management Sciences; Education and Human Rights in Diversity; and Tourism Research in Economic Environs and Society.

NWU hosts thirteen research focus areas, which are: Ancient Texts -Text, Context and Reception; Chemical Resource Beneficiation, Community Psychosocial Research, Enabling Optimal Expression of Individual, Social and Institutional Potential; Human Metabolomics, Material Science Innovation and Modelling; Physical Activity, Sport and Recreation; Population and Health, Quality in Nursing and Midwifery, Self Directed Learning, Social Transformation, Trade and Development, and Understanding and Processing Language in Complex Settings.

There are eleven research niche areas at the NWU: Edu-lead, Food Security and Safety, Global Innovative Focused Talent, Indigenous Language Media in Africa, Lifestyle Diseases, Medicine Usage in South Africa, Multilingual Speech Technologies, Musical Arts in South Africa: Resources and Applications, Occupational Hygiene and Health Research Initiative, Technology-Enhanced Learning and Innovative Education and Training - South Africa, and Visual Narratives and Creative Output through Interdisciplinary and Practice-led Research.

The University hosts five research entities which are: Department of Science and Technology (DST) Infrastructure Centre of Competence in Hydrogen production, storage, reticulation and safety codes and standards; DST/NWU Pre-Clinical Drug Development Platform, Department of Trade and Industry (DTI) Centre for Advanced Manufacturing, DST Centre of Excellence in Indigenous Knowledge Systems, and Centre for Human Metabonomics. The University has one commercial research entity: Centre for Pharmaceutical Biomedical Services. NWU holds nine research chairs: Astrophysics and Space Physics, Coal Research, Biofuels and other Clean Alternative Fuels, Early Detection and Prevention of Cardiovascular Disease in Africa, ETDP SETA research chair in early childhood education, Eskom Power Plant Engineering Institute – Emissions Control,

Nutrition Research Foundation in Clinical Nutrition, and World Trade Organisation Chair (NWU, 2018).

The university policy on academic staff promotions recognises that individuals have different competencies, interests, and potential, therefore, the policy does not prescribe the pathway to promotion, leaving that discretion to faculties. The university states that academic staff shall be promoted based on merit, and will have to fit within the budget of the faculty (NWU, 2005). All research related matters fall within the ambit of the office of the Vice-Chancellor: Research and Innovation who oversees all research related issues at a strategic level. At an operational level there is an office of research support run by a director who supports postgraduate students and researchers.

Among its responsibilities, this research office collates all research output of the university and submits them to the DHET for subsidy purposes. This office is also responsible for providing support to lecturers with NRF ratings. The researchers at NWU are supported by three campus libraries located within the three campuses of the University. The library plays a principal role on NRF ratings mainly by providing bibliometrics data from GS, Scopus, and WoS, as well as assisting researchers to create their unique author identification such as Open Researcher and Contributor IDs (ORCID), GS profiles, Scopus profiles. The library also assists with academic social media platforms such as ResearchGate (RG) and Mendeley. Over the years, the University has increased its number of rated researchers as reflected in Table 2.

Table 2: Number of NWU's rated researchers from 2006 to 2017

Year	NRF-rated researchers*
2006	82
2007	95
2008	103
2009	116
2010	117
2011	125
2012	140
2013	169
2014	190
2015	146
2016	195
2017	229
Total	1707

***The above figures are reflected in the various research reports of NWU from 2006 to 2017**

The number of NRF-rated researchers at NWU has been on the upward trend since 2006 except in 2015 where the numbers decreased.

1.3 Statement of the problem

The NRF rating mechanism has gained traction and is well recognised in South Africa. Many researchers sought and attained ratings in the past few years. Although the NRF is convinced that its researcher rating system is a valuable tool for benchmarking the quality and impact of South African researchers with international peers (Morell, 2015), the NRF rating system has not been without its critics. It has been accused of bias, subjectivity, hierarchisation of researchers, operational complexities, attempting a 'one size fits all', providing inappropriate reviewers, bureaucracy, distorted rankings, lack of transparency and verifiability, and inconsistencies due to its over reliance on one research evaluation mechanism, the peer-review (Morell, 2015; Callaghan, 2018). Some critics advocate for research impact to play a bigger role in the NRF ratings than it currently does (Fedderke, 2012). Most of the NRF rating system's short-comings are associated with its over-reliance on peer-review mechanisms in the ranking of researchers. Most critics of the NRF rating

system do not necessarily criticise the ranking system per se but its over-reliance on one measure in evaluating and ranking academic researchers. Despite its flaws, research-intensive institutions in the country consider the NRF ratings for the recruitment and promotion of researchers (Morell, 2015; Callaghan, 2018). Public universities in South Africa have been the main beneficiaries and enablers of the NRF rating system. University strategies in South Africa explicitly state the increase of NRF-rated researchers as one of their main research strategies (for example: University of Pretoria, 2011; Stellenbosch University, 2011). Universities consider that there is a possible relationship between the higher percentage of NRF-rated researchers and a university's ranking by international ranking agencies (Ntshoe and Selesho, 2014:1559-1560). Through their active participation in the rating system, universities provide a positive justification for the evaluation of researchers. As a result, public universities in the country strive to retain and attract more NRF-rated researchers. The North-West University has not been immune from this race as its current strategy seeks to promote the participation of academics in the National Research Foundation's rating system. In some instances, NRF ratings are factored into the processes for academic staff promotions at the University. The University also seeks to ensure that its academic staff members are encouraged to participate in the NRF rating system through performance management agreements, training and development, and coaching. Further, the University seeks to recruit NRF-rated researchers (NWU, 2017:79). There is recognition at the University and the country at large that the system has become institutionalised for the foreseeable future; therefore it is vital to evaluate its impact. At the NWU, the increase of NRF-rated researchers has not been accompanied by any empirical evidence to determine the impact of their output, especially in view of the Department of Higher Education (DHET)'s proposal to consider impact as a determinant of subsidy allocation to Universities in the future. Therefore, the main question addressed in this study is:

What is the academic and societal impact of NRF-rated researchers' output at NWU?

In other words, the study examines whether NRF-rated researchers' output at NWU quantitatively and qualitatively evinces significant impact that would justify the effort taken to attract, produce, and retain such rated researchers.

1.4 Purpose of the study

The main purpose of this study is to examine the research impact of the NRF-rated researchers' output at the NWU from 2006 to 2017, specifically, the production of research output, and the academic and societal impact of these outputs.

1.5 Objectives of the study

The specific objectives are designed to:

- Ascertain the research output of rated researchers at NWU in GS, Scopus and WoS.
- Determine the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Compare the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Identify a list of core journals in which the rated researchers publish.
- Assess the visibility of the rated researchers' output at the NWU in academic social media sites (ResearchGate and Mendeley).
- Determine the relationship between academic impact and societal impact of the research output of rated researchers at NWU.

1.6 Research questions

The inspiration for research studies emanates from a desire to answer pertinent questions or to solve a particular problem (Thomas and Hodges, 2010:240). This research study seeks to answer the following questions:

- What is the research productivity of rated researchers at NWU?
- What is the impact of the rated researchers' output at the NWU?
- How does the research output of NWU rated researchers compare in Google Scholar (GS), Web-of-Science (WoS), and Scopus?
- Which journals cite rated researchers?
- To what extent are the rated researchers visible on academic social media sites (RG and Mendeley), and what is their impact?

- Is there a relationship between the societal impact and academic impact of research conducted by rated researchers at NWU?

1.7 Significance of the study

Bibliometrics are essential for libraries in that they can immediately inform the librarians of any gaps in the collection. They are critical in studying usage patterns of materials in the library. Bibliometrics help the librarians to track publishing output and its impact (Thomson Reuters, 2008:2). Of late, altmetrics have improved as more research impact studies use these citation figures sometimes in combination with bibliometrics (Bangani, 2018). The trend in South Africa has been that most citation analysis studies focus on the citation analysis of master's and doctoral theses. Very few have analysed citation and altmetrics patterns of researchers (Rotich and Onyancha, 2017:21). The few that are in the public and academic domains have focussed on certain disciplines. This study adds useful detail and knowledge that is anticipated to benefit the following categories of stakeholders:

- University management - if it is found that the research produced by NRF-rated researchers has more impact, the University will be justified in investing on strategies to attract, produce and retain them. If the opposite is found, then the University may have to reconsider its strategies.
- Universities - A study of this nature could be replicated in other universities or adapted to different contexts.
- National Research Foundation and other research entities - the NRF could use this study to determine the value of the rating system and its impact on research. Other research entities could gain a deeper understanding of the impact of NRF-rated researchers and take into account the NRF rating system in granting research grants.
- Librarians - those librarians involved in collection development may use this study to identify a list of core collection of journals that cite the NRF-rated researchers.
- The Researchers - the study is significant for NRF-rated researchers and non-NRF-rated researchers as they could gain insight into the impact of NRF rating. The study shall assist the current researcher to obtain a master's degree.
- Bibliometricians - students and scholars of bibliometrics will be enriched by this study as they would gain insight of the impact of research output of rated

researchers. Further, this study is meant to be a contribution to the field of library and information science.

1.8 Literature review

Jesson, Matheson & Lacey (2011:10) define a literature review as a written appraisal of what is already known about a topic or a field. It is meant to show the researcher/s what has already been done in a field and what the possible gaps are. Each research is meant to fill a small part of a bigger puzzle. In any area of research there are related studies that a researcher uses to enrich and strengthen the current research. The researcher conducted searches on electronic databases including the NWU and the University of South Africa's library Catalogues, Southern African Catalogue (SA CAT); Ebsco-Host, Emerald, SA ePublications, ScienceDirect, National ETD Portal, Nexus Database, Proquest Theses and Dissertations, GS and other databases in order to ensure a thorough and comprehensive review of the literature. The focus was on those studies that relate to the conceptual framework and the questions that this study seeks to answer. The literature review focuses on the following themes:

- **Conceptual framework**

The conceptual framework focused on peer-review mechanism, bibliometrics and altmetrics.

- **Research output of researchers**

This section discusses the meaning of research output in the academy and then lays out the different types of research output.

- **Researchers' visibility in GS, WoS, Scopus and social media sites (RG and Mendeley)**

  This section focuses on the visibility of South African researchers on Google Scholar (GS), Web-of-Science (WoS) and Scopus, and how these bibliographic

databases are used to evaluate research. Further, this section discusses academic social media platforms, ResearchGate (RG) and Mendeley.

- **Academic and societal impact of researchers**

The concept of research impact is discussed in this theme but the focus is on academic and societal impact. This theme further covers the practice of ranking researchers in South Africa.

(See Chapter two for a comprehensive literature review)

1.9 Scope and limitations of the study

This study is focused on NWU's NRF-rated researchers. There are many respected researchers at NWU who are not NRF-rated. The current researcher knows of instances where some researchers delay application for a rating till such time that they are assured of a higher rating (Pouris, 2007:440). Those researchers are not covered in this study. The year 2006 to 2017 has been selected because most university mergers started in 2004. The year 2006 marks the date that most mergers became functional as the two years between 2004 and 2006 were spent on planning and preparatory work. A 12-year period is deemed sufficient since citations accumulate over a longer period (Brody, Harnad & Carr, 2006). This is also the reason why the study covers NWU's rated researchers' output up to 2017 to ensure that the outputs have been allowed reasonable time to garner some citations. The other rationale for doing the study over 12-year period is that the NRF rates researchers based on the research output in the immediate recent seven-year period (Fedderke and Goldschmidt, 2015: 469). Some of the other limitations of this study are associated with the inherent shortcomings of using bibliometrics and altmetrics as research methods, such as:

- The study does not seek to determine whether some of the research output of rated researchers has been used without the necessity to cite them. In preparation for publishing, researchers use a variety of resources but cite a selected few. This study does not go further than the items cited to determine whether the research has had an impact.

- The study does not determine whether the citing researchers are satisfied with the quality of the research cited. Some of them may have gone through frustrations trying to find high-quality resources but end up settling for what they could access.
- The study does not determine the reasons for citing the research output of rated researchers. It is well known that some papers tend to get high citation rates for the poor quality of the research as other researchers criticise them. A phenomenon where research is cited for its poor quality or controversial nature is called negative citation. Since this study does not concern itself with the reasons for citations, negative citations contribute as a positive indicator of impact.
- The study covers 12 years from 2006 to 2017. This may have a negative effect especially for papers published in later years as these publications may not have had time to accrue citations and enough altmetrics data. The other challenge relates to the different fields of study as some disciplines accrue citations faster than others (Byl *et al.*, 2016: vi).

However, it is hoped that the use of two methods (bibliometrics and altmetrics) could somewhat alleviate the impact of the limitations discussed.

1.10 Research Methodology

In the introduction it was pointed out that research is a systematic enquiry, meaning that it is not an activity that is conducted in a haphazard manner. There are approaches, methods, techniques, and procedures that are employed in order to fulfil the objectives of a study (De Villiers, 2012:226). The research methodology in this study focuses on the research approach, the research design, and data collection methods and procedures applied. This is a quantitative study that relies on bibliometrics and altmetrics to respond to its objectives. The quantitative approach is associated with the positivist research paradigm that is preoccupied with measurements, causality, generalisations, and replication of results (Bryman and Bell, 2015). Quantitative researchers are not concerned about why a phenomenon occurs but by how many times it occurs (Bryman and Bell, 2015).

This study establishes the research production (output) and impact of the rated researchers' output. NRF rated researchers are already evaluated using mainly a quality measure, the peer review mechanism. This study analyses such data statistically. The approach

followed, therefore, is a quantitative research approach, specifically the bibliometrics research design. Several data collection methods and procedures were used to collect data: the NWU annual reports, bibliographic databases (GS, WoS, and Scopus) and academic social media platforms (RG, and Mendeley). The data was collected using Excel spread-sheets for easy analysis. To determine correlations between citations in bibliographic databases and RG reads and Mendeley readership, the IBM Statistical Package for the Social Sciences (SPSS), particularly, the Spearman's Correlation Analysis was used to test the correlations (Chapter three contains a detailed description of the research methodology of this study).

1.11 Ethical considerations

Ethics are moral standards for distinguishing between what is right or wrong. Ethics help researchers to decide how to act or analyse complex problems (Resnik, 2015). The University of South Africa's (UNISA) Policy on Research Ethics advises researchers to guard against the possible undesirable or harmful consequences of research (UNISA, 2016:6-8). Among other things, the Policy implores all researchers associated with UNISA to maintain high standards of integrity. In order to maintain integrity, researchers should avoid bias, inappropriate provision or deprivation of a treatment, use of inappropriate research methodology, incorrect reporting, and inappropriate use of the information (Kumar, 2014:286-288). Both the UNISA Policy on Research Ethics (UNISA, 2016), and the NWU Policy and Rules for Research Ethics (NWU, 2016b) emphasise that researchers at these two universities must obtain the necessary ethical clearance before conducting research. As such, the necessary ethical clearance was obtained from UNISA to conduct this research and approval obtained from NWU. To avoid bias, the researcher follows the methodology and data analysis techniques indicated in the study. The researcher kept a file of the data used in the research for scrutiny and ratification by other researchers. As the UNISA Policy on Research Ethics and the NWU Policy and Rules for Research Ethics emphasise getting informed consent, the researcher requested consent from the NWU to conduct this research. Lists of these researchers' publications were requested through the Research Office at NWU. The population studied are outputs of researchers who are aware of what research entails and therefore may be willing to participate in the study. The research itself poses minimal possibility of harm to the NRF-rated researchers as the main focus is on output that are already in the public domain. The researcher references all

material sourced from other information sources and a list of references is provided following the Harvard Referencing method prescribed by UNISA.

1.12 Definition of terms

Academic impact: Academic impact is the contribution of research to the advancement of academia including to the research theory, research methods and research output (Jones and Cleere, 2014).

Altmetrics - Altmetrics refer to web and social media indicators accumulated by research output that are used to measure the societal impact of research (Shema, Bar-Ilan and Thelwall, 2014).

A-rated researcher – these are researchers who are unequivocally recognised by their peers as leading international scholars in their field for the high quality, and impact of their research output (NRF, 2017b).

Bibliometrics - this is the use of statistical and quantitative methods including citation analysis and Altmetrics on research output in order to determine their research impact (University of Leeds Library, 2014:2).

B-rated researcher – these are researchers who enjoy considerable international recognition by their peers for the high quality and impact of their recent research output (NRF, 2017b).

Citation Analysis – is the examination and analysis of frequencies, patterns, and graphs of citations in research output (Fairclough and Thelwall, 2015).

C-rated researcher – this is an NRF-rated researcher whose research output is considered by the overwhelming majority or most reviewers as an established researcher in his or her field (NRF, 2017b).

Impact: research impact is the measurement of how useful research has been to other researchers, community, institution, region, country, or globally (SFI, 2013).

Impact Factors – The impact factor of a journal represents the average citation count of the articles published in the journal during a two-year period (Shen, Hu, Lin, Tsai & Ke, 2016).

Internationally acclaimed researcher – this means an A-rated Researcher (NRF, 2017b).

NRF-rated researcher - an NRF-rated researcher is a researcher who has been awarded an A, B, C, P or Y rating by the NRF. These researchers are also referred to as "rated researchers" in this study (NRF, 2017b).

Peer review mechanism – this is a scholarly evaluation method that relies on the judgment and assessment of experts within a field of study (Bornmann, 2017).

P-rated researcher – these are NRF-rated young researchers (normally younger than 35 years of age), who have held a doctorate or equivalent qualification for less than five years at the time they applied for rating and who, on the basis of exceptional potential demonstrated in their published doctoral work and/or their research output in their early post-doctoral careers, are considered likely to be international leaders in their field (NRF, 2017b).

Rated researcher – see NRF-rated researcher

Research – this is a rigorous and systematic process of enquiry that is aimed at generating, preserving, augmenting, and improving knowledge (Simpson and Gevers, 2016).

Research impact – see impact

Research output - this refers to the published outcome of research including conference papers, journals, patents, books, book chapters, theses and dissertations (DHET, 2015a).

Research Publications – see research output.

Scholarly impact – see academic impact.

Societal Impact - this is the demonstrable contribution that scholarly research makes to society and the economy (Jones and Cleere, 2014).

Young researchers – this means P and Y-rated researchers (NRF, 2017b).

Y-rated researcher – Young researchers (40 years or younger) who have held a doctorate or equivalent qualification for less than five years at the time of applications, and who are recognised as having the potential to establish themselves as researchers within a five-year period after evaluation, based on their performance and productivity of quality research output during their doctoral studies and/or post-doctoral careers (NRF, 2017b).

1.13 Structure of the dissertation

This dissertation is divided into six chapters:

Chapter 1: Introduction and background to the study

This chapter is a general introduction and background to the study. The chapter provides a conceptual and contextual setting of the study, statement of the problem, objectives of the study, the research questions, and significance of the study. The chapter also provides a general overview of literature review and research methodology. At the end of Chapter 1, a general orientation to all the chapters of the dissertation is provided under the structure of the dissertation.

Chapter 2: Literature review

The chapter provides a comprehensive and thorough analysis of literature relevant to this study. The first section of this chapter is dedicated to the conceptual framework followed by studies related to the current study. Themes discussed in this chapter include research in South Africa, evaluation of scholarly research, bibliometrics and altmetrics; the meaning and the laws of bibliometrics, peer-review mechanism, the practice of ranking and rating researchers, research impact, academic and societal impact of research, core journals used by researchers to publish their work, use of GS, Scopus and WoS to evaluate research, and measuring societal impact using RG and Mendeley.

Chapter 3: Research methodology

Chapter 3 is a master plan of how the study was conducted. It covers the research methodology of the study. The chapter consists of research approach, research methods,

population, sampling procedures and methods, data collection procedures and methods, and ethical considerations of the study.

Chapter 4: Presentation and analysis of data

This chapter analyses and presents the data in response to the objectives and questions of the study.

Chapter 5: Discussion of findings

This is the penultimate chapter of the study and it discusses the findings of the study in relation to the literature reviewed in Chapter 2.

Chapter 6: Summary, conclusions, implications and recommendations

This is the last chapter of the dissertations and consists of a summary, conclusions, implications and recommendations of the whole study. The chapter is then followed by the reference list of all material cited in this dissertation.

1.14 Summary of the Chapter

Chapter one provided the introduction and background to the study as a whole. The conceptual setting, contextual setting, problem statement, objectives, research questions, scope and limitations of the study, and ethical considerations are all covered in this chapter. Further this chapter provides a brief overview of the literature review and research objectives that are covered in chapter two and chapter three respectively. The last part of the chapter lays out the structure of the dissertation.

Chapter 2: Literature Review

The previous chapter served as an introduction and background to the study. This second chapter offers a literature review of sources that provide insight into the research area, allowing the study to identify significant gaps in the problem identified for the study.

2.1 Introduction

Jesson *et al.* (2011:10) define literature review as a written appraisal of what is already known about a topic or a field. Du Plooy-Cilliers, Davis & Bezuidenhout (2014:101) concur and state that a literature review involves searching, finding, studying and interpreting what has already been done on a topic. The premise of conducting a literature review is to relate, compare or test the present study to relevant and often recent research conducted in the field. This provides the researcher with a better understanding of what has been done in the research area and the gaps in the field. Literature review enriches the present study and ensures that researchers do not reinvent the wheel (Maluleka, 2014). By conducting a thorough literature review, the researcher identifies any contextual, conceptual and methodological weaknesses in previous studies and seeks to improve from them (Maree, 2016). Kumar (2014) states that a literature review is a process that forms an integral part of any research from the beginning to the end. Therefore, this chapter seeks to:

- provide clarity on the conceptual framework used in the study such as bibliometrics, altmetrics, research impact, citation analysis, and NRF-ratings.
- examine the role of bibliometrics, citation analysis and altmetrics in the evaluation of scholarly research
- review recent studies related and relevant to the current one

The literature review is divided into four sections:

- Conceptual setting
- Research output of researchers
- Researchers' visibility in GS, WOS, Scopus and social media sites (RG and Mendeley)
- Academic and societal impact of researchers

2.2 Conceptual setting

There are various ways in which scholarly research can be evaluated including through determining impacts using bibliometrics and altmetrics, peer-review, case studies, input measures (for example, the amount of funds generated from research), econometric analysis, retrospective studies and surveys (Jones and Cleere, 2014). Bibliometrics and altmetrics indicators tend to evaluate academic research through focusing attention on the

research output. In other words, they focus on the interest, sometimes non-interest, of people to specific research output. Peer-review, on the other hand, relies on experts to determine impact. This section deals with the conceptual setting of the study by highlighting the methods of evaluating research, that is

(a) peer-review

(b) bibliometrics

(c) altmetrics.

2.2.1 Peer-review

Wilsdon, Allen, Belfiore, Campbell, Curry, Hill, Jones, Kain, Kerridge, Thelwall, Tinkler, Viney, Wouters, Hill & Johnson (2015:59) describe peer-review mechanism as "expert-based review practices including the review of journal manuscripts, peer review of applications for funding and career promotions, and national peer review-based research assessments." Peer-review mechanism relies on the judgment of experts (Bornmann, 2017). It is still the most common measure of research impact (Bornmann, 2017). According to Bornmann (2017), peer-review as a method of research evaluation has its strengths and weaknesses, which are reflected in Table 3.

Table 3: Weaknesses and strengths of peer-review mechanism (Wilsdon *et al.*, 2015)

Weaknesses	**Strengths**

• It is slow, inefficient and expensive, although most costs are hidden; • Human judgment is subjective – which may however also be seen as a strength; • It is almost by definition not transparent; • It is inconsistent, sometimes characterised as a lack of inter-rater reliability;	• It has a foundation in specialised knowledge of the subject, methodology and literature relevant for specific decisions; • It is social in nature; • The subjectivity of this approach could be seen as a strength (as well as a weakness);

Bornmann (2017) points out that other research evaluation methods including bibliometrics and altmetrics are used to complement the peer-review mechanism.

2.2.2 Bibliometrics

This sub-section elucidates the key concepts in conducting the study bibliometrically, namely the definition of bibliometrics, citation analysis, Bradford's Law, and application of bibliometrics in measuring research impact.

2.2.2.1 Origin and definition of bibliometrics

Bibliometrics evolved into a field from the early to the mid twentieth century (Diodato and Gellatly, 2012). There are several notable studies conducted in bibliometrics even before it was called by this specific name. Wallace and Van Fleet (2012) cite Weinberg as having traced the origin of bibliometrics to the Babylonian Talmund which was published between 1522 and 1524. Wallace and Van Fleet further suggest that the first publication of the legal citation indexing was as early as 1743 – a publication called Raymond's Reports. This was followed by Shepard's Citations in 1873. Campbell (1896) published "The Theory of National and International Bibliography" in 1896. Campbell meant the work to bring law and order into the world of literature in order to facilitate research. Some of the works in the monograph had been presented in conferences as early as 1893. Co-authored by Cole and Eales, "The History of Comparative Anatomy: Part i – a statistical analysis of the literature" appeared in 1917. The term "statistical bibliography" was coined by Hulme (1922) in the work "Statistical Bibliography in Relation to the Growth of Modern

Civilization" (Wallace and Van Fleet, 2012:243). According to Pritchard (1969), the term was used only twice in a forty-five year period by Gosnell in 1944 and then Raisig in 1962. Pritchard concluded that due to its confusing nature, the term could not have been popular with researchers hence the suggestion to use the term bibliometrics.

Rousseau (2014) argues that the term bibliometrics was first used by Paul Otlet, a Belgian librarian, who used the term in the book titled *Traité de Documentation* in 1934. Rousseau identifies Paul Otlet as the first researcher to call for the usage of the term to refer to all measurement of all aspects related to the publication and reading of books and documents. Thirty-five years later in 1969, Alan Pritchard argued that bibliometrics should replace the usage of the term statistical bibliography as the latter was "clumsy, not very descriptive, and can be confused with statistics itself or bibliographies on statistics" (Pritchard, 1969:348). Pritchard was apparently not aware of the earlier usage of the term by Otlet as he pointed out that searches in the Oxford English Dictionary and other works did not yield any results for the term.

A pioneering study with regards citation analysis was that of Gross and Gross (1927). In this study Gross and Gross sought to determine the top journals in Chemistry by conducting a citation analysis of articles cited in *The Journal of the American Chemical Society* (Gross and Gross, 1927). Among their findings were that *The Journal of the American Chemical Society*, *Chemical Abstracts*, and *The Journal of Industrial and Engineering Chemistry* were indispensable to a Chemistry library (Gross and Gross, 1927). Impact Factors can be traced to Eugene's Garfield's work on "Citation Indexes for Science" in 1955 (Garfield, 1955). This resulted in the introduction of the Science Citation Index in 1963 by the Institute for Scientific Information (ISI). This was followed by the Social Science Citation Index in 1973, Journal Citation Reports in 1976, and the Arts and Humanities Citation Index in 1978 (Wallace and Van Fleet, 2012).

The Internet played a major role in the history of bibliometrics, especially with regards the development of citation indexes. Roemer and Borchardt (2015) point out that more than 7 000 institutions provided access to WoS database and approximately 3 000 provided access to Scopus although most of those who provided content to Scopus also provided content to WoS. Bibliometrics is a compound term formed by blending a Latin term "biblio" (book) and Greek term "metric" (measurement (Sengupta, 1992: 76; Beck and Manuel, 2008: 165; Norton, 2010:131). In its literal sense, bibliometrics means the measurement of books. The

definition of bibliometrics has remained essentially unchanged since Alan Pritchard first popularized the term in 1969. Pritchard defined bibliometrics as "the application of mathematical and/or statistical methods to books and other media of (scholarly) communication" (Pritchard, 1969: 349). In paraphrasing Pritchard, Fairthorne (1969:319) defined bibliometrics as the "quantitative treatment of the properties of recorded discourse and behaviour pertaining to it." Bibliometrics is the "study and measurement of the publication patterns of all forms of written communication and their authors" (Hertzel, 2003:295).

De Bellis (2009) stresses that bibliometrics are concerned with counting books, articles, publications, citations, in general any statistically significant manifestation of recorded information, regardless of the discipline. For its part, the University of Leeds Library (2014) defines bibliometrics as the "statistical analysis of bibliographic data, commonly focusing on citation analysis of research output and publications." Another contemporary definition of bibliometrics is that "bibliometrics is the application of quantitative analysis and statistics to publications such as journal articles and their accompanying citation counts" (Thomson Reuters, 2008). Roemer and Borchardt (2015:27) choose to limit bibliometrics to print-based resources. To them bibliometrics are "quantitative methods used to measure, track, and analyze print-based scholarly literature." Bibliometrics use quantitative methods to examine scholarly communication (Norton, 2010:131). As if to sum it up, Wilsdon *et al.* (2015:5) maintains that "bibliometrics focus on the quantitative analysis of scientific and scholarly publications, including patents" and other research output.

It is clear from all the definitions above that bibliometrics involve measurement, counting or statistics. Because of its reliance on quantitative methods, bibliometrics is a quantitative science (Hertzel, 2003). Bibliometrics methods can be applied to all forms of recorded scholarly communication including the Internet, books, journals, magazines, and newspapers. Bibliometrics helps inform libraries about the usage of their libraries and the collection gaps. Bibliometrics are an essential tool for measurement of the impact of libraries and their resources. Bibliometrics can determine the research impact of an institution's researchers and the quality of papers they cite or researchers that cite them (Thomson Reuters, 2008). Other terms that refer to studies that use bibliometrics techniques include: "altmetrics", "webometrics", "cybermetrics", "infometrics",

"netometrics", "scientometrics" (Beck and Manuel, 2008:165). The terminology depends on where the information that is studied is recorded.

The Encyclopaedia of Library and Information Science classified bibliometrics into two broad areas which are descriptive bibliometrics and behavioural or literature usage bibliometrics (Hertzel, 2003; Sengupta, 1992). The descriptive bibliometrics define the characteristics of literature while the literature usage bibliometrics evaluate usage of the literature. According to Beck and Manuel (2008) bibliometrics studies can be divided into four categories. Those are:

- Studies that seek to learn about information sources,
- Studies that seek to learn about institutional trends
- Studies that seek to learn about people's behaviour and
- Studies that seek to learn about socio-intellectual phenomena.

This study defines bibliometrics as the use of statistical and quantitative methods, including citation analysis and altmetrics, on research output in order to determine their research impact. The current study is a behavioural or literature usage bibliometrics study that uses citations and pays attention to documents as a proxy for their academic and societal impact.

2.2.2.2 Citation analysis

Citation analysis is the most common bibliometrics measure which uses the number of times academic and scholarly research output have been cited to determine their quality and impact (Fairclough and Thelwall 2015). The assumption of citation analysis is that the more a document or researcher is cited, the better the quality and impact of that document or researcher. Citation analysis plays a critical role in the evaluation of research. Shen *et al.* (2016) noticed that there are two important citation analysis measures which are the journal impact factor and H-index. The journal impact factor is based on the average number of citations of recent articles published in a journal while the H-index is used to measure the productivity and impact of individual scientists (Shen *et al.*, 2016). Some of the pioneering works in bibliometrics resulted in what later became known as the universal laws of bibliometrics. One of the bibliometrics laws, Bradford's Law, is privileged in this study.

2.2.2.3 Laws of bibliometrics/altmetrics

Though Diodato and Gellatly (2012) identified at least ten bibliometrics laws, they concede that only three of those laws are widely used in bibliometrics studies. Those are Zipf's Law (1917), Lotka's Law (1926), and Bradford's Law (1934). Andres (2009) indicates that Chen and Leimkuhler (1986) managed to demonstrate a common mathematical base between the three laws. Each one of the three laws relates to two variables. In the case of Zipf's Law, it is the words in the text and the frequency of their occurrence. In the case of Bradford's Law, the number of journals and number of related papers are considered while in the case of Lotka's Law, it is the number of authors to the number of publications. The only difference between the three laws lies in the type of data analysed (Hertzel, 2003). Zipf's Law is useful for content analysis, Lotka's Law for author productivity, while Bradford's Law is useful for journal productivity (Wallace and Van Fleet, 2012).

Unlike other pioneers of bibliometrics laws, Bradford was a practising librarian at the British Museum Library (Wallace and Van Fleet, 2012). While working as a librarian, Bradford realised that abstracters and indexers could be missing up to 67% of scholarly articles. Bradford's law states that: "If scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same articles as the nucleus, when the number of periodicals in the nucleus and succeeding zones will be as 1: n: n2, where 'n' is a multiplier." Bradford's (1985) study found that in applied geophysics, 9 journals published 429 articles, 59 published 499, while 254 published 404. In lubrication, 8 journals produced 110 articles, 29 produced 133 articles, and 127 journals produced 152 articles. Bradford's formula was designed to show how articles scatter throughout the journals. Table 4 is a distribution table of Bradford's Law (Bradford, 1985).

Table 4: Bradford's original distribution (Bradford, 1985:176)

Braford's distribution of Applied Geophysics journals and articles		
Zone	Number of journals	Number of articles

1	9	429
2	59	499
3	258	404
Braford's distribution of Lubrication journals and articles		
1	8	110
2	29	133
3	127	152

Bradford Law divides journals on a given field into three zones:

- Zone 1 journals – these are core journals devoted to a field which account for one-third of the articles.
- Zone 2 journals – a second larger group of journals that contain approximately the same number of articles as the zone one journals.
- Zone 3 journals – the largest group of journals that contain approximately the same number of articles as the other two groups.

In other words, Bradford's Law postulates that researchers looking for relevant articles in a given field will have to go through a larger set of journals in zone 2 and 3 to find the same number of articles found in a few journals from the nucleus or zone 1. One of the questions answered in this study relates to journal productivity as it establishes a core list of journals where NWU's rated researchers publish their work. Bradford's Law of journal productivity is tested to check if the publications by NWU's rated researchers conform to the principle of Bradford's Law which basically states that a small group of journals account for a majority of important and influential research in a given field (Pouris, 2006).

2.2.3 Altmetrics

Roemer and Borchardt (2015) and Priem (2014) trace alternative metrics from the early 1990s through the development of the World Wide Web and the early 2000s with the development of social media networks. Among other bibliometrics concepts that Bornmann (2014) associates with altmetrics are webometrics, web-based bibliometrics, web citations, and scientometrics 2.0 which are all web or social media based metrics. With the development of social media, there was a necessity for bibliometricians to develop a term that would distinguish the academic impact measures to the societal impact measures

hence the coining of the term altmetrics. The term altmetrics has its roots from two words, the English word "alternative" and the Greek word "metrics" (Priem, 2014). It was coined by Priem in 2010 (Roemer and Borchardt, 2015). Priem, Taraborelli, Groth & Neylon (2010) would go on to write a document titled the "Alt-metrics: a manifesto". In this Manifesto, they call for diversity in the way research impact is measured. They called for altmetrics to be considered as part of the tools of research impact measurements. The Manifesto popularised the use of the term to the research community (Roemer and Borchardt, 2015).

Later, Shema, Bar-Ilan, & Thelwall (2014) would describe altmetrics as all web-based metrics for the societal impact of scholarly research. Altmetrics measure societal impact of research using social media indicators such as views, reads, readership, downloads, followership and many more (Roemer and Borchardt, 2015). The biggest advantage of altmetrics is that they accumulate almost immediately from the moment the paper is published (Priem, 2014; Fairclough and Thelwall, 2015). Other advantages include broadness, speed and diversity (Priem, 2014). Some of the limitations of altmetrics are that they are easy to manipulate, it is difficult to determine their origin, and may be biased towards internet savvy academics (Thelwall, Kousha, Dinsmore & Dolby, 2016). In this study, altmetrics refer to web and social media indicators accumulated by research output that are used to measure the societal impact of research.

Roemer and Borchardt (2015: 104) tabulate the evolution of altmetrics as shown in the Table 5 below:

Table 5: Altmetrics milestones

Year	Almetrics Milestone
1990	Tim Berners-Lee writes the first web browser as part of the WorldWide Web.
1994	Tomas C. Almind and Peter Ingwersen coin the term webometrics in a published paper.
1998	International DOI Foundation (IDF) is created to develop the digital object identifier (DOI) system.
2003	Social bookmarking service Del.icio.us (now known simply as Delicious) is founded.
2004	Online social networking service Facebook launches at Harvard University.
2004	Richard Cameron begins developing academic social bookmarking site CiteULike.
2006	The first full version of Twitter becomes available to the public.
2006	Open access peer-reviewed journal PLOS ONE is established.
2008	Academic networks Academia.edu, Mendeley, and ResearchGate launch online.
2008	The ResearcherID author identification system is introduced by Thomson Reuters.
2010	The Open Researcher and Contributor ID (ORCID) nonprofit is founded.
2010	Dario Taraborelli launches ReaderMeter.
2010	Jason Priem coins the term altmetrics via Twitter.
2010	Jason Priem, Dario Taraborelli, Paul Groth, and Cameron Neylon publish “Alt-Metrics: A Manifesto.”
2011	Mark Hahnel launches the online digital repository Figshare.
2011	Andrea Michalek and Mike Buschman start altmetrics-focused Plum Analytics.
2011	Euan Adie founds Altmetric, an altmetrics aggregator site.
2012	Jason Priem and Heather Piwowar launch Total-Impact (later renamed Impactstory).
2012	Elsevier partners with Altmetric to add altmetrics data to Scopus.
2013	Elsevier acquires Mendeley.

2014	EBSCO Information Services acquires Plum Analytics.
2014	Wiley officially partners with Altmetric to add altmetric data to its journals.
2014	Impactstory announces a new individual subscription model.

Table 5 shows that altmetrics is a relatively new field of study in the broader field of bibliometrics. As shown in the table, its evolution cannot be divorced from the World Wide Web and social media networks.

Barnes (2015) divides altmetrics tools into eight categories:

- micro-blogging or short-message services (Twitter),
- social networking sites (Facebook), blogs (WordPress, Blogger),
- social bookmarking networks (Delicious),
- academic bookmarking platforms (ResearchGate, Mendeley),
- peer review services (F1000, now F1000Prime),
- academic networks (Academia.edu),
- collaboratively edited online encyclopaedias (Wikipedia).

The two academic bookmarking platforms, RG and Mendeley are used to study the social media attention of NWU's rated researchers in this study. Chapter 3 on research methodology provides more attention to these two platforms.

2.3 Research output of researchers

Research output refers to the published outcome of research, including conference papers, journals, patents, books, book chapters, theses and dissertations (DHET, 2015a). Research output can be used as a bibliometrics measure in its own right when researchers want to compute the productivity of an individual researcher, research entity, institutions, research area or country (Rotich and Onyancha, 2017; Sooryamoorthy, 2018). In South Africa, research output attracts a subsidy from the government. The DHET issues a preselected list of journals and conference proceedings from which researchers should publish in order for their universities to be subsidised by government (DHET, 2015a). The list as from 2016 is selected from WoS, Scopus, ScieLO, Scopus, International Bibliography of Social Science (IBSS), and Norwegian List. Other South African journals are selected by a panel

of experts appointed by the Department of Higher Education and this is called DHET list of Approved South African Journals. The list is selected based on the quality of the publications but the Department has left room to consider metrics and impact in future amendments to the Research Output Policy (DHET, 2015a). The subsidy provides an important source of income for the universities. As a result, academics are encouraged to publish their research in this prescribed list. Articles that have not been published in this prescribed list may not make it into a university's research report. The DHET policy and the NRF further discourages researchers from publishing in predatory journals (DHET, 2015a; NRF, 2017c). This system has been criticised for, among other things, its assumption that the motivation for publication is for remuneration (Bibi, 2003). It ignores the intrinsic motivating reasons for publishing. According to Jacobs (1998) there are both extrinsic and intrinsic motivating factors for researchers to publish their work. Extrinsic motivations include: NRF-rating, subsidy, academic rank, promotion, remuneration, recognition, and prestige. Intrinsic motivating factors include: motivation, work habits, "love" of publishing, and competitiveness.

Another way of categorising research output maybe through the research impact, for example, academic output, societal output, socio-economic output and other types of impact factors. Although the number of South African researchers remains low, the number of research output in international databases continues to increase (Albrecht, 2009; Kahn, 2011). Albrecht (2009), for example, determined that 36% of researchers who received the Cancer Association of South Africa grants from 1994 to 2003 did not publish at all. However, 10% of those grant recipients published more than 10 papers each, which resulted in an average of close to 4 papers for each grant recipient. This points to a reliance of the country on a small but productive cohort of researchers.

Kahn (2011) noticed an increase of more than 61% when comparing article output from 1990 to 1994 and 2004 to 2008 in WoS. This was attributed to the government subsidy paid for individual article publications as well as an increase in the number of South African published journals indexed on WoS (Tijssen, Mouton, Van Leeuwen & Boshoff, 2006). By 2006, about 5% of journals published in South Africa were also indexed by WoS. Although this number is low, Tijssen *et al.* (2006) speculate this could be better when compared to other African countries. The findings of Kahn (2011) are corroborated by Sooryamoorthy (2015) who also realised that South Africa experienced a sharp increase in

research output in journals indexed by WoS from 1995 onwards. The country breached the 3 000 research output mark on WoS indexed journals in the period from 1995 to 2010. Studies conducted in South Africa about research output converge on several aspects. South African research output over the past few years has increased considerably. The country is dependent on a small but highly productive cohort of researchers. More still needs to be done to raise the number of researchers in the country in order to further expand research output.

2.3.1 Journals publishing researchers' output

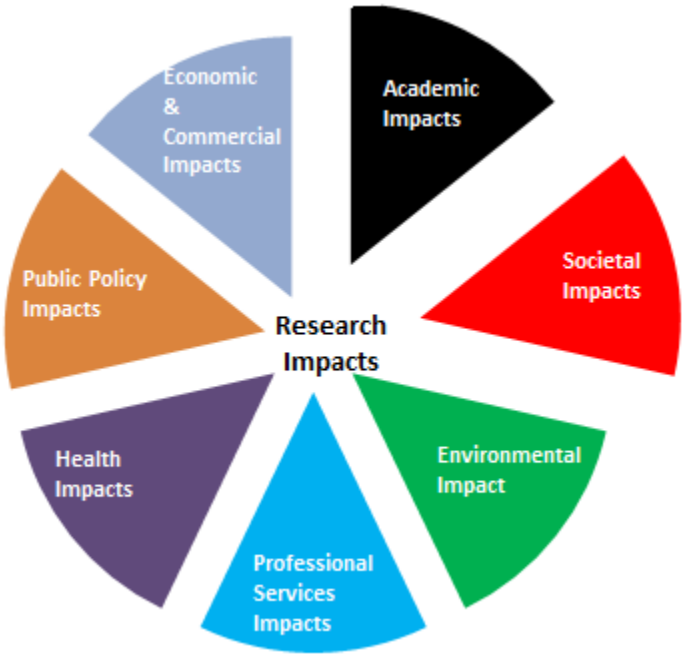
Journals play a critical role in scholarly communication (Pouris and Pouris, 2015; DHET, 2015a). Contemporary researchers are interested in knowing which journals have a high impact in order to maximise their recognition among peers (Pouris and Pouris, 2015). Due to financial constraints, academic librarians are forced to purchase material that has higher academic value hence their interest to the usage, quality and impact of journals (Pouris and Pouris, 2015). One way of determining the usage of journals is through applying Bradford's Law to published material in order to rank journals. Venable, Shepherd, Roberts, Taylor, Khan & Klimo (2014), for example, applied Bradford's Law to identify core journals of paediatric neurosurgery in North America. In their study they were able to identify zone one journals in which the top 150 researchers published 50% of all articles in the area (Venable, Shepard, Loftis, McClatchy, Roberts, Fillinger, Tansey & Klimo, 2014). Another study by Venable *et al.* (2016) was able to identify the core journals for all neurosurgery and its sub-specialties using Bradford's Law. Neelamma and Anandhalli (2016) applied Bradford's Law in their study in botany studies and found that the distribution of journals conforms to Bradford's Law.

2.4 Academic and societal impact of researchers

Research impact is "the direct and indirect 'influence' of research or its 'effect on' an individual, a community, the development of policy, or the creation of a new product, service or technology" (SFI, 2013:2). Research impact is a demonstration of the usefulness of research in an academic programme and beyond. It can be established at different levels including researcher level, faculty and institutional level, country level, and international level. Impacts of research can be academic, societal, health, commercial, policy,

environmental, social, and cultural (SFI, 2015). Figure 2 below shows the different types of research impact:

Figure 2: Types of research impacts (as adapted from Bracken, 2015)



Since the focus of this research is on academic and societal impacts of research, it is important that these two impacts are contextualised. Academic impact is the contribution of research to the advancement of academia, including to the research theory, research methods and research output (Jones and Cleere, 2014). In other words, academic impact is the influence of research on other research or other researchers. The most common measure of academic impact is citation analysis (Carroll, 2016). On the other hand, societal impact is the impact of research on the life, attitudes, behaviours, culture, welfare, practices, knowledge and understanding of communities (Jones and Cleere, 2014).

The most common measure of societal impact are altmetrics indicators which show the interest of a society to academic research (Bornmann, 2014; Thelwall *et al.*, 2016). Research impact demonstrates the value of research to funders, governments, industry, community, and academic institutions. The reasons for measuring impact include showing return on investment, budgeting and ensuring accountability to research funders (SFI, 2015). Several international research funders expect researchers to indicate the impact of

their research not only academically but also to the society at large (SFI, 2013; Australian Research Council, 2014).

2.4.1 Researchers' visibility in bibliographic databases (GS, WoS and Scopus)

Studies on the visibility of researchers on GS, WoS and Scopus often compare the extent of their availability on bibliographic databases. Onyancha and Ocholla (2009) compared the representation of LIS South African researchers on Scopus, GS and WoS from 1981 to 2007. These scholars concluded that GS was the alternative for developing countries as research produced by researchers from South Africa was well-represented on GS compared to WoS and Scopus. Adriaanse and Rensleigh (2011), on the other hand, conducted a study comparing citations of South African environmental sciences journals on WoS, GS and Scopus. Their study found that GS lags behind Scopus and WoS in the coverage of environmental sciences journals and they concluded that it is not yet a substitute for the fee-based bibliographic databases. Later, Adriaanse and Rensleigh (2013) compared the comprehensiveness of environmental sciences content in GS, WoS and Scopus. They found that WoS was better in terms of quantity and quality in its coverage of environmental science journals. This shows that there are disciplinary differences between the three databases in research coverage.

Another study of 146 Associate Professors and full Professors at the University of Melbourne, Australia by Harzing and Alakangas (2016) found that GS had a higher number of output than both Scopus and WoS. Further, GS had more citations than both databases. Boshoff and Akanmu (2017) studied the bibliometrics profile of the Obafemi Awolowo University (OAU) in Nigeria and found that 10% of the 588 articles published at this university appear on Scopus while only 3% appear on WoS. Another study by Kerchhoff (2017) at the University of the Western Cape in South Africa sought to ascertain the impact of researchers of the Institute for Poverty, Land and Agrarian Studies (PLAAS) over a 20 year period from 1995 to 2015 using both GS and Scopus. The study found that the researchers published 535 publications in GS and 134 publications in Scopus. The citations in GS were higher at 11,522 compared to Scopus' 2,033. This essentially means that each publication accumulated just more than 21.5 citations on average while on Scopus the average per output was 15,2. In a study of 252 subject areas, Martín-Martín, Orduna-Malea; Thelwall & López-Cózar (2018) determined that GS found the largest citations compared to the two commercial databases in all subject areas. Ninety-five percent of

citations found by WoS were also found by GS while 92% of citations found by Scopus were also found by GS. This led the authors to conclude that GS is a superset of WoS and Scopus, with substantial extra coverage. Literature therefore shows that, generally, GS has more output and variety of output than the two commercial databases (Scopus and WoS), although this may differ by disciplines.

2.4.2 Societal impact of researchers on RG and Mendeley

There are various recent studies on societal impact that have been conducted using RG and Mendeley. The majority of studies in this area compare RG or Mendeley with one, two or all three main bibliographic databases in order to ascertain if there is a relationship between them. Some of these studies include Onyancha (2015); Thelwall and Wilson (2015); Shrivasta and Mahajan (2016); Shrivastava and Mahajan (2017); Yan and Zhang (2018).

Onyancha (2015) conducted a study of South African public universities comparing RG, Web of Science and the Webometrics Ranking of World Universities (WRWU) and found that, based on the number of output of South African researchers on RG, many researchers have adopted RG. There was a high relationship between RG and WoS in terms of their coverage of papers produced by universities in South Africa. Onyancha determined that the uptake of RG in South Africa was fairly good and that there was a strong correlation between coverage of South African research on RG and WoS (Onyancha, 2015).

In related research, Yan and Zhang (2018) studied 61 United States universities on RG and concluded that RG mirrors the research activity of institutions. The researchers also found a high correlation between research productivity, citations, profile views and followers and RG scores. Although Shrivastava and Mahajan (2017:564) found that the uptake of RG by physics researchers at the University of Dehli was low, they further add that the relationship between those papers that have been added on RG and academic impact was high. A strong relationship between Mendeley readership counts and academic impact were reported by Thelwall and Wilson (2015); Fairclough and Thelwall (2015), Shrivasta and Mahajan (2016) and Asemi and Heydari (2018).

Thelwall and Wilson (2015) researched Mendeley readerships of 45 medical fields using Scopus documents and found that citations and Mendeley readership correlated strongly. Similarly, Asemi and Heydari (2018) sought to identify the availability of 165 Iranian

researchers' WoS indexed output in Mendeley and RG and found that out of the 165 outputs, 164 were available in both RG and Mendeley. The degree of Spearman's correlations between WoS and Mendeley was 0.352, while that between WoS and RG was 0.177. Not all studies, however, found high correlations between altmetrics indicators and the three main databases. In a highly critical study of correlation studies between societal impact and academic impact studies, Ortega (2015) found that the majority of social media altmetrics correlated weakly with bibliographic databases. Several other studies found a weak relationship between certain social impact and academic impact indicators (Costas, Zahedi & Wouters, 2014; Ortega, 2015; Bangani, 2018). Studies that have found weak correlations, however, do not suggest that use of altmetrics to measure research impact is a futile exercise; rather they point out that academic impact and societal impact are two independent impacts, one measured through citation analysis and the other through altmetrics.

2.4.3 Impact of rated researchers

The NRF as a research institution is interested in the impact of its rating system. The NRF commissioned a study in 2015 to establish the socio-economic impact of research funded by NRF. Among the findings were that NRF funding has had academic and societal impact for the funded researchers (Adam, Bawa, Cloete, Duggan, Goldman, Jackson, Kahn, Liphadzi, Parker, Potgieter, Singh, Swanepoel, van den Bergh & Wingfield (2015: 25, 33) meaning that there is a strong correlation between research funding, rating and impact. Fedderke (2013) conducted a study to test the NRF ratings against academic impact measures and concluded that citations of output reflect the levels of ratings of researchers. Fedderke and Goldschmidt (2015) attempted to link the amount of research funding to academic impact and found a strong correlation between highly-funded, highly-rated researchers and academic impact (Fedderke and Goldschmidt, 2015). This is in line with the findings of another study by Shen *et al.* (2016) who concluded that funded papers tended to be highly cited. These studies confirm the Cumulative Advantage Theory (CAT) that "success breeds success" meaning that a rating may lead to more output and citations. Marais (2007) found that quantitatively, rated researchers produced more research than non-rated researchers. It was also established that the higher the rating, the higher the research output, thereby conforming to CAT. Further, Marais (2007) observed that NRF-rated researchers have a perceptible preference for international journals to local ones.

2.5 Summary of the Chapter

This chapter adequately conceptualised and contextualised the study. Concepts like bibliometrics, altmetrics, research impact, citation analysis and NRF ratings were defined. The chapter also discussed research evaluation and impact. Further, Chapter two provided a glimpse into the evolution of bibliometrics and altmetrics. Related studies to the current study were also outlined in this chapter.

The reviewed literature shows that despite the strategies to attract, produce, and retain NRF-rated researchers, there is a paucity of studies that sought to determine the impact of these researchers at public universities in South Africa, specifically at the NWU. Previous studies have sought to test the objectivity of the NRF rating system using bibliometrics data (Marais, 2007; Fedderke, 2013: 177, 179; Fedderke and Goldschmidt, 2015). This is because the dominant assessment method for NRF ratings is through peer reviews. These previous studies did not focus on a specific university. The current researcher could not identify any studies that examined the altmetrics of NRF-rated researchers in detail. It appears that this study is the first study in South Africa to conduct this niche research. The following chapter discusses the methodology and design of the study.

Chapter 3: Research methodology

3.1 Introduction

The previous chapter was a literature review of the study that discussed the conceptual and contextual framework. The present chapter discusses the research methodology. De Villiers (2012:226), and Soanes and Stevenson (2008:898) define research methodology as systematic research methods used in an enquiry. Research is systematic therefore its methods are systematic 6 and Bellamy (2012: 1) is convinced that research methodology involves a nuanced understanding of how to design the research in order to arrive at the "truth." According to 6 and Bellamy (2012: 1-2), the importance of designing an effective research methodology includes the following attributes, refined to:

- Showcase how the research was conducted
- Draw defensible conclusions about the cause/s of phenomena
- Enable the researcher to make better judgements about what might be going on beneath the facts.
- Ensure that results can be generalised or replicated
- Explain how conclusions have been drawn.

In the present research, the research methodology is discussed following the prescripts of the UNISA outline for Master's and Doctoral studies research. This means that the sections are categorised as follows:

- research approach
- research design
- population
- sampling procedures and methods
- data collection procedures and methods, and
- ethical considerations .

3.2 Research approach

There are three main approaches to library and information science research: qualitative, mixed methods, and quantitative approach.

3.2.1 Qualitative approach

Qualitative research is measured against other research of a similar kind (Soanes and Stevenson, 2008: 1174). Quality is often associated with value judgment, for example, excellent researcher, good researcher, best paper and other value judgment statements. Qualitative approach usually relies on thick descriptions of the entire research inquiry (Bryman, 2016: 694). The aim is not to measure phenomena but to understand it and interpret underlying meanings that emerge as themes and constructs (Leedy and Ormrod (2015: 269). The research focus is on different experiences, views, behaviours and attitudes of human subjects. Qualitative studies are concerned with trustworthiness and the authenticity of the research findings (Bryman, Bell, Hirschsohn, Dos Santos, Du Toit, Masenge, Van Aaardt & Wagner, 2014:44). Trustworthiness includes the credibility of the findings, the transferability of findings to other contexts, the dependability of the findings when applied at other times, and the confirmability of the results of the study (Bryman, 2016: 44; Bryman *et al.*, 2014:44-45). The qualitative approach uses case studies, interviews, open-ended questions, textual analysis, interviews, focus group discussions, and other qualitative methods to collect data. Bryman (2016: 398) endorses that this approach is subjective, susceptible to human error, and open to bias due to its reliance on human judgments.

3.2.2 Mixed Methods Research (MMR) approach

The MMR approach has developed into one of the most significant approaches in the social sciences (Kumar, 2014: 19; Romm and Ngulube, 2015: 159) and by extension in Library and Information Science research. Mixed approaches combine the paradigms, methods, and data collection, analysis, and procedures of quantitative and qualitative research approaches in one study (Flick, 2011:189; Romm and Ngulube, 2015: 159).

According to Creswell (2014: 19), and Romm and Ngulube (2015: 159) the assumption of mixed methods approach is that using both approaches in one study enriches the present study. The advantage of this approach is that methodological triangulation is inherent

within it (Bless, Higson-Smith & Sithole, 2013: 240). Mixed methods approach uses both the quantitative methods of data collection, for example, bibliometrics, and confirm the study through using interviews or open ended questionnaires (Maluleka, 2014). Some researchers (Alexander, Thomas, Cronin, Fielding & Moran-Ellis, 2016: 121) argue that studies that bring two qualitative or quantitative methods could be regarded as mixed methods. Romm and Ngulube (2015:159), however, argue that such researchers confuse mixed-methods with multi-methods. Many Library and Information Science researchers concur that MMR mixes qualitative and quantitative methods (Maluleka, 2014; Romm and Ngulube, 2015; Saurombe, 2016; Sitienei, 2009).

3.2.3 Quantitative approach

The quantitative approach is often erroneously contrasted with the qualitative approach. Quantitative is derived from the word quantity, which means amount or number (Soanes and Stevenson, 2008: 1174). Quantitative research therefore means the constructs and variables are measured in numbers (Flick, 2011:11). Creswell (2014: 694) concurs that quantitative research is concerned with the measurement of phenomena. In terms of data analysis, quantitative approach uses mathematical models and statistical analysis (Flick, 2011:11). Bryman and Bell (2015:174-176) and Bryman *et al.* (2014:40) sum it up by indicating that quantitative researchers are preoccupied with measurement, causality, generalisations, and replication. The most popular quantitative studies in Library and Information Science are bibliometrics studies. The criticism levelled on this approach is that it does not appreciate nor cater for the complexity of human problems (Flick, 2011:13). Some of its advantages are that it is objective, unobtrusive, value free, and results can be replicated (Bless et al, 2013:17; Neuman, 2014: 17).

3.2.4 Approach adopted for this study

The quantitative approach is widespread in bibliometrics studies (Saurombe, 2016; Sitienei, 2009) hence the reference to the field of bibliometrics as a quantitative science (Hertzel, 2003: 295). This is because most bibliometrics studies test the validity and complementarity of quality measures, for example, peer review. The present study, for example, tests the impact of researchers that have already been ranked using mainly the peer-review system by the NRF. Since the ranking has been done using an essentially qualitative measure, it is pertinent therefore to test their validity and complementarity by

utilising quantitative measures. Combinations of citation analysis and altmetrics data tools constitute the best way to verify and test the complementarity of the NRF ratings, as well as academic and societal impact. Based on Romm and Ngulube's (2015:159) observations, this study uses a quantitative multi-method approach.

3.3 Research design

Various bibliometricians divide bibliometrics studies into descriptive and evaluation studies (Hertzel, 2003: 295; Sengupta, 1992: 78). Descriptive studies investigate the productivity of researchers based on geographic locations, periods, disciplines, ranks and other descriptive indicators. Descriptive studies include those that seek to establish the productivity of rated researchers. Such a study may count the number of publications the NRF-rated researchers publish, without necessarily looking into their impact. Evaluative studies weigh citation counts and references in order to determine the quality and impact of research. These two types of bibliometrics, however, are not mutually exclusive as researchers may conduct a study with elements of both descriptive and evaluative aspects. This study, for example, counts the number of output of rated researchers as well as determining citations and reads from those outputs. This study therefore engages with both the descriptive and evaluative aspects of bibliometrics.

3.3.1 Strengths and weaknesses of bibliometrics

Bibliometrics have a lot of strengths most associated with the fact that it is a quantitative method. Its weaknesses also reflect those of the quantitative approach to research generally. Table 6 below depicts the strengths and weaknesses of bibliometrics.

Table 6: Strengths and weaknesses of bibliometrics

Strengths	Weaknesses
It is objective	Does not provide understanding of reasons for researchers' actions
Results can be replicated	It may yield different results in different contexts therefore results cannot be generalised
It uses quantitative measures	The meaning behind the measures may be missed
Does not require interaction with subjects	Lack of interaction with researchers behind the citation may mean missing out crucial information
It determines the impact and influence of researchers, research outputs and institutions	Cannot be used to measure the quality of research
Can easily be used to rate researchers and research outputs	Biased towards established researchers and the natural sciences
It can use bibliometrics laws to test certain activities	Bibliometrics laws are not scientific laws
Dynamic field	As a result lacks universal theory
bibliometrics and altmetrics databases provide easy access to some citation indicators	Bibliometrics and altmetrics data differ from database to database. Most are biased towards English. Most focus on journal articles to the detriment of other research outputs. Some of the data is inaccurate.
Uses citations counts and altmetrics among other indicators	Assumes positive reasons for citations or accumulation of altmetrics

Bibliometrics studies utilise certain impact measures including citation analysis, altmetrics, co-word analysis, bibliometrics coupling, co-citation analysis and others (Sitienei, 2009: 40). Citation analysis and altmetrics as research impact measures are discussed in this section. Several studies have utilised bibliometrics (Jacobs, 1998; Sitienei, 2009; Maluleka, 2014) and altmetrics (Bangani, 2018; Rotich and Onyancha, 2017; Onyancha, 2015; Adriaanse and Rensleigh, 2013) in South Africa to measure research

impact. This study seeks to determine the quality and impact of research output of rated researchers who have been evaluated using the peer-review mechanism, which is qualitative by nature. This study, therefore, uses bibliometrics and altmetrics to complement the peer-review method of rating researchers in order to identify whether or not their research output and impact justify the ratings and levels thereof. This study is a significant contribution to the discourse about ratings which was recently triggered by Callaghan (2018) who called for a hybrid system that uses both the peer-review and research output and bibliometrics to decide on researchers' ratings. Other researchers, notably Marais (2007); Fedderke (2013) made similar suggestions previously.

3.4 Target Population

The population is the number of all research subjects from which the research is conducted (Du Plooy-Cilliers *et al.*, 2014:132, 133). The meaning of population in the context of research should not be confused with population as in human society (Remler and Van Ryzin, 2015:139). In research, population are all objects (including documents and other research output) and participants (including individuals and animals) that are the subject of scientific enquiry (Flick, 2011: 251). The primary target population of this study, therefore, were all NWU rated researchers and their outputs as listed in GS, Scopus, WoS, RG, and Mendeley from 2006 to 2017. There were 8 276 outputs of NWU's rated researchers in GS, 5 536 in Scopus, 5 003 in WoS, 6 026 in RG, and 5 850 in Mendeley. The NWU's rated researchers targeted were 1707 rated from 2006 to 2017. These all form part of the population of the study.

3.5 Sampling procedures and methods

Sampling means a segment of the population selected to represent the whole population of a study (Bryman, 2016:695; Bless *et al.*, 2013: 395; Du Plooy-Cilliers *et al.*, 2014: 135). Sampling, therefore, entails the methods and procedures used to select a sample of the population (Remler and Van Ryzin, 2015:139). According to Du Plooy-Cilliers *et al.* (2014: 145) most researchers do not have enough budget, resources, and time to research the entire population hence they opt for sampling. Research scholars (Flick, 2011; Leedy and Ormrod, 2015; Bryman, 2016) agree that, generally, there are two methods of sampling: probability and non-probability sampling. In probability sampling all elements

of the population have an equal chance of being selected (Leedy and Ormrod, 2015:177) while in non-probability sampling the prospect of elements of the population getting selected is not the same (Bryman, 2016: 693). Some elements of the population may have a zero chance of being selected.

3.6 Sampling methods and techniques

This section discusses probability and non-probability sampling and also justifies the sampling method selected for this study.

3.6.1 Probability sampling

Bryman (2016: xii) lists four types of probability sampling: simple random sampling, systematic sampling, stratified random sampling, and multi-stage cluster sampling.

In simple random sampling, each element of the population has an equal chance of being included in the sample. In systematic sampling only the first case is selected randomly, subsequent cases are selected based on a sampling interval. Based on the requirements of the sample, every 20th case on the list can be selected, for example. Stratified sampling, on the other hand, means dividing the population into different strata, each with similar characteristics, for example, same age, rank, and rating and other characteristics.

Multi-stage cluster sampling involves dividing the population into clusters, and then conducting a random sample within those clusters.

3.6.2 Non-probability sampling

Du Plooy-Cilliers *et al.* (2014: 142-144) list six types of non-probability sampling:

- Accidental sampling – this is a sample based on the availability of the elements of the population at the time of the research.
- Convenience sampling – this is a sample based on the elements of the population that the researcher already know.
- Quota sampling – this is a sample where the elements are purposefully selected but the sample is then drawn to match certain characteristics.

- Snowball sampling – this is common with marketers, wherein the technique makes use of referrals.
- Volunteer sampling – this is a sample of people who volunteer to participate in a study.
- Purposive sampling – this is based on the purposeful selection of elements of the population based on certain characteristics. All members of the population that do not possess those characteristics are excluded from the sample.

The present study uses the NWU's rated researcher's output as its population. This research, therefore, used non-probability sampling approach and more particularly purposive sampling to select the output of NWU's rated researchers. NRF-rated researchers' output who are not associated with NWU were not included in the study and non-rated researchers' output were not included either except in cases of a collaboration with NWU's rated researcher. All output of NWU's rated researchers form part of this study.

3.6.3 Sample size

This study made use of a census technique. A census is the enumeration of the entire population (Rumsey, 2011: 54; Bryman, 2016: 689). In a census, no sampling technique is employed as all eligible elements of the population are studied (Israel, 2013). Israel (2013) supports the use of a census technique in smaller populations. A census technique eliminates sampling error and provides data on all the individuals in the population (Israel , 2013). In this study, all NWU's rated researchers and their output from 2006 to 2017 in GS, Scopus, WoS, RG, and Mendeley formed part of the study. In order to obtain the output, searches were conducted on all five databases (that is: GS, Scopus, WoS, RG, and Mendeley) using the authors' surnames and initials. The results were then limited to NWU using the filters provided in the databases. In cases where researchers' Open Researcher and Contributor ID (ORCID) was publicly available, these were used to confirm the data. The final sample size was as follows: there were 8 276 outputs of NWU's rated researchers in GS, 5 536 in Scopus and 5 003 in WoS, 6 026 in RG, and 5 850 in Mendeley generated by the 1707 NWU's rated researchers reflected in Table 2 of the study. The section on data collection procedures in 3.8 provides further details on how the sample was sourced.

3.7 Data collection procedures and methods

This section discusses the data collection methods, and the main citation tools used in the study.

3.7.1 Data collection methods

Data refers to numerical and non-numerical information that is gathered following certain protocols in order to answer specific research questions (Neuman, 2014:9). The data must be collected using trusted research instruments and tools. Poor data collection instruments and tools may affect the integrity of the results of a study. Data collection represents the key moment of a research project (Bryman, 2016:10). Data collection methods, therefore, are the instruments and tools used to gather data from the research sample in order to answer the questions of a study (6 and Bellamy, 2012: 10; Bryman, 2016:12). This study uses both citation analysis instruments and tools, and altmetrics instruments and tools to collect measurable data (Bless *et al.*, 2013:217) to answer the research questions.

3.7.2 The main citation tools

There are three web-based citations tools: WoS, Scopus, and GS (Waltman, 2016:367). Scopus and WoS are subscription-based databases while GS is freely accessible. Studies including Meho and Yang (2007) and Waltman (2016) have compared the three databases. To a limited extent, the NRF also considers these three bibliographic databases together with peer-review mechanism in their rating of researchers (Skeef, 2014:30). In this section, a brief description of each of these databases and citation indicators is provided.

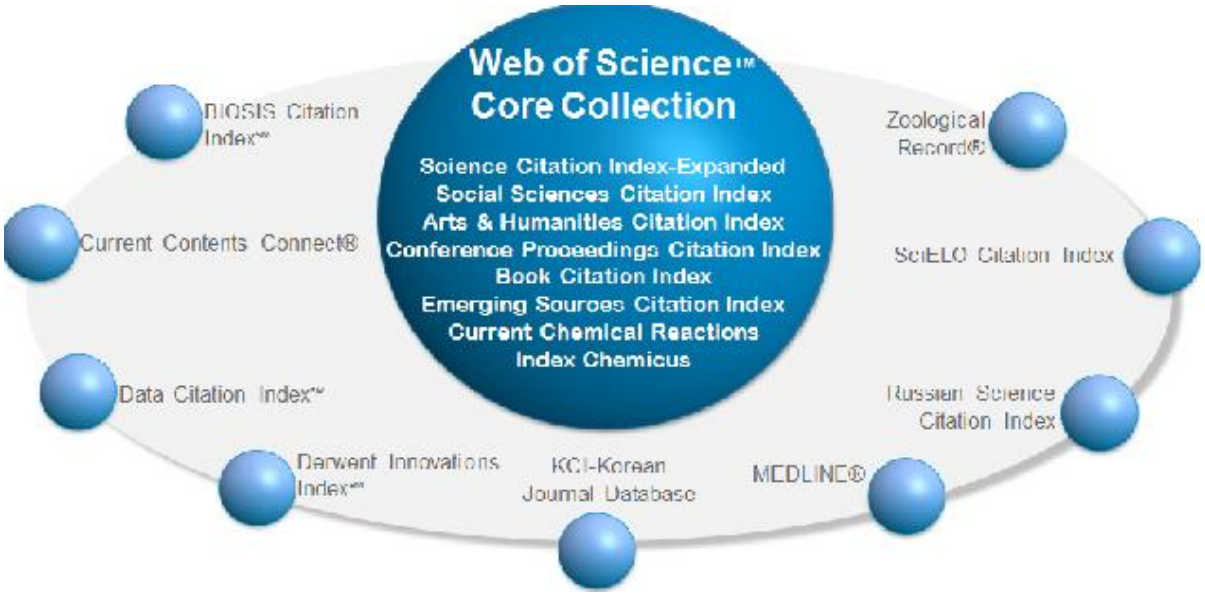
Google Scholar was launched by Google in 2004 (Adriaanse and Rensleigh, 2013: 728; Andres, 2009: 143). GS indexes academic literature available on the web, including journals, books, book chapters, book reviews, conference papers, patents, institutional repositories, web-pages from universities, and technical reports (Giles, 2005:554; Google Scholar, n.d.). Though Google is secretive about the number of records GS has, it is widely accepted that GS offers the most comprehensive and widest coverage of scholarly literature from African countries and elsewhere (Meho, 2007:32; Okafor, 2010: 183). Orduna-Malea, Ayllón, Martín-Martín & López-Cózar (2015) estimated the records on GS to be between 160-165 million documents by May 2014. As a result, GS h-indices are normally higher than other major databases (Wimmer, Rethlefsen, Jarvis & Shipman, 2016:406;

Andres, 2009: 145). The quantity of data covered, however, may present challenges as much time is required to clean the data (Meho, 2007:35).

Scopus was launched by Elsevier in 2004 in direct competition to the already established WoS database. Scopus indexes academic journals, magazines, books, and conference proceedings. Scopus has more titles than WoS (Elsevier, 2017, 305) although WoS continues to claim a hold on more quality research than the former (Clarivate Analytics, 2017a). Some of the limitations of commercial bibliometrics databases is that their Arts and Humanities coverage is significantly limited (Agarwal, Durairajanayagam, Tatagari, Esteves, Harlev, Henkel, Roychoudhury, Homa, Puchalt, Ramasamy, Majzoub, Ly, Tvrda, Assidi, Kesari, Sharma, Banihani, Ko, Abu-Elmagd, Gosalvez, & Bashiri, 2016: 305-306). Scopus is deemed to have more than 54.5 million records as of May 2014.

Web-of-Science is the oldest and the most subscribed citation tool globally (Roemer and Borchardt, 2015:32). Its history is traceable back to1955 when Garfield first proposed a platform for research impact of scholarly output (Garfield, 1955: 109). In 1964, the first WoS platform, the Science Citation Index, was formed. Other platforms followed over the years: Social Science Citation Index in 1973, Journal Citation Reports in 1976, and the Arts and Humanities Citation Index in 1978 (Wallace and Van Fleet, 2012:243). More platforms were added in the 90s and 2000s (Clarivate Analytics, 2017b). Figure 2 shows all current WoS platforms.

Figure 3: WoS Platforms (Clarivate Analytics, 2017b)



WoS is used to identify and measure research the impact of researchers and publications (Thomson Reuters, 2008). The most significant limitation of WoS is that its coverage of Arts and Humanities is inadequate (Agarwal *et al.*, 2016: 305-306). Both Scopus and WoS have limited content from African journals (Onyancha and Ocholla, 2009; and Okafor, 2010: 183). Web of Science Core Collection was reported to hold 56.9 million as of May 2014 (Orduna-Malea *et al.*, 2015).

3.7.3 Altmetrics tools and altmetrics indicators

In Chapter two of the study the categories of altmetrics according to their functions was provided. This section gives attention to both, Mendeley readership indicators and RG reads that are used in this study.

3.7.3.1 ResearchGate (RG)

According to its website, RG was formed in 2008 by Ijad Madisch, Sören Hofmayer, Horst Fickenscher (ResearchGate, 2019). RG touts itself as a professional network for scientists and researchers (ResearchGate, 2019). It had more than 15 million members by June 2019 (ResearchGate, 2019). Martín-Martín, Orduna-Malea, Ayllon & Lopez-Cozar (2016) identified at least eight altmetrics indicators in RG. Those were reads (which combines

views and downloads), RG Score, citations, total number of publications, researchers following, followers, profile views and impact points. Since then RG added the h-Index and recommendations. In this study, the reads altmetrics indicator are used because of the ease of access and relevance in measuring the impact of researchers. Ortega (2015:41) points out that RG is suitable to get author-level altmetrics such as reads, number of publications and citations. Orduna-Malea, Martín-Martín, Thelwall & López-Cózar (2016) are highly critical of the RG Score as it relies primarily on activity related to asking and answering questions in RG. The number of publications and reads altmetrics indicators is therefore used in this study. This is not the first study to use these altmetrics indicators (number of documents and reads in RG) to determine the visibility of researchers as well as test the correlations of their citations in GS, WoS and Scopus. These altmetrics indicators are also widely used by other researchers (Batooli, Ravandi & Bidgoli, 2016; Shrivastava and Mahajan, 2017).

3.7.3.2 Mendeley

According to Bhardwaj (2017), Mendeley was initiated in 2007 in London by two German doctoral students. It started as an independent company until its purchase by Elsevier in 2013. There are four altmetrics indicators on Mendeley (Martín-Martín, Orduna-Malea, Ayllon & Lopez-Cozar, 2016): readership or readers, publications, researcher followers and following. Researchers point out that Mendeley is suitable for researchers to share, collaborate, and discover research output (Wouters and Costas, 2012: 27; Ortega, 2015: 42). Fairclough and Thelwall (2015:848) state that Mendeley readership altmetrics indicators have a high correlation to citation counts than any other altmetrics measure. It is in the interest of this research, therefore, to test whether the high correlations apply in the case of NWU's rated research output. The visibility of NWU's rated researchers on Mendeley is also examined using the number of publications.

3.8 Data collection procedures

Data collection procedures are an indication of how the research tools and indicators are used for data collection (Kumar, 2014). The NWU annual research reports were obtained for purposes of collecting the names of NWU's rated researchers at the University from 2006 to 2017. Five Excel data files were created and each divided into eleven spreadsheets representing the year under study. The three data files that assembled data from WoS,

Scopus and GS were divided into the following columns: name of NWU's rated researcher, rating category, title of document published, citations, journal names, conference names, book/book chapters, others and notes. The notes column was meant to keep any interesting facts about a researcher such as when the researcher does not have a WoS/Scopus profile. The two files meant to collect almetrics data were also divided into eleven spreadsheets each representing the year covered by the study with each spreadsheet capturing the following information: name of NRF-rated researcher/s, rating category, availability (on RG or Mendeley), title of document, citations (RG or Mendeley), Reads (RG) or Readership (Mendeley), journal, conference, book/chapter, and notes. In order to obtain the NWU's NRF-rated researchers' output and citation counts, searches were then conducted on WoS and Scopus using the surname and initials of NWU's rated researchers in each year from 2006 to 2017. For purposes of ascertaining that the researcher was the correct one, the results were then limited to North-West University using the filters provided by the two databases. Where a researcher's Open Researcher and Contributor ID (ORCID) was publicly available, this was used to search in Scopus and WoS. The results obtained were then compared to the profile and research areas of individual NWU's rated researchers provided in the NWU's annual research report. In the case of GS, the researcher used Publish or Perish (PoP) software to search for the NWU's rated researchers' publications and citation counts. The data on GS required a lot of effort to eliminate duplicate records and cleaning. The problem of errors and duplicate records in GS is well known by researchers (Meho, 2007:35; Onyancha and Ocholla, 2009). Other searches using the authors' surnames and initials were conducted on Mendeley and RG in order to determine social impact and correlate RG and Mendeley reads and readerships with the citation data in the three bibliographic databases (GS, Scopus and WoS). To ensure that the data was correct, the affiliation details of the authors of the documents were checked on those databases against the NWU's annual research reports from 2006 to 2017. The research profiles on RG and Mendeley were also compared with those provided in the NWU's annual research reports.

3.9 Data analysis and presentation

Data analysis is the management, analysis and interpretation of data (Bryman, 2016). In data analysis, the researcher sifts through a large body of data and establishes meaning and

order out of it (Hammond and Wellington, 2013). Data analysis involves decisions about what kind of data to use for the study and which data to discard or use for later studies (Brynard, Hanekom & Brynard, 2014). To assist with data analysis, quantitative researchers often make use of online software like IBM SPSS Statistics program for easy analysis and presentation of data and results (Neuman 2014). Quantitative data is often presented in the form of graphs and tables in order to highlight structure and for easy presentation of results (Kumar, 2014). This bibliometrics quantitative study used Microsoft Excel 2010 statistical programme functionalities to sort out data, and then create tables and graphs. To test correlations between social impact and academic impact, the IBM SPSS program, in particular the Spearman's correlation analysis, was used following Rumsey's guidelines in interpreting the data (Rumsey, 2011). According to Rumsey, correlations can be interpreted by determining whether R is closest to +1 denoting a perfect uphill (positive) linear relationship or -1 denoting a perfect downhill (negative) linear relationship (Rumsey, 2011:284). Several researchers, including Thelwall and Wilson (2016) and Bangani (2018) used this method to test correlations between altmetrics indicators and citation data. The data was then analysed using basic statistical methods. Findings of this study are presented in tables and graphs that are preceded by analysis and interpretations.

3.10 Summary

This chapter discussed the methods, approach and procedures followed in conducting this research. This is a bibliometrics and altmetrics study that employs quantitative methods. The bibliometrics and altmetrics tools namely: GS, Scopus, WoS, RG and Mendeley used in this study were discussed in this chapter. The following chapter presents the data and executes systematic analysis.

Chapter 4: Presentation and analysis of data

4.1 Introduction

The preceding chapter outlined the research methods, instruments and procedures used in this study. The current chapter presents and analyses the data gathered for this study in order to achieve the initial objectives that were set to:

- Establish the research output of rated researchers at NWU in GS, Scopus and WoS.
- Determine the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Compare the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Establish a list of the most cited journals in which the rated researchers publish.
- Assess the visibility of the rated researchers' output at the NWU in academic social media sites (ResearchGate and Mendeley).
- Determine the relationship between academic impact and societal impact of the research output of rated researchers at NWU.

As pointed out in Chapter 3, the data were collected using Publish or Perish software for GS and the rest were collected using WoS, Scopus, Mendeley, and RG. A bibliometrics/altmetrics approach to data collection and analysis was adopted.

4.2 Research output of NWU's rated researchers

There are three bibliographic databases that were used to obtain data for NWU's rated researchers' output in this study: GS, Scopus and WoS. The data from GS was obtained using a programme called Publish or Perish - a software developed by Anne-Wil Harzing in 2007 to retrieve and analyse citations from GS (Washington State University Libraries, 2019). Other researchers such as Kerchhoff (2017) also used this programme to retrieve research output and citations from GS. Due to the fact that the three databases do not always index the same research output and journals, the section on the research output of NWU's rated researchers is presented in three sub-sections with each sub-section dealing with data from a different bibliographic database.

4.2.1 Research output in GS

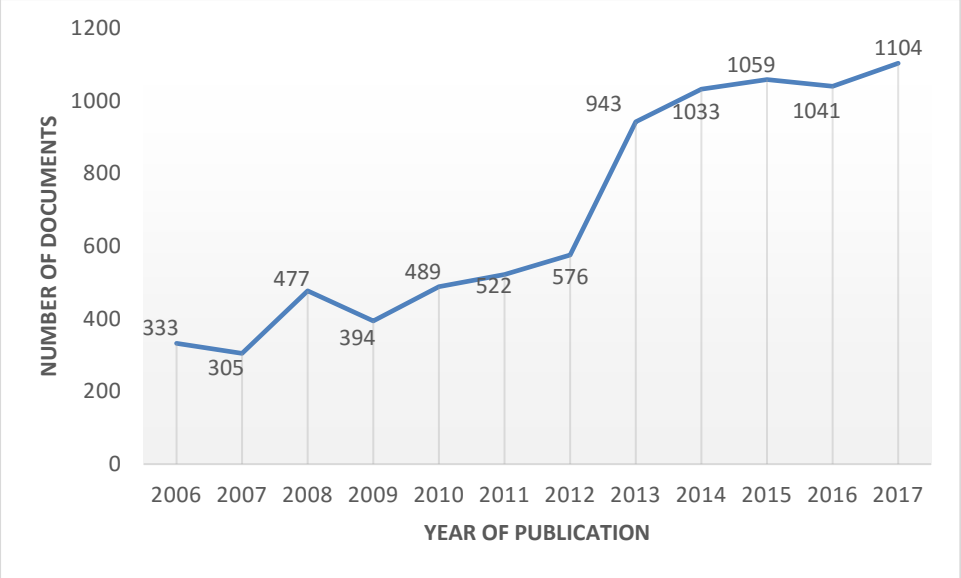
Table 7 depicts the trends of NWU's rated researchers' output in GS from 2006 to 2017. NWU's rated researchers produced 8 276 documents in GS during this period. Taking into account the number of rated researchers during this period, which shows that there were 1707 of them at NWU from 2006 to 2017, then each rated researcher published close to 4.9 outputs in GS indexed publications on average. These researchers produced a variety of documents with the vast majority being journal articles (6696 or close to 81% of 8276), followed by conference papers (885 or close to 11% of 8276), books and book chapters (463 or close to 6% of 8276), and lastly 232 (or close to 3% of 8276) other forms of publications. Others included patents (23), inaugural lectures (29), theses and dissertations (19), different kinds of reports (technical, projects, water and other) for organisations (the United Nations (UN), Food and Agriculture Organisation (FAO), Institute for Tourism and Leisure Studies, Institute of Labour Economics, South African National Biodiversity Institute and Water Research Commission, among others) (58), working papers (32), a memorandum (1), newspaper article (1), posters (25), policy research (12), position papers (9), lecture notes (1), discussion papers (12), panel discussions (1), course notes (1), website post (1), presentations (1), policy briefs (4), and 2 documents that could not be classified. There were differences in the extent of production by years with 2017 being the year that the rated researchers were at their most productive though the picture could change were the average number of publications per rated researcher per year taken into account. Given that 2017 had the highest number of rated researchers, the higher output produced by rated researchers in 2017 is not surprising.

Table 7: Trends of NWU's rated researchers' output in GS

Year/s	Number of rated researchers	Number of output	Average ouput per rated researcher	Number of Journal articles (%)	Number of Conference Papers (%)	Number of Books and chapters (%)	Number of Others (%)
2006	82	333 (100)	4.1	246 (73.9)	42 (12.6)	17 (5.1)	28 (8.4)
2007	95	305 (100)	3.2	229 (75.1)	51 (16.7)	11 (3.6)	14 (4.6)
2008	103	477 (100)	4.6	392 (82.2)	49 (10.3)	14 (2.9)	22 (4.6)
2009	116	394 (100)	3.4	313 (79.4)	46 (11.7)	18 (4.6)	17 (4.3)
2010	117	489 (100)	4.2	391 (79.9)	62 (12.7)	19 (3.9)	17 (3.5)
2011	125	522 (100)	4.2	428 (82)	45 (8.6)	34 (6.5)	15 (2.9)
2012	140	576 (100)	4.1	476 (82.6)	53 (9.2)	33 (5.7)	14 (2.4)
2013	169	943 (100)	5.6	762 (80.8)	76 (8.1)	71 (7.5)	34 (3.6)
2014	190	1033 (100)	5.4	841 (81.4)	103 (10)	60 (5.8)	29 (2.8)
2015	146	1059 (100)	7.3	824 (77.8)	156 (14.7)	70 (6.6)	9 (0.9)
2016	195	1041 (100)	5.3	873 (83.9)	105 (10.1)	51 (4.9)	12 (1.2)
2017	229	1104 (100)	4.8	921 (83.4)	97 (8.8)	65 (5.9)	21 (1.9)
Total	1707	8276 (100)	4.9	6696 (80.9)	885 (10.7)	463 (5.6)	232 (2.8)

To further illustrate the research output of NWU's rated researchers from 2006 to 2017, a line graph (Figure 4) was generated to show productivity in years. At face value, the most productive year was 2017 with 1 104 documents produced followed by 1 059 in 2015. The lowest productive years by NWU's rated researchers were 2007 with 305 outputs followed by 2006 with 333 outputs. Averages reveal a different picture. To count the averages, the number of research outputs in a year were divided by the number of rated researchers on the same year. The average production of rated researchers for 2006, therefore, is 333 research outputs divided by 82, which is the number of rated researchers in 2006. This gives an average of 4.1 research output per NWU's rated researcher in 2006. The averages for other years are as follows: 3.2 in 2007; 4.6 in 2008; 3.4 in 2009; 4.2 in 2010; 4.2 in 2011; 4.1 in 2012; 5.6 in 2013; 5.4 in 2014; 7.3 in 2015; 5.3 in 2016, and 4.8 in 2017. Based on these averages, the most productive years for rated researchers were 2015 and 2013 while the least productive were 2007 and 2009. The overall average number of 4.9 per rated researcher was exceeded in four years which are: 2013, 2014, 2015, and 2016.

Figure 4: NWU's rated researchers' output in GS, 2006-2017



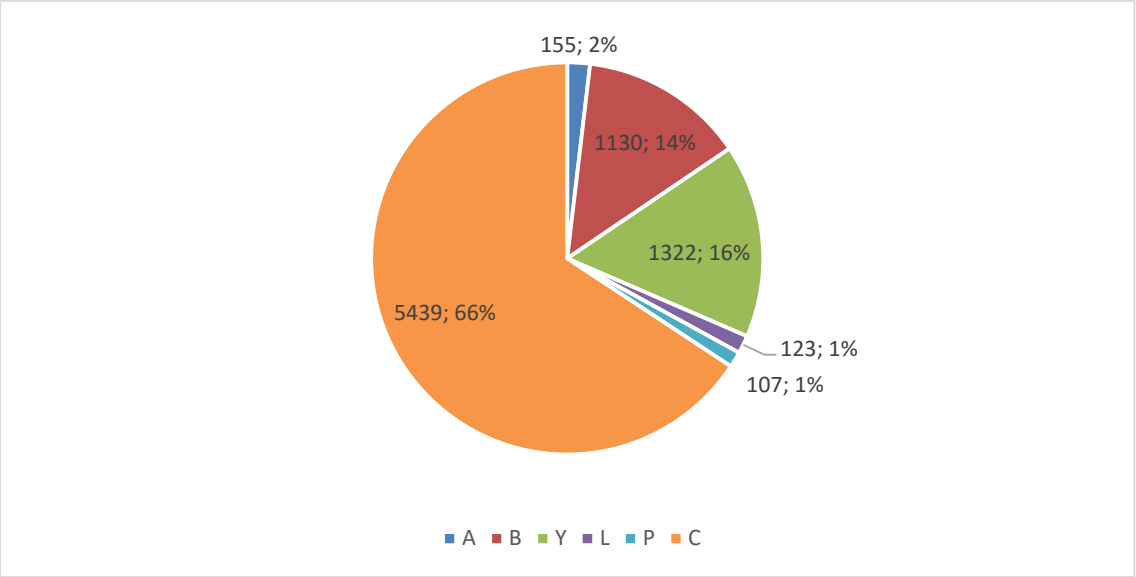
The researcher was also interested to know the research output of rated researchers by category as depicted in Table 8 and Figure 5. It is clear in Figure 5 that the overwhelming majority of documents are produced by C-rated researchers. C-rated researchers produced close to 66% of all documents by rated researchers during this period followed by Y-rated researchers with 16%, B-rated researchers with 13.7%. A-rated researchers' publications accounted for 1.9% of all documents produced while those of L-rated researchers stood at 1.5 follwed by P-rated researchers with 1.3%. However, there were 1154 (67.6% of 1707) C-rated researchers during this period followed by 295 (17.8% of 1707) Y-rated, 188 (11% of 1707) B-rated, 28 (1.6% of 1707) L-rated, 27 (1.6 of 1707) A-rated, and 15 (0.9% of 1707) P-rated researchers.

Admittedly, most of these individuals are counted several times over different years for easy analysis of data in years. These may not always be unique individuals. If, for example, researcher "X" was rated in 2006, 2007, and 2008 etc., s/he will be counted each time for each year based on their rating category in that year. A-rated researchers published 5.7 outputs per researcher in GS, B-rated researchers published 6 outputs per researcher in GS, C-rated researchers published 4.7 outputs per researcher in GS, L-rated researchers published 4.4 outputs per researcher in GS, P-rated researchers published 7.1 outputs per researcher in GS, and Y-rated researchers published 4.5 outputs per researcher in GS. When averages are considered, P-rated researchers outperformed all categories in GS followed by B-rated researchers and in close third are A-rated researchers. Y-rated researchers were second last after L-rated researchers.

Table 8: Research output of NWU's rated researchers in GS by rating category

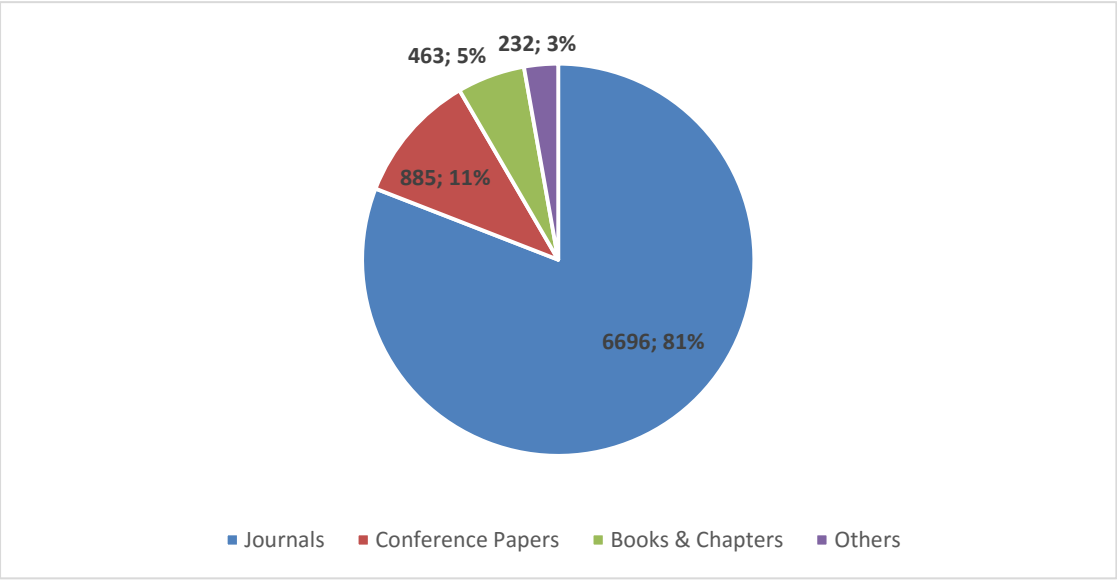
Year	A (%)	B (%)	C (%)	L (%)	P (%)	Y (%)	Total (%)
2006	11 (3.3)	58 (17.4)	210 (63.1)	12 (3.6)	6 (1.8)	36 (10.8)	333 (100)
2007	9 (2.9)	58 (19)	172 (56.4)	10 (3.3)	6 (2)	50 (16.4)	305 (100)
2008	25 (5.2)	104 (21.8)	250 (52.4)	21 (4.4)	8 (1.7)	69 (14.5)	477 (100)
2009	11 (2.8)	69 (17.5)	218 (55.3)	10 (2.5)	6 (1.5)	80 (20.3)	394 (100)
2010	11 (2.3)	60 (12.3)	321 (65.6)	21 (4.3)	5 (1)	71 (14.5)	489 (100)
2011	15 (2.9)	60 (11.5)	363 (69.5)	2 (0.4)	0 (0)	82 (15.7)	522 (100)
2012	11 (1.9)	81 (14.1)	431 (74.8)	4 (0.7)	6 (1)	43 (7.5)	576 (100)
2013	7 (0.7)	108 (11.5)	669 (70.9)	6 (0.6)	7 (0.7)	146 (15.5)	943 (100)
2014	13 (1.3)	110 (10.6)	699 (67.7)	37 (3.6)	14 (1.4)	160 (15.5)	1033 (100)
2015	17 (1.6)	108 (10.2)	725 (68.5)	0 (0)	19 (1.8)	190 (17.9)	1059 (100)
2016	12 (1.2)	165 (15.9)	646 (62.1)	0 (0)	17 (1.6)	201 (19.3)	1041 (100)
2017	13 (1.2)	149 (13.5)	735 (66.6)	0 (0)	13 (1.2)	194 (17.6)	1104 (100)
Total	155 (1.9)	1130 (13.7)	5439 (65.7)	123 (1.5)	107 (1.3)	1322 (16)	8276 (100)
No. of rated researchers	27	188	1154	28	15	295	1707

Figure 5: Research output of NWU's rated researchers in GS by rating category, 2006-2017 (N=8276)



Further, the research investigated the types of output hosted by GS that are published by NWU's rated researchers. Figure 6 shows that the majority of documents produced are journal articles followed by conference papers, books and book chapters and then other forms of documents. Interestingly, it was established that rated researchers do not only produce academic documents but other kinds of documents such as inaugural lectures, policy documents, invited lectures, position papers, reports, posters, presentations, technical reports, theses, working papers and patents.

Figure 6: Types of output published by NWU's rated researchers in GS, 2006-2017 (N=8276)



4.2.2 Research output in Scopus

Table 9 shows research output of NWU's rated researchers in Scopus. The majority of NWU's rated researchers' output in Scopus in 2006 to 2017 were journals, followed by conference papers and books and book chapters. The most productive year in terms of the number of output produced was 2017 while 2006 saw the least number of research output by rated researchers. This is in line with the gradual increase in the number of NWU's rated researchers yearly since 2006 to 2017. Cumulatively, this makes sense as 2006 had the least number of rated researchers at NWU while 2017 had the most number of these researchers.

Table 9: Trends in research output of NWU's rated researchers in Scopus

Year	Number of rated researchers	Number of output (%)	Average ouput per rated researcher	Journal Articles (%)	Conference Papers (%)	Books & chapters (%)
2006	82	194 (100)	2.4	182 (93.8)	10 (5.2)	2 (1)
2007	95	207 (100)	2.2	165 (79.7)	33 (15.9)	9 (4.4)
2008	103	265 (100)	2.6	247 (93.2)	13 (4.9)	5 (1.9)
2009	116	205 (100)	1.8	175 (85.4)	26 (12.7)	4 (1.9)
2010	117	278 (100)	2.4	237 (85.3)	37 (13.3)	4 (1.4)
2011	125	381 (100)	3.1	319 (83.7)	38 (10)	24 (6.3)
2012	140	411 (100)	3.1	377 (91.7)	32 (7.8)	2 (0.5)
2013	169	634 (100)	3.8	549 (86.6)	63 (9.9)	22 (3.5)
2014	190	670 (100)	3.5	627 (93.6)	30 (4.5)	13 (1.9)
2015	146	754 (100)	5.2	674 (89.4)	56 (7.4)	24 (3.2)
2016	195	743 (100)	3.8	673 (90.6)	43 (5.8)	27 (3.6)
2017	229	794 (100)	3.5	698 (87.9)	65 (8.2)	31 (3.9)
Total	1707	5536 (100)	3.2	4923 (88.9)	446 (8.1)	167 (3)

Figure 7 assists to further determine the differences in production of research output by year. The output generally increased with years though there were minor dips in 2009 and 2016. This dip may be attributed to the absence of two very productive C-rated researchers in the 2009 list when compared to 2008. There were also three productive C-rated researchers absent in 2016 when compared to 2015. The output of rated researchers showed a marked increase of close to 309.3% from 2006 compared to 2017. The average publications per rated researcher over the years of the study stood as follows: 2.4 (2006);

2.2 (2007);2.6 (2008); 1.8 (2009); 2.4 (2010); 3.1 (2011); 3.1 (2012); 3.8 (2013); 3.5 (2014); 5.2 (2015); 3.8 (2016) and 3.5 (2017). The lowest production of research output per rated researcher, therefore, were in 2006, 2007, 2009, and 2010. The year 2015 was the most productive in terms of averages followed by 2013, 2016 and 2017.

Figure 7: Research output of NWU's rated researchers in Scopus, 2006-2017

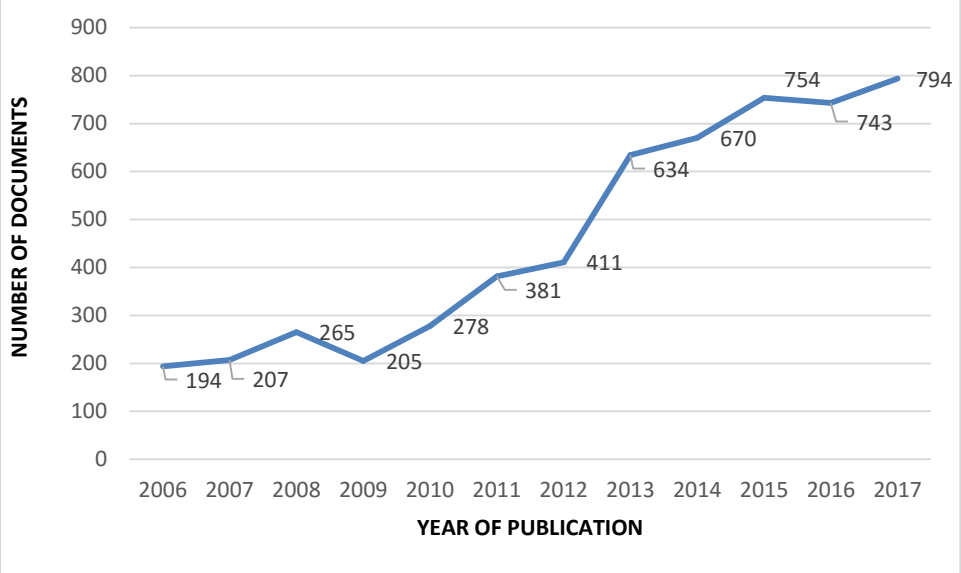
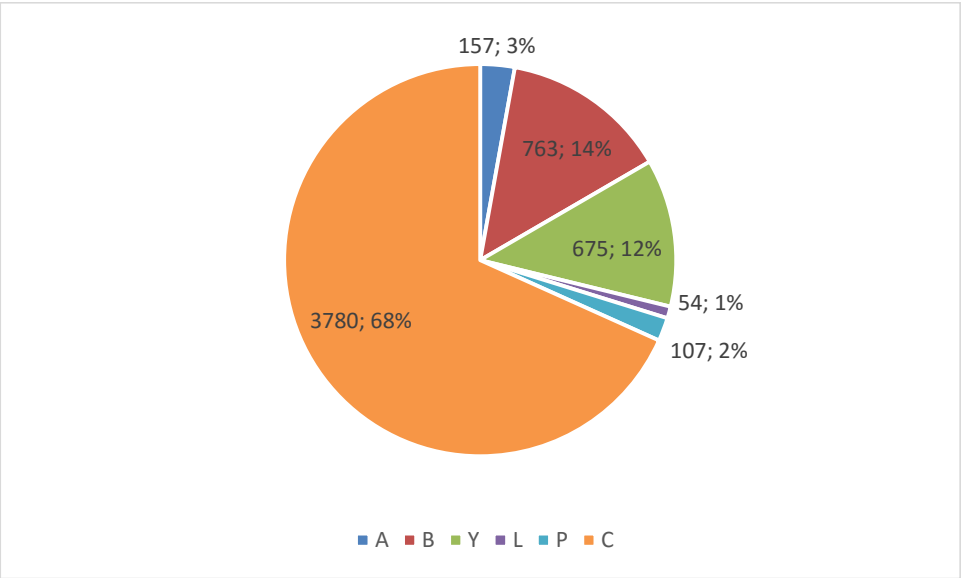


Table 10 and Figure 8 depict the research output of rated researchers in Scopus by rating category. The vast majority of rated researchers' output (3780 or 68.3%) in this period were C-rated, followed by B-rated researchers (763 or 13.8%), Y-rated researchers (675 or 12.2%), A-rated researchers (with 157 or 2.8%), P-rated researchers (107 or 1.9%), and lastly the L-rated researchers at 54 (or 1%). On average, P-rated researchers published 7.1 output per researcher in Scopus, followed by A-rated researchers (5.8 output per researcher), B-rated researchers (4.1 output per researcher), C-rated researchers (3.2 output per researcher), Y-rated researchers (2.3 output per researcher) and L-rated researchers (1.9 output per researcher).

Table 10: Trends in research output of NWU's rated researchers in Scopus

Year	A (%)	B (%)	C (%)	L (%)	P (%)	Y (%)	Total (%)
2006	10 (5.2)	32 (16.5)	132 (68)	0 (0)	3 (1.5)	17 (8.8)	194 (100)
2007	12 (5.8)	28 (13.5)	129 (62.3)	5 (2.4)	7 (3.4)	26 (12.6)	207 (100)
2008	18 (6.8)	55 (20.8)	144 (54.3)	7 (2.6)	8 (3)	33 (12.5)	265 (100)
2009	11 (5.4)	39 (19)	112 (54.6)	7 (3.4)	5 (2.4)	31 (15.1)	205 (100)
2010	8 (2.9)	27 (9.7)	195 (70.1)	14 (5)	2 (0.7)	32 (11.5)	278 (100)
2011	23 (6)	33 (8.7)	289 (75.9)	1 (0.3)	2 (0.5)	33 (8.7)	381 (100)
2012	9 (2.2)	42 (10.2)	334 (81.3)	0 (0)	0 (0)	26 (6.3)	411 (100)
2013	7 (1.1)	71 (11.2)	460 (72.6)	9 (1.4)	16 (2.5)	71 (11.2)	634 (100)
2014	18 (2.7)	63 (9.4)	475 (70.9)	11 (1.6)	18 (2.7)	85 (12.7)	670 (100)
2015	13 (1.7)	75 (9.9)	546 (72.4)	0 (0)	22 (2.9)	98 (13)	754 (100)
2016	13 (1.7)	142 (19.1)	478 (64.3)	0 (0)	9 (1.2)	101 (13.6)	743 (100)
2017	15 (1.9)	156 (19.6)	486 (61.2)	0 (0)	15 (1.9)	122 (15.4)	794 (100)
Total output	157 (2.8)	763 (13.8)	3780 (68.3)	54 (1)	107 (1.9)	675 (12.2)	5536 (100)
No. of rated researchers	27	188	1154	28	15	295	1707

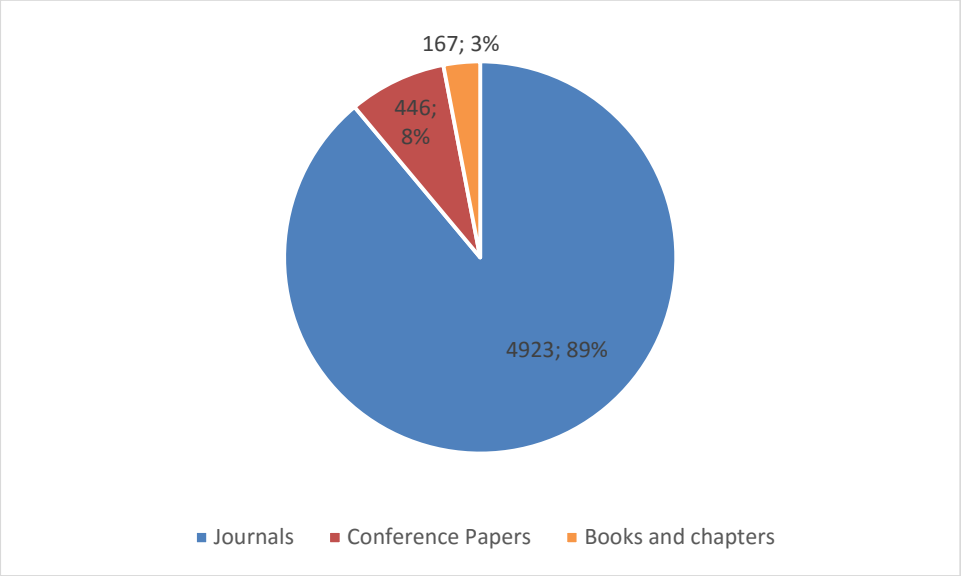
Figure 8: Research output of NWU's rated researchers in Scopus by rating category, 2006-2017 (N=5536)



To further analyse research output, it is pertinent to classify what types of output were produced by NWU's rated researchers. Figure 9 shows that the most popular output were

journal articles which stood at close to 89% of all research output in Scopus followed by conference papers at just more than 8% with books and chapters occupying the last place at just more than 3%.

Figure 9: Types of output of NWU's rated researchers in Scopus, 2006 - 2017 (N=5536)



4.2.3 Research output in WoS

WoS was also used to determine the research output of rated researchers at NWU. Table 11 shows that close to 99.5% (4976 of 5003) of all research output published by rated researchers in WoS were in journals. Close to 0.5% (25 of 5003) of output were conference papers while book chapters constitute close to 0.04% (2 of 5003) of outputs.

Table 11: Trends in research output of NWU's rated researchers in WoS

Year	Number of rated researchers	Number of output	Average ouput per rated researcher	Journal Articles	Conference Papers	Books and chapters
2006	82	142 (100)	1.7	142 (100)	0 (0)	0
2007	95	155 (100)	1.6	155 (100)	0 (0)	0
2008	103	250 (100)	2.4	250 (100)	0 (0)	0
2009	116	192 (100)	1.7	192 (100)	0 (0)	0
2010	117	261 (100)	2.2	261 (100)	0 (0)	0
2011	125	313 (100)	2.5	313 (100)	0 (0)	0
2012	140	428 (100)	3.1	428 (100)	0 (0)	0
2013	169	330 (100)	2	326 (98.8)	4 (1.2)	0
2014	190	600 (100)	3.2	593 (98.8)	7 (1.2)	0
2015	146	688 (100)	4.7	685 (99.6)	3 (0.4)	0
2016	195	756 (100)	3.9	750 (99.2)	5 (0.7)	1 (0.1)
2017	229	888 (100)	3.9	881 (99.2)	6 (0.7)	1 (0.1)
Total	1707	5003 (100)	2.9	4976 (99.5)	25 (0.5)	2 (0.04)

Figure 10 depicts that the number of outputs in WoS by NWU's rated researchers increased yearly except 2009 and 2013 where there were decreases compared to previous years. The number of outputs between 2006 and 2017 increased by close to 525.4%. This is better than the increase in the number of NWU's rated researchers from 82 in 2006 to 229 in 2017 which is equal to a 179.3% increase. The average publications per rated researchers for the respective years are as follows: 1.7 in 2006, 1.6 in 2007, 2.4 in 2008, 1.7 in 2009, 2.2 in 2010, 2.5 in 2011, 3.1 in 2012, 2 in 2013, 3.2 in 2014, 4.7 in 2015, 3.9 in 2016, and 3.9 in 2017. In terms of the average productivity of individual rated researchers in years, 2015, 2016 and 2017 were the most productive in WoS indexed resources. The researchers were least productive in 2007 and 2006.

Figure 10: Research output of NWU's rated researchers in WoS, 2006-2017

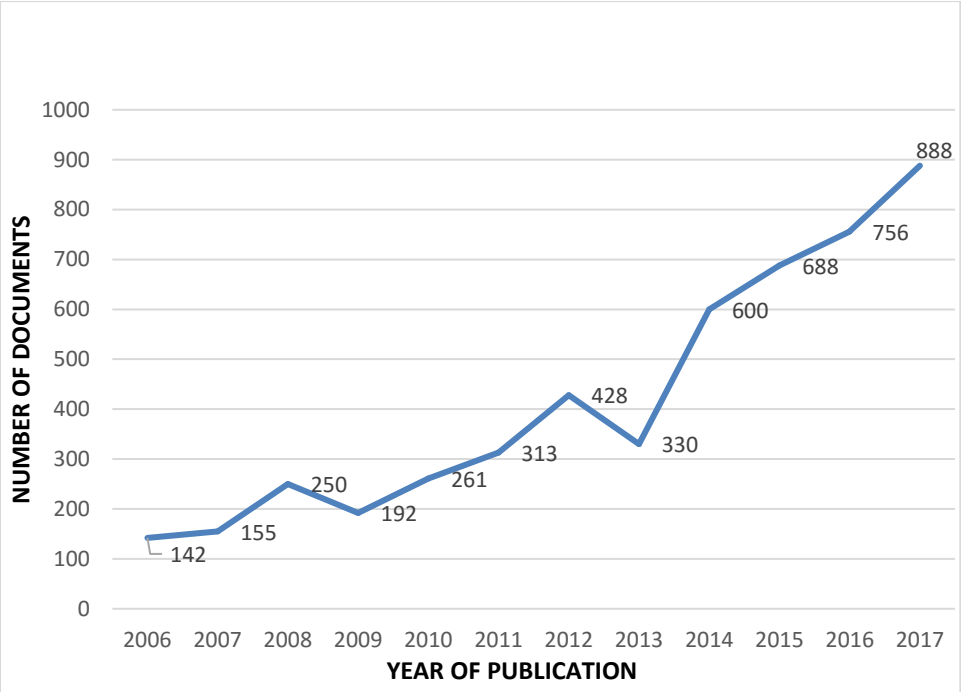
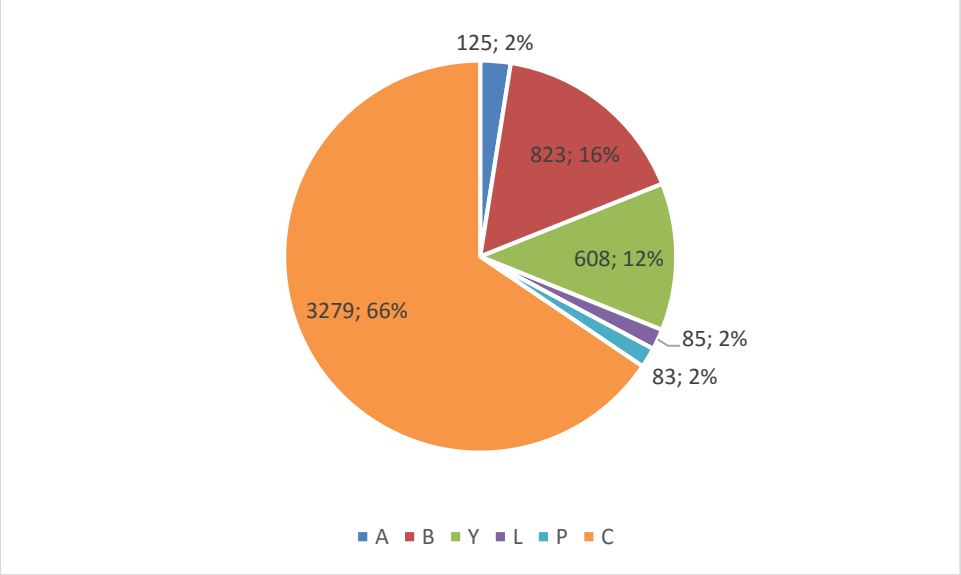


Table 12 and Figure 11 show that C-rated researchers were the biggest contributors of output in WoS indexed documents with more than 65.5% of research output while the A, P, and L-rated researchers contributed the least number. C-rated researchers, however, underperformed when one considers the averages while P and A-rated researchers performed significantly well. On average, A-rated researchers produced 4.6 output per researcher in WoS, B-rated researchers produced 4.4 output per researcher in WoS, C-rated researchers produced 2.8 output per researcher in WoS, L-rated researchers produced 3 output per researcher in WoS, P-rated researchers produced 5.5 output per researcher in WoS, and Y-rated researchers produced 2.1 output per researcher in WoS.

Table 12: Trends in research output of NWU's rated researchers in WoS

Year	A (%)	B (%)	C (%)	L (%)	P (%)	Y (%)	Total
2006	7 (4.9)	22 (15.5)	92 (64.8)	1 (0.7)	3 (2.1)	17 (12)	142 (100)
2007	4 (2.6)	29 (18.7)	86 (55.5)	7 (4.5)	0 (0)	29 (18.7)	155 (100)
2008	16 (6.4)	57 (22.8)	132 (52.8)	14 (5.6)	0 (0)	31 (12.4)	250 (100)
2009	1 (0.5)	19 (9.9)	119 (62)	7 (3.6)	12 (6.3)	34 (17.7)	192 (100)
2010	8 (3.1)	30 (11.5)	161 (61.7)	14 (5.4)	5 (1.9)	43 (16.5)	261 (100)
2011	9 (2.8)	34 (10.5)	256 (79)	12 (3.7)	2 (0.6)	11 (3.4)	324 (100)
2012	7 (1.6)	35 (8.2)	344 (80.4)	3 (0.7)	3 (0.7)	36 (8.4)	428 (100)
2013	15 (4.2)	43 (12.2)	206 (58.4)	25 (7.1)	15 (4.2)	49 (13.9)	353 (100)
2014	19 (3.2)	64 (10.7)	418 (69.7)	2 (0.3)	20 (3.3)	77 (12.8)	600 (100)
2015	13 (1.9)	78 (11.5)	498 (73.5)	0 (0)	2 (0.3)	87 (12.8)	678 (100)
2016	12 (1.6)	214 (28.7)	422 (56.6)	0 (0)	5 (0.7)	92 (12.4)	745 (100)
2017	14 (1.6)	198 (22.6)	545 (62.3)	0 (0)	16 (1.8)	102 (11.7)	875 (100)
Total	125 (2.5)	823 (16.5)	3279 (65.5)	85 (1.7)	83 (1.7)	608 (12.1)	5003 (100)

Figure 11: Research output of NWU's rated researchers in WoS by rating category, 2006-2017 (N=5003)



4.3 Academic impact of NWU's rated researchers' output

In order to determine the academic impact of rated researchers at NWU, the citations of their output were used as a proxy. Since this study relied on three bibliographic databases (GS, Scopus and WoS) that do not always index the same output, the academic impact has been divided into three sections in line with the bibliographic databases used. Later in the section, the academic impact in GS, Scopus and WoS is compared.

4.3.1 Academic impact in GS

Table 13 reflects the citation levels of NWU's rated researchers in GS from 2006 to 2017. Table 13 shows that there were 108 279 citations from documents produced by NWU's rated researchers from 2006 to 2017. Given that there were 8 276 output from NWU's rated researchers during this period, each output was cited an average of close to 13.1 times. Each researcher out of the 1 707 rated researchers was cited an average of 63.4 times. Of the 333 documents in 2006, 52 (15.6% of 333) were not cited at all. The number of uncited documents in 2007 stood at 35 (11.5% of 305), 62 (13% of 477) in 2008, these stood at 88 (22.3% of 394) in 2009, 102 (20.9% of 489) in 2010, there were 89 (17% of 522) in 2011, 83 (14.5% of 576) in 2012, 259 (27.5% of 943) in 2013, a total 266 (26.1% of 1018) in 2014, there were 282 (26.3% of 1074) in 2015, a significant 339 (32.6% of 1041) in 2016, while there were was a total 411 (37.3% of 1101) in 2017.

Overall 2016 (24.4% of 8276) of all documents in GS did not receive a citation. The citations levels reflected in Table 13 appear to follow 3-4 year trends. Research output from 2006 to 2008 are highly cited with averages of more than 30 citations each year. Those from 2009 to 2014 were well cited with averages of more than 10 citations each year while output from 2015 to 2017 had less than 5 citations on average each year. A similar trend can be noticed with the average citation rate per rated researcher. The period from 2006 to 2008 shows very high citation averages of more than 114 per rated researcher. The period from 2009 to 2014 shows a good citation rate of at least 49 citations per rated author each year. The period from 2015 to 2017 show less citation averages of less than 28 citations per rated researcher than the other periods. The citation averages are impressive, but it must be noted that the most cited author in 2006 had 5270 citations followed by another with 5195 citations. Removing these two authors would leave the average citation per author significantly lower in that year. These two researchers account for 62.8% of all citations in 2006. The highly cited NWU's rated researchers in the other years accumulated the following citations: 2855 (2007), 3132 (2008), 2198 (2009), 674 (2010), 608 (2011), 1119 (2012), 1182 (2013), 2209 (2014), 1630 (2015), 1413 (2016), 1190 (2017). It must be noted that citations of individual authors and papers may skew the averages. To deal with this problem, the researcher sought to find the median of citations in each year. The median of citations are highest from 2006 to 2009, and lowest in the last two years (2016 and 2017) of the study. Both years (2016 and 2017) show citation median levels above 3,

predicting even higher levels of citations in the coming years since citations take longer to accumulate.

Table 13: Citation trends of rated researchers in GS

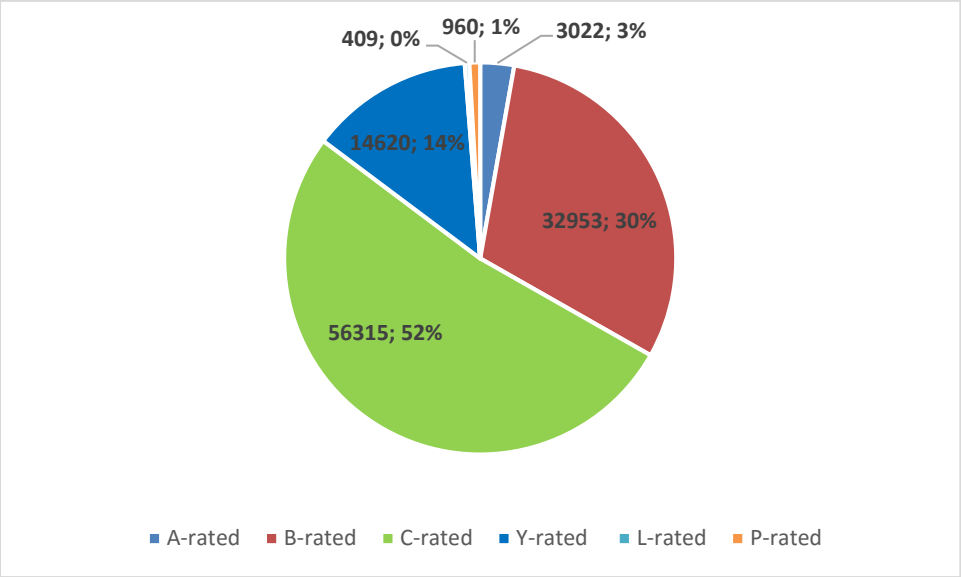
Year	Number of rated researchers	Output	Citations (%)	Average citations per output	Average citations per rated researcher	Citation median
2006	82	333	16676 (15.4)	50.1	203.4	18
2007	95	305	10914 (10.1)	35.8	114.9	18
2008	103	477	16487 (15.2)	34.6	160.1	10
2009	116	394	5687 (5.3)	14.4	49	11
2010	117	489	7400 (6.8)	15.1	63.3	6
2011	125	522	8188 (7.6)	15.7	65.5	8
2012	140	576	8467 (7.8)	14.7	60.5	9
2013	169	943	11558 (10.7)	12.3	68.4	8
2014	190	1033	10774 (10)	10.4	56.7	8
2015	146	1059	4038 (3.7)	3.8	27.7	6
2016	195	1041	4091 (3.8)	3.9	21	4
2017	229	1104	3999 (3.7)	3.6	17.5	4
Total	1707	8276	108279 (100)	13.1	63.4	7

The researcher was interested in identifying the extent of citation by rating category in order to determine if there were differences in academic impact between the rating categories. Table 14 and Figure 12 show that the bulk of research impact generated by NWU's rated researchers is by C-rated researchers. This is not surprising as C-rated researchers form close to 68% of rated researchers during this period. However, C-rated, Y-rated, and P-rated researchers underachieved in terms of citations of their output. Assisted by the good citation returns of earlier years (2006 to 2009) B-rated researchers did very well with regards citation in GS. The average citations per researcher in GS were as follows: 111.9 for A-rated researchers, 175.3 for B-rated researchers, 48.8 for C-rated researchers, 14.6 for L-rated researchers, 64 for P-rated researchers, and 49.6 for Y-rated researchers.

Table 14: Citations trends of research in GS per rating category

Year	A (%)	B (%)	C (%)	L (%)	P (%)	Y (%)	Total
2006	722 (4.3)	10652 (63.9)	4215 (25.3)	12 (0.1)	6 (0)	1069 (6.4)	16676 (100)
2007	100 (0.9)	5574 (51.1)	3994 (36.6)	100 (0.9)	125 (1.2)	1021 (9.4)	10914 (100)
2008	316 (1.9)	5125 (31.1)	9464 (57.4)	21 (0.1)	143 (0.9)	1418 (8.6)	16487 (100)
2009	99 (1.7)	3013 (53)	1331 (23.4)	163 (2.9)	6 (0.1)	1075 (18.9)	5687 (100)
2010	169 (2.3)	1036 (14)	4681 (63.3)	21 (0.3)	5 (0.1)	1488 (20.1)	7400 (100)
2011	374 (4.6)	539 (6.6)	5711 (69.7)	6 (0.1)	0 (0)	1562 (19.1)	8192 (100)
2012	225 (2.7)	694 (8.2)	6813 (80.4)	6 (0.1)	2 (0)	730 (8.6)	8470 (100)
2013	235 (2)	1449 (12.5)	7430 (64.2)	20 (0.2)	98 (0.9)	2336 (20.2)	11568 (100)
2014	314 (2.9)	1260 (11.7)	7481 (69.4)	60 (0.6)	507 (4.7)	1162 (10.8)	10784 (100)
2015	228 (5.7)	518 (12.9)	2017 (50.2)	0 (0)	68 (1.7)	1186 (29.5)	4017 (100)
2016	128 (3.1)	1647 (40.3)	1437 (35.2)	0 (0)	0 (0)	875 (21.4)	4087 (100)
2017	112 (2.8)	1446 (36.2)	1741 (43.6)	0 (0)	0 (0)	698 (17.5)	3997 (100)
Total	3022 (2.8)	32953 (30.4)	56315 (52)	409 (0.4)	960 (0.9)	14620 (13.5)	108279 (100)

Figure 12: Citations of rated researchers in GS by rating category, 2006-2017 (N=108279)



To further determine the academic impact of rated researchers, Scopus was used.

4.3.2 Academic impact in Scopus

The second database used to show academic impact of NWU's rated researchers was Scopus. Table 15 is a reflection of academic impact of NWU's rated researchers in Scopus by year. Table 15 reflects that a total of 71137 citations were made from documents published by NWU's rated researchers from 2006 to 2017. Given that there were 5536 outputs, overall each output received close to 12.9 citations on average. Out of the 1707, each researcher was cited a total of 41.7 times on average. There were 55 (28.4% of 194) uncited output in 2006, 67 (32.4% of 207) in 2007, 44 (16.6% of 265) in 2008, 69 (33.7% of 205) in 2009, 86 (30.9% of 278) in 2010, 96 (25.2% of 381) in 2011, 76 (18.5% of 411) in 2012, 149 (23.5% of 634) in 2013, 159 (23.7% of 670) in 2014, 200 (26.5% of 754) in 2015, 261 (35.1% of 743) in 2016, and 391 (49.2% of 794) in 2017. Overall, 1653 (29.9% of 5536) of all documents in Scopus did not receive a citation. The citation averages are higher in 2006 to 2008, and lower in the last two years of the study. The most cited documents in respective years from 2006 to 2017 received the following citations: 2795 (2006), 1581 (2007), 1471 (2008), 1038 (2009), 368 (2010), 326 (2011), 797 (2012), 880 (2013), 963 (2014), 1065 (2015), 1389 (2016), and 1001 (2017). To counter the influence of individual highly cited researchers or documents from affecting the averages, the

citation medians were also found. The citation medians also follow the same trends as citations and citation averages. These are higher in the first three years and lowest in the last two, further giving credence to the results of this study.

Table 15: Citation trends of research in Scopus

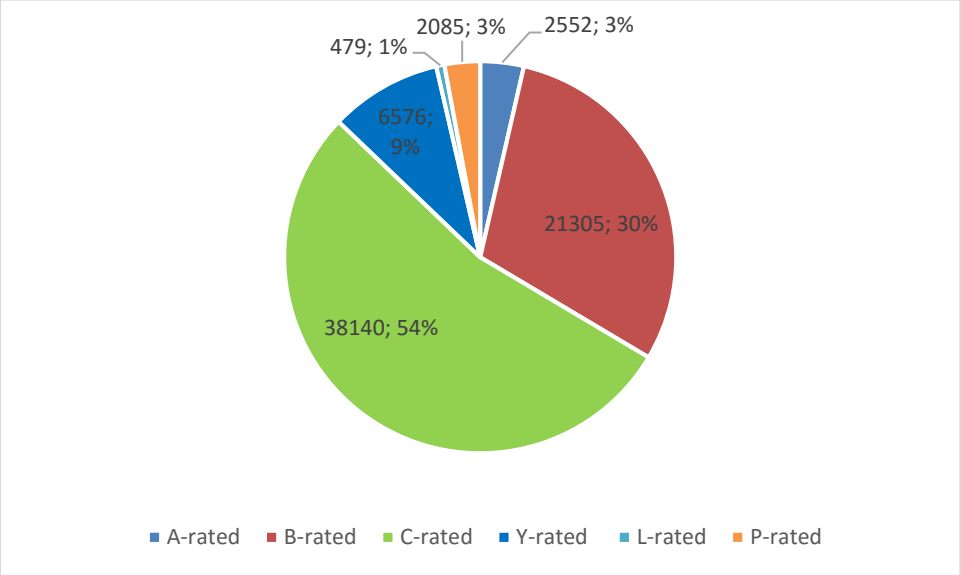
Year	Number of rated researchers	Output	Citations (%)	Average citations per output	Average citations per rated researcher	Citation median
2006	82	194	8985 (12.6)	46.2	109.6	17
2007	95	207	5449 (7.7)	26.3	57.4	10
2008	103	265	7123 (10)	26.9	69.2	17
2009	116	205	4256 (6)	20.8	36.7	9
2010	117	278	3670 (5.2)	13.2	31.4	8
2011	125	381	5323 (7.5)	14	42.6	9
2012	140	411	5201 (7.3)	12.7	37.2	8
2013	169	634	7078 (9.9)	11.2	41.9	12
2014	190	670	7747 (10.9)	11.6	40.8	7
2015	146	754	5540 (7.8)	7.4	38	5
2016	195	743	5365 (7.5)	7.2	27.5	2
2017	229	794	5400 (7.6)	6.8	23.6	1.5
Total	1707	5536	71137 (100)	12.9	41.7	7

Table 16 and Figure 13 serve to determine the academic impact by category. They show that quantitatively, C-rated researchers have more citations than any other category. However, when considering the averages, the P-rated researchers received far more citations than the former, followed by the B-rated and then A-rated. The average citations per rated researchers in Scopus were as follows: 94.5 for A-rated researchers, 113.3 for B-rated researchers, 33.1 for C-rated, 17.1 for L-rated researchers, 139 for P-rated researchers and 22.3 for Y-rated researchers.

Table 16: Citations trends of research in Scopus per rating category

Year	A (%)	B (%)	C (%)	L (%)	P (%)	Y (%)	Total (%)
2006	477 (5.3)	5659 (63)	2293 (25.5)	0 (0)	97 (1.1)	459 (5.1)	8985 (100)
2007	82 (1.5)	1737 (31.9)	3081 (56.5)	69 (1.3)	63 (1.2)	417 (7.7)	5449 (100)
2008	317 (4.5)	3616 (50.8)	2323 (32.6)	97 (1.4)	104 (1.5)	666 (9.3)	7123 (100)
2009	60 (1.4)	1963 (46.1)	1443 (33.9)	107 (2.5)	64 (1.5)	619 (14.5)	4256 (100)
2010	135 (3.7)	500 (13.6)	2230 (60.8)	166 (4.5)	27 (0.7)	612 (16.7)	3670 (100)
2011	287 (5.4)	414 (7.8)	3909 (73.4)	0 (0)	0 (0)	713 (13.4)	5323 (100)
2012	237 (4.6)	520 (10)	4063 (78.1)	0 (0)	0 (0)	381 (7.3)	5201 (100)
2013	114 (1.6)	1423 (20.1)	3996 (56.5)	29 (0.4)	880 (12.4)	636 (9)	7078 (100)
2014	310 (4)	449 (5.8)	5938 (76.7)	11 (0.1)	256 (3.3)	783 (10.1)	7747 (100)
2015	243 (4.4)	386 (7)	4227 (76.3)	0 (0)	156 (2.8)	528 (9.5)	5540 (100)
2016	143 (2.7)	2273 (42.4)	2383 (44.4)	0 (0)	215 (4)	351 (6.5)	5365 (100)
2017	147 (2.7)	2365 (43.8)	2254 (41.7)	0 (0)	223 (4.1)	411 (7.6)	5400 (100)
Total Citations	2552 (3.6)	21305 (30)	38140 (53.6)	479 (0.7)	2085 (2.9)	6576 (9.2)	71137 (100)
No. of rated researchers	27	188	1154	28	15	295	1707

Figure 13: Citations of rated researchers in Scopus by category, 2006-2017 (N=5536)



4.3.3 Academic impact in WoS

The last bibliographic database used to determine the research impact of rated researchers was WoS. Table 17 depicts that the 5003 outputs indexed in WoS accumulated 60174 citations meaning that each output accumulated just more than 12 citations on average. The citation averages in the first three years (2006-2008) are higher than those of the later years. The last four years (2014-2017) have the lowest average citations per output than all other years before them. On average, each NWU's rated researcher in the years (2006-2017) covered by this study accumulated 35.3 citations in WoS. Uncited output stood as follows: 65 (45.8% of 142) in 2006, 70 (45.2% of 155) in 2007, 58 (23.2% of 250) in 2008, 106 (55.2% of 192) in 2009, 99 (37.9% of 261) in 2010, 92 (29.4% of 313) in 2011, 114 (26.6% of 428) in 2012, 147 (44.6% of 330) in 2013, 211 (35.2% of 600) in 2014, 246 (35.8% of 688) in 2015, 283 (37.4% of 756) in 2016, and 321 (36.2% of 888) in 2017. Overall, 1812 (36.2% of 5003) of all documents in WoS did not receive a citation. Surprisingly, 2006 to 2010 had the highest proportion of uncited documents compared to the later years (2014 – 2017).

These trends predict an even lower percentage of uncited output in the upcoming years for output published in 2014 to 2017 as more of them get the necessary visibility to be cited by other researchers. The most cited documents in WoS during this period in respective years accumulated the following citations: 2694, 1315, 1413, 930, 341, 321, 604, 770, 760,

891, 1290, and 988. A B-rated researcher had more citations in WoS than all NWU's rated researchers from 2006 to 2009, and 2016 and 2017 so far. It is evident that a C-rated researcher had more citations in WoS than any other researcher from 2010 to 2012, and 2014 to 2015. There is evidence also that a P-rated researcher had more citations in 2013. It must be noted that the two C-rated researchers who had more citations in these years are now B-rated. No A-rated researcher had the highest number of citations than all rated researchers in a year during this period. To further determine if any of the A-rated researchers was involved in highly cited papers, the researcher interrogated the highly cited papers in WoS from 2006 to 2017 and NWU A-rated researchers are not involved in any of these papers. Instead, there were 12 times that an NWU B-rated researcher is involved in such a paper, 30 times that an NWU C-rated researcher is involved, two that a P-rated researcher is involved and two that a Y-rated NWU researcher is involved.

Table 17: Citation trends of rated researchers in WoS

Year	Number of rated researchers	Output	Citations (%)	Average citations per output	Average citations per rated researcher	Citation median
2006	82	142	6305 (10.5)	44.4	76.9	19
2007	95	155	4398 (7.3)	28.4	46.3	15
2008	103	250	5450 (9.1)	21.8	52.9	17
2009	116	192	3115 (5.2)	16.2	26.9	9
2010	117	261	4289 (7.1)	16.4	36.7	9
2011	125	313	4565 (7.6)	14.6	36.5	9
2012	140	428	4851 (8.1)	11.3	34.7	7
2013	169	330	6315 (10.5)	19.1	37.4	7
2014	190	600	4439 (7.4)	7.4	23.4	5
2015	146	688	4601 (7.6)	6.7	31.5	4.5
2016	195	756	5885 (9.8)	7.8	30.2	4
2017	229	888	5961 (9.9)	6.7	26	3
Total	1707	5003	60174 (100)	12	35.3	8

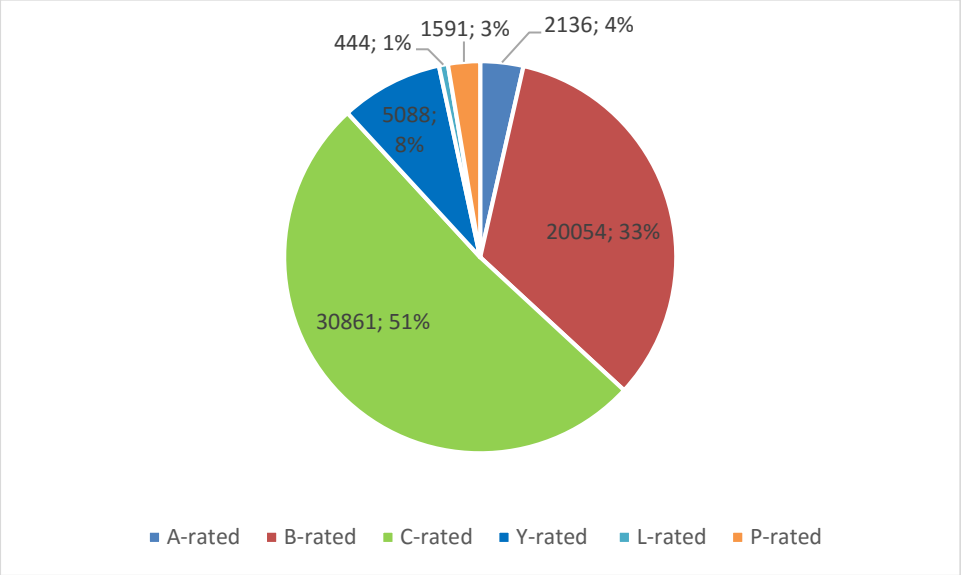
Table 18 and Figure 14 show that C and B-rated researchers were responsible for 84% of academic impact. However, given that the percentage of C-rated researchers during this period was close to 68%, they relatively underperformed in terms of academic impact. They only generated 51% of citations of all NWU's rated researchers' citations. On average, each rated researcher was cited about 35.3 times in WoS. The category with the most citations per researcher on average were B-rated researchers with 106.7 citations, followed by P-rated researchers with 106.1 citations, A-rated occupies a distant third with

79.1 citations on average per researcher. In close tow were C-rated with 26.7 citations per researcher on average, then Y-rated researchers with 17.3 citations per researcher on average, and lastly L-rated with 15.6 citations per researcher on average.

Table 18: Citation trends of rated researchers in WoS per rating category

Year	A (%)	B (%)	C (%)	L (%)	P (%)	Y (%)	Total (%)
2006	370 (5.9)	3829 (60.7)	1730 (27.4)	35 (0.6)	76 (1.2)	265 (4.2)	6305 (100)
2007	60 (1.4)	2657 (60.4)	1021 (23.2)	63 (1.4)	41 (0.9)	556 (12.6)	4398 (100)
2008	125 (2.3)	2715 (49.8)	1778 (32.6)	110 (2)	78 (1.4)	644 (11.8)	5450 (100)
2009	69 (2.2)	1086 (34.9)	1404 (45.1)	46 (1.5)	32 (1)	478 (15.4)	3115 (100)
2010	102 (2.4)	511 (11.9)	3097 (72.2)	161 (3.8)	11 (0.3)	407 (9.5)	4289 (100)
2011	224 (4.9)	431 (9.4)	3840 (84.1)	0 (0)	0 (0)	70 (1.5)	4565 (100)
2012	182 (3.8)	465 (9.6)	3800 (78.3)	15 (0.3)	9 (0.2)	380 (7.8)	4851 (100)
2013	373 (5.9)	780 (12.4)	3902 (61.8)	5 (0.1)	770 (12.2)	485 (7.7)	6315 (100)
2014	263 (5.9)	430 (9.7)	2775 (62.5)	9 (0.2)	215 (4.8)	747 (16.8)	4439 (100)
2015	184 (4)	377 (8.2)	3467 (75.4)	0 (0)	79 (1.7)	494 (10.7)	4601 (100)
2016	98 (1.7)	3506 (59.6)	1838 (31.2)	0 (0)	148 (2.5)	295 (5)	5885 (100)
2017	86 (1.4)	3267 (54.8)	2209 (37.1)	0 (0)	132 (2.2)	267 (4.5)	5961 (100)
Total Citations	2136 (3.6)	20054 (33.3)	30861 (51.3)	444 (0.7)	1591 (2.6)	5088 (8.5)	60174 (100)
No. of rated researchers	27	188	1154	28	15	295	1707

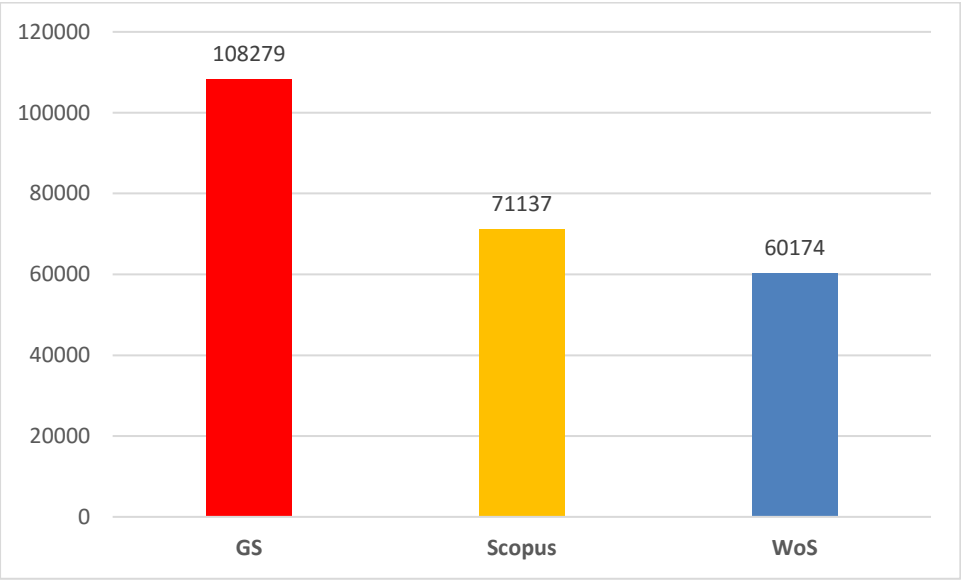
Figure 14: Citations of rated researchers in WoS by category, 2006-2017 (N=60174)



4.4 Comparison of academic impact in GS, Scopus and WoS

The third objective of this study was to compare academic impact of rated researchers across the three bibliographic databases (GS, Scopus and WoS). Figure 15 compares the academic impact in the three databases.

Figure 15: NWU's rated researchers' academic impact in GS, Scopus and WoS



The data shows that there were 108 279 citations of rated researchers in GS during this period followed by 71 137 for Scopus, and 60 174 for WoS. The top cited documents in

years in all databases are exactly the same, although they have different citation numbers. The most cited researchers are the same persons across all three databases in 9 of the 12 years. Only in one year (2016) are the most cited authors different in each database. In the other two years, there is the same most cited rated researcher in both GS and Scopus in 2010, though it is different in WoS. In 2013, Scopus and WoS share one most cited rated researcher although a different researcher has more citations in GS. The B-rated researchers show considerably higher impact across the three databases though they were outperformed by P-rated researchers in Scopus. A-rated researchers came third in all bibliographic databases when considering average citations per rating behind both B and P-rated researchers. C-rated researchers are responsible for more than 50% of citations across the three databases, although their average citations rates are lower than B-rated, P-rated and A-rated researchers. Y-rated researchers underperformed in all three bibliographic databases although their performance was better than L-rated researchers.

4.5 Core journals in which NWU's rated researchers publish

To further understand the research impact of rated researchers, the study strove to establish the core journals (or top one-third) from which rated researchers' work is cited. There were 473 journal titles that were common among the three databases (GS, Scopus and WoS). Meaning that 34.7% (473 out of 1363) of all journal titles in GS were also in Scopus and WoS, 47.5% (473 out of 996) of all journal titles in Scopus also appear in GS and WoS, and 55.6% (473 out of 851) of all journal titles in WoS were also in GS and Scopus. GS and Scopus shared 902 journal titles which equals to 66.2% of 1363 journal titles in GS and 90.6% of 996 journal titles in Scopus. GS and WoS shared 845 journal titles which equals to 62% of 1363 journal titles citing NWU's rated researchers in GS and 99.3% of 851 journal titles in WoS. Scopus and WoS shared 621 titles between them. This is close to 62.4% of 996 journal titles citing NWU's rated researchers in Scopus and 73% of 851 journal titles in WoS. The full list of common journal titles across the three databases is shared as Appendix D of this thesis.

This section is also divided into three subsections in line with the bibliographic databases used in this study.

4.5.1 Core journals as reflected in GS

Table 19 shows that there were 1363 journal titles that were cited for 106 394 times in GS from 2006 to 2017 suggesting that the overwhelming majority of citations in GS emanated from journal articles. The journals were then listed in descending order and subsequently divided into three almost equal zones by number of citations such that each zone consisted of more or less one-third of the citations. This study submits that 1.3% (17 of 1363) of journals produced 33% of citations in GS. These were deemed the core journals that produced most citations in GS. The second zone consists of 112 (8.2% of 1363) journal titles that produced 35435 citations (33.3% of 106394). The third zone consists of 1234 (90.5% of 1363) journal titles that had 35907 citations (33.8% of 106394) in their articles.

Table 19: Scattering of journals in GS by number of citations

Zone	**Number of journal titles (% out of 1363)**	**Number of citations (% out of 106 394)**
1	17 (1.3)	35052 (33)
2	112 (8.2)	35435 (33.3)
3	1234 (90.5)	35907 (33.7)

Table 20 depicts the journals where rated researchers published output that received most citations. The list of journals with most citations is dominated by journals that are deemed international journals. Only one journal out of 17 on this list is a South African one. This means that rated researchers mostly received citations from journals published elsewhere other than South Africa. Although a study of predatory journals is outside the scope of this study, it was interesting to notice that articles published in the notorious *Mediterranean Journal of Social Sciences* (MJSS) received 100 citations. This placed the *MJSS* in the first quarter of most cited journals where rated researchers published. The number of all predatory journals on the list was not interrogated as this is outside the scope of this study.

Table 20: The list of most citing journals in GS in descending order

Journal Title	Number of citations	% of citations out of 106394	Cumulative % of citations
Astronomy and Astrophysics	7041	6.6	6.6
Astrophysical Journal	3748	3.5	10.1
American Economic Review	2932	2.8	12.9
Nature	2906	2.7	15.6
Physical Review Letters	2090	2	17.6
International journal of electrochemical science	2024	1.9	19.5
SA Journal of Industrial Psychology	2013	1.9	21.4
Journal of Molecular Liquids	2001	1.9	23.3
Lancet	1380	1.3	24.6
European Heart Journal	1303	1.2	25.8
Journal of Hypertension	1234	1.2	27
Fuel	1134	1.1	28
Atmospheric Chemistry and Physics	1091	1	29
Science	1091	1	30.1
PLoS ONE	1087	1	31.1
Bioorganic and Medicinal Chemistry	1027	1	32.1
International Journal of Epidemiology	950	0.9	33

4.5.2 Core journals as reflected in Scopus

Table 21 shows that 996 journals were cited at least once in Scopus. These journals accumulated 68576 citations in Scopus during the period under study. Eleven journals (1.1% of 996) produced 22975 (33.5% of 68576) citations in Scopus. In line with the study's objectives, these were deemed core journals citing rated researchers. The second zone consists of 84 journal titles (8.4% of 996) which account for 33.4% of all citations on cited journals. The third one consists of 901 (90.5% of 996) titles which accumulated 22698 citations (or 33.1% of 68576 citations).

Table 21: The scattering of journals by citations in Scopus

Zone	Number of journal titles (% out of 996)	Number of citations (% out of 68576)
1	11 (1.1)	22975 (33.5)
2	84 (8.4)	22903 (33.4)
3	901 (90.5%)	22698 (33.1)

Table 22 lists the most cited journal titles in Scopus in descending order. There are no South African journals on the list, further confirming that rated researchers prefer publishing their quality works in international journals. However, this could also be a reflection of the fact that the commercial databases index very few South African journals. Almost all top cited journals in Scopus appear on the top cited journals in GS except the *American Economic Review* and the *South African Journal of Industrial Psychology*. These two journals are indexed from 2010 and 2011 respectively in Scopus, suggesting that they were added in Scopus only in the later years of the study. The notorious *MJSS* also made an appearance on the list of journals where rated researchers published in Scopus. It was number 324 on the list with 33 citations, allowing an inference that it was in the second quarter of preferred journals.

Table 22: The list of most cited journals in Scopus in descending order

Journal Title	Number of citations	% of citations out of 68576	Cumulative % of citations
Astronomy and Astrophysics	6855	10	10
Astrophysical Journal	3115	4.5	14.5
Nature	2912	4.3	18.8
Physical Review Letters	2004	2.9	21.7
Fuel	1387	2	23.7
Lancet	1350	2	25.7
Science	1300	1.9	27.6
International Journal of Electrochemical Science	1296	1.9	29.5
Bioorganic and Medicinal Chemistry	983	1.4	30.9
Atmospheric Chemistry and Physics	936	1.4	32.3
Journal of Molecular Liquids	837	1.2	33.5

4.5.3 Core journals as reflected in WoS

Table 23 below reflects that there were 851 journals where rated researchers published that received at least a single citation. The journals accounted for 59 990 citations of which 33% (19 807) came from just 8 journal titles. Close to 33.5% of citations came from 62 journal titles (7.3% of 851 journal titles) while 91.8% (781 of 851) of journals accounted for another 33.5%. The 8 journals in zone one of Table 23 were then considered as the most cited WoS indexed journals in this study.

Table 23: Scattering of journals by number of citations in WoS

Zone	Number of journal titles (% out of 851)	Number of citations (% out of 59 990)
1	8 (0.9)	19807 (33)
2	62 (7.3)	20091 (33.5)
3	781 (91.8)	20092 (33.5)

Table 24 is a list of the 8 journal titles considered the core journals by number of citations. Six journal titles on this list also appear among the top cited journals in both GS and Scopus, suggesting some kind of relationship between citations of the three databases. The indifference towards journal titles published in South Africa/Africa is also evident on the WoS list of top cited journals as no South African/African journal appears on this list.

Table 24: The list of most cited journals in WoS in descending order

Journal Title	Number of citations	% of citations of 59990	Cumulative % of citations
Lancet	4989	8.3	8.3
Astrophysics	3978	6.6	15
Astronomy and Astrophysics	3559	5.9	20.9
Physical Review Letters	2834	4.7	25.6
Astrophysical Journal	1495	2.5	28.1
Science	1033	1.7	29.8
Astrophysical Journal Letters	993	1.7	31.5
International Journal of Electrochemical Science	926	1.5	33

4.6 Visibility of NWU's rated researchers in academic social media platforms

To establish the visibility of rated researchers on academic social media sites, two academic social media platforms (RG and Mendeley) were used. Firstly, this section sought to determine the proportion of rated researchers with research profiles on both sites followed by their social impact.

4.6.1 NWU's rated researchers with RG profiles

Table 25 and Figure 16 show that most rated researchers have embraced RG and have profiles on it. The proportion of researchers with profiles versus those without profiles generally increased in the last three years, compared to the earlier years from 2006 to 2012 during which there was a close balance between researchers with and those without RG profiles. Of concern to the researcher were the high numbers of researchers with profiles that were partially or not populated at all. There were 63 profiles spread over the course of the 12 years that were sparsely populated, if at all. Additionally, 41 profiles were partially populated with output ranging from one to five indicators. All in all 64% of NWU's rated researchers have some recognisable visibility in RG although 104 of those researchers had profiles that were not populated or partially populated. Table 26 is a reflection of NWU's researchers in RG by rating category. All A-rated and P-rated researchers had RG profiles, 62.2% of B-rated researchers had RG profiles, 65.8% of C-rated researchers had RG profiles, 53.6% of L-rated researchers had RG profiles and 53.6% of Y-rated researchers had RG profiles. However as pointed out, not all profiles were populated. Forty-nine C-rated researchers' profiles were not populated at all over the 12 year period, and 30 were partially populated meaning that they had less than 5 records. The other group with the highest number of unpopulated profiles were Y-rated researchers with 9, followed by L-rated researchers with 4, and B-rated researchers with one. Y-rated researchers and L-rated researchers were also guilty of a high number of partially populated profiles with 9 and 2 respectively.

Table 25: NWU's rated researchers in RG

Year	With RG Profile/s	Without RG Profile/s	% with RG Profile	% without RG Profile	Total (%)
2006	35	47	42.7	57.3	82 (100)
2007	51	44	53.7	46.3	95 (100)
2008	56	47	54.4	45.6	103 (100)
2009	67	49	57.8	42.2	116 (100)
2010	70	47	59.8	40.2	117 (100)
2011	80	45	64	36	125 (100)
2012	72	68	51.4	48.6	140 (100)
2013	113	56	66.9	33.1	169 (100)
2014	124	66	65.3	34.7	190 (100)
2015	121	25	82.9	17.1	146 (100)
2016	141	54	72.3	27.7	195 (100)
2017	161	68	70.3	29.7	229 (100)
2006 – 2017	1091	616	63.9	36.1	1707 (100)

Figure 16: Visibility of NWU's rated researchers in RG, 2006-2017 (N=1707)

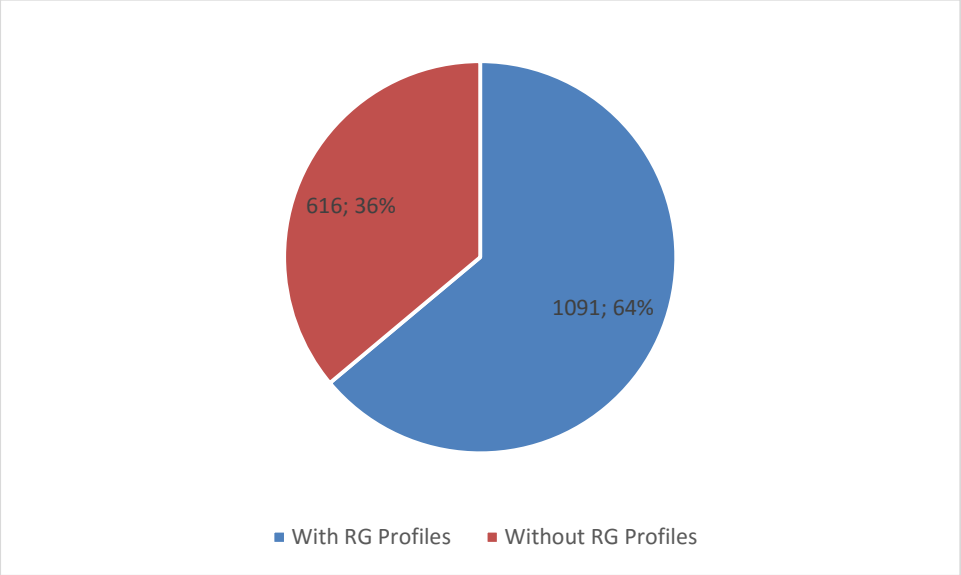


Table 26: NWU's researchers in RG by rating category

Year	A-rated	B-rated	C-rated	L-rated	P-rated	Y-rated	Total
2006	2	3	25	0	0	5	35
2007	2	4	34	3	1	7	51
2008	2	4	37	4	1	8	56
2009	2	5	44	3	1	12	67
2010	2	7	47	3	1	10	70
2011	2	8	59	1	1	9	80
2012	2	11	54	0	0	5	72
2013	3	10	80	1	2	17	113
2014	3	10	89	0	2	20	124
2015	3	14	80	0	2	22	121
2016	2	17	100	0	2	20	141
2017	2	24	110	0	2	23	161
Total	27	117	759	15	15	158	1091
Total No. of rated researchers	27	188	1154	28	15	295	1707

4.6.2 NWU's rated researchers with Mendeley profiles

Tables 27, 28 and Figure 17 depicts that rated researchers have embraced Mendeley with close to 85% of them having Mendeley profiles. The percentage of rated researchers with

Mendeley profiles from 2014 to 2017 indicates that researchers realise the importance of visibility in academic social sites. However, 19 researchers chose to restrict access to their Mendeley profiles to only those researchers that follow them. All A-rated and P-rated researchers had Mendeley profiles compared to 163 (or 86.7% of 188) B-rated researchers, 996 (or 86.3% of 1154) C-rated researchers, 24 (85.7% of 28) L-rated researchers, and 218 (or 73.9% of 295) Y-rated researchers.

Table 27: NWU's rated researchers in Mendeley

Year	With Mendeley Profile/s	Without Mendeley Profile/s	% with Mendeley Profile/s	% without Mendeley Profile/s	Total (%)
2006	56	26	68.3	31.7	82 (100)
2007	76	19	80	20	95 (100)
2008	87	16	84.5	15.5	103 (100)
2009	96	20	82.8	17.2	116 (100)
2010	97	20	82.9	17.1	117 (100)
2011	105	20	84	16	125 (100)
2012	119	21	85	15	140 (100)
2013	135	34	79.9	20.1	169 (100)
2014	170	20	89.5	10.5	190 (100)
2015	130	16	89	11	146 (100)
2016	173	22	88.7	11.3	195 (100)
2017	203	26	88.7	11.3	229 (100)
2006-2017	1443	264	84.5	15.5	1707 (100)

Figure 17: Visibility of NWU's rated researchers in Mendeley, 2006-2017 (N=1707)

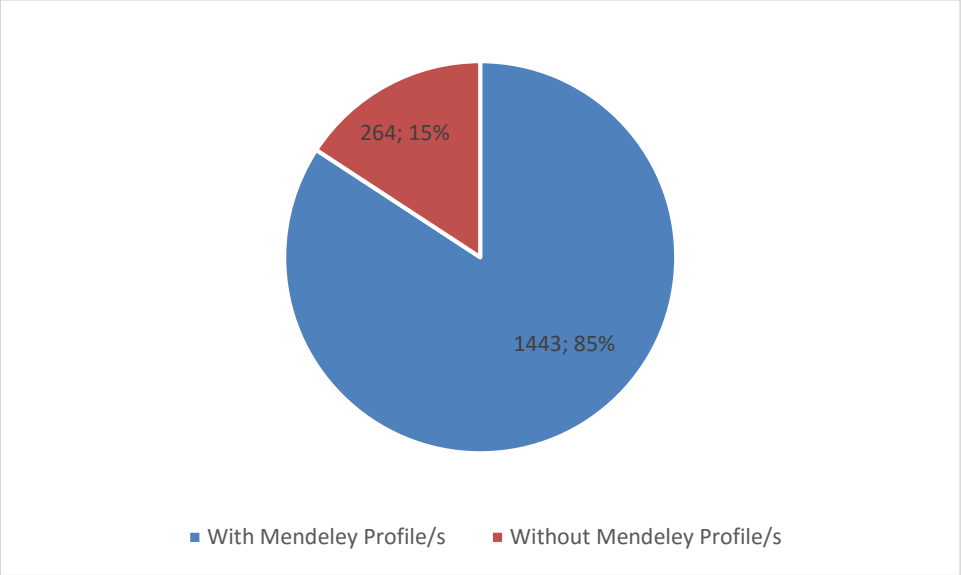


Table 28: NWU's researchers in Mendeley by rating category

Year	A-rated	B-rated	C-rated	L-rated	P-rated	Y-rated	Total
2006	2	5	40	2	1	6	56
2007	2	6	56	4	1	7	76
2008	2	9	58	3	1	14	87
2009	2	8	62	3	1	20	96
2010	2	12	59	4	1	19	97
2011	2	12	74	3	0	14	105
2012	2	15	91	2	1	8	119
2013	3	14	94	2	1	21	135
2014	3	15	121	1	2	28	170
2015	3	14	91	0	2	20	130
2016	2	24	116	0	2	27	171
2017	2	29	134	0	2	34	201
Total	27	163	996	24	15	218	1443
Total No. of researchers	27	188	1154	28	15	295	1707

The research extended the analysis to ratify the social impact of rated researchers on both RG and Mendeley in preparation for comparing the social impact with research impact in the last section of this study.

4.6.3 Social impact of NWU's rated researchers in social media platforms

In this study the RG reads and Mendeley readership data of rated researchers' output were used as a proxy to determine their (rated researchers) societal impact. This section presents the results.

4.6.3.1 Social impact of NWU's rated researchers in RG

Data in RG shows that the most read document in 2006 had 2 343 reads followed by 1861 in 2007, 3585 in 2008, 5047 in 2009, 1360 in 2010, 5730 in 2011, 3119 in 2012, 2043 in 2013, 3283 in 2014, 3775 in 2015, 5287 in 2016, and 3538 in 2017. Table 29 and Figure 18 depicts the number of NWU's rated researchers' output in RG as well as the reads. Rated researchers' output in RG increased from a low of 131 in 2006 to 967 in 2017. In line with the increase in RG output of rated researchers, the reads also increased although the increases were irregular. However, there is no significant difference in the average reads per output in RG between the earlier years and the later years of the study. The average number of reads per rated researcher show significant increases from 2013 to 2017. These average reads would be higher if only those researchers with RG profiles were to be considered. Table 30 shows RG reads by rating category. Output of A-rated researchers received 10 644 reads in RG, those of B-rated researchers received 83236 reads, those of C-rated researchers received 4 828 624, L-rated researchers received 3662 reads, P-rated researchers received 5975, and Y-rated researchers received 90 540. The averages per rating category of those researchers with RG profiles was as follows: 394.2 reads per A-rated researcher, the average for B-rated researchers was 711.4, for C-rated researchers it was 636.2, for L-rated researchers it was 244.1, for P-rated researchers it was 398.3 and for Y-rated researchers it was 573. Therefore, on average, B-rated researchers' output received the most reads, followed by C-rated, Y-rated, P-rated, A-rated, and L-rated researchers' output.

Table 29: NWU's rated researchers' RG reads

Year	Number of rated researchers	Number of output in RG	RG reads	Average reads per Output in RG	Average Reads per rated researcher
2006	82	131	18029	137.6	219.9
2007	95	139	13840	99.6	145.7
2008	103	263	25689	97.7	249.4
2009	116	218	36636	168.1	315.8
2010	117	316	22218	70.3	189.9
2011	125	411	48962	119.1	391.7
2012	140	436	34240	78.5	244.6
2013	169	678	75867	111.9	448.9
2014	190	818	97562	119.3	513.5
2015	146	836	108162	129.4	740.8
2016	195	813	96106	118.2	492.9
2017	229	967	99608	103	435
Total	1707	6026	676919	112.3	396.6

Figure 18: Representation of NWU's rated researchers' RG reads

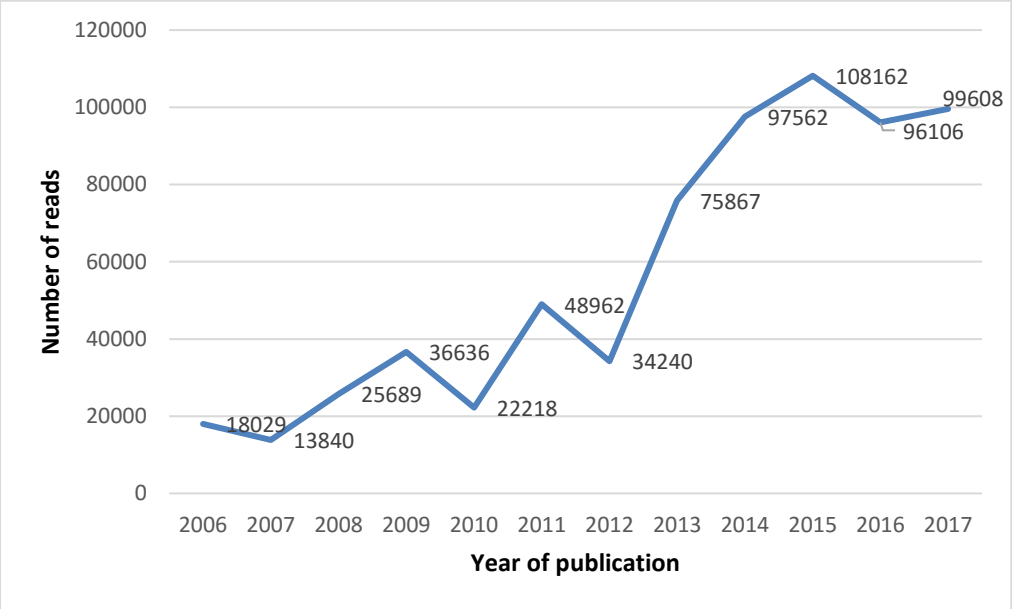


Table 30: NWU's rated researchers' RG reads by category

Year	A-rated	B-rated	C-rated	L-rated	P-rated	Y-rated	Total
2006	950	670	11844	0	0	4565	18029
2007	546	1024	8071	1800	43	2356	13840
2008	634	1253	21216	334	252	2000	25689
2009	207	1179	30200	628	53	4369	36636
2010	300	1371	13275	107	66	7099	22218
2011	1270	5987	39532	0	161	2012	48962
2012	498	1751	31022	0	0	969	34240
2013	1123	1579	62130	123	1213	9699	75867
2014	911	4670	74449	670	344	17188	98232
2015	1598	7061	83572	0	1603	14328	108162
2016	1278	27611	53450	0	1010	12757	96106
2017	1329	29080	54101	0	1230	13198	98938
Total	10 644	83 236	482 862	3662	5975	90 540	676 919
No. rated researchers	27	117	759	15	15	158	1091

4.6.3.2 Social impact of NWU's rated researchers in Mendeley

The document with the most readership in Mendeley in 2006 had 340 followed by 227 in 2007, 197 in 2008, 329 in 2009, 603 in 2010, 406 in 2011, 372 in 2012, 272 in 2013, 881 in 2014, 229 in 2015, 1707 in 2016, and 3538 in 2017. Table 31 and Figure 19 depicts that Mendeley readership data was on the upward trend from a low of 4012 in 2006 to a high of 30934 in 2017. Overall, the 5850 output were read for 142621 times in Mendeley for an average of 83.6 reads per output. The average reads per output in Mendeley were irregular over the years. Interestingly, the Mendeley readership data show a marked increase from 2013 to 2017. The average readership per rated researcher also shows significant increase from 2013 to 2017. The readership by rating category is reflected in Table 32. Output of A-rated researchers attracted 3018 readerships, that of B-rated researchers 23870, C-rated attracted 95159 Mendeley readerships, then L-rated researchers with 1120 readerships, P-rated researchers with 2068 readerships, and Y-rated researchers with 17386 readerships. The averages were 111.8 readerships per A-rated researcher, 146.4 per B-rated researcher, 95.5 per C-rated researcher, 46.7 per L-rated researcher, 137.9 per P-rated researcher, and 79.8 per Y-rated researcher. The B-rated researchers had the highest number of readerships

per researcher, followed by P-rated researchers, A-rated researchers, C-rated researchers, Y-rated researchers, and L-rated researchers.

Table 31: NWU's rated researchers' Mendeley readership

Year	Number of rated researchers	Number of output in Mendeley	Mendeley readership	Average Readership per Output in Mendeley	Average Readership per rated researcher
2006	82	159	4012	25.2	48.9
2007	95	185	3163	17.1	33.3
2008	103	239	5311	22.2	51.6
2009	116	202	5135	25.4	44.3
2010	117	292	6413	22	54.8
2011	125	409	9423	23	75.4
2012	140	423	9023	21.3	64.5
2013	169	664	14436	21.7	85.4
2014	190	722	18474	25.6	97.2
2015	146	799	15017	18.8	102.9
2016	195	825	21280	25.8	109.1
2017	229	931	30934	33.2	135.1
Total	1707	5850	142621	24.4	83.6

Figure 19: Representation of NWU's rated researchers' Mendeley readership, 2006-2017

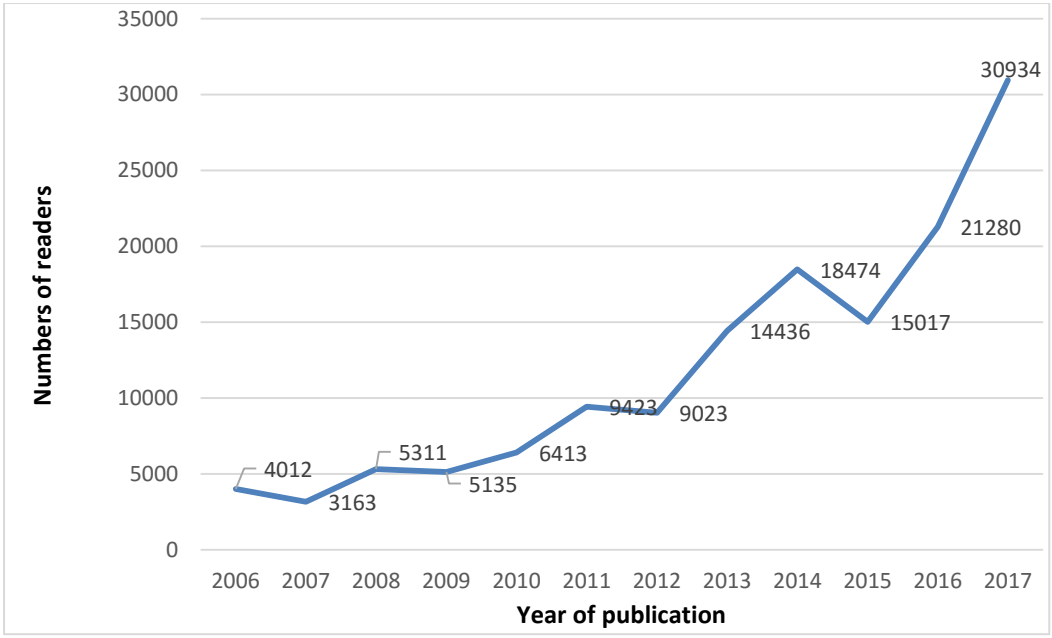


Table 32: NWU's rated researchers' Mendeley readership by category

Year	A-rated	B-rated	C-rated	L-rated	P-rated	Y-rated	Total
2006	17	502	2913	91	96	393	4012
2007	27	633	1949	62	21	471	3163
2008	98	681	3629	185	30	688	5311
2009	28	416	3492	146	26	1027	5135
2010	57	309	4376	283	8	1380	6413
2011	117	693	7004	12	0	1597	9423
2012	82	735	6830	0	487	889	9023
2013	287	1165	10 565	190	242	1987	14436
2014	242	1256	13 911	151	338	2576	18474
2015	257	1117	11 758	0	244	1641	15017
2016	186	6183	13 054	0	183	1674	21280
2017	1620	10 180	15 678	0	393	3063	30 934
Total	3018	23 870	95 159	1120	2068	17 386	142 621
No. rated researchers	27	163	996	24	15	218	1 443

The final objective of this study was to find the relationship between the academic impact and social impact of rated researchers.

4.7 Relationship between academic and societal impact of NWU's rated researchers' output

Overall, there were 3981 (48.1 % of 8276) documents shared between GS and RG, 2652 (or 47.9% of 5536) between Scopus and RG, and 2165 (or 43.3 of 5003) between RG and WoS. There were 3893 (or 47% of 8276) common documents between Mendeley and GS, 4030 (or 72.8% of 5536) between Mendeley and Scopus, and 3403 (68%) between Mendeley and WoS. When considering the percentage of common documents, the relationship between RG and GS appear better than that of the two commercial bibliographic databases. The same could be said about Mendeley and Scopus that share a higher proportion of common documents than the other two bibliographic databases.

In studying the relationship between the bibliographic databases and the academic social sites, all citations or reads of documents shared between the particular bibliographic database and the academic social media site were compared, irrespective of whether they are cited or read. To test correlations between social impact and academic impact, the IBM

SPSS program, in particular the Spearman's correlation analysis, was used following Rumsey's guidelines to interpret the data (Rumsey, 2011). Several researchers, including Thelwall and Wilson (2016) and Asemi and Heydari (2018) used this method to test correlations between altmetrics indicators and citation data. The interpretation of correlations in this study are 0.1 to 0.49 depict a positive weak correlation between citations and reads or readership and 0.5 to one (1) show a strong positive relationship between citations in GS or Scopus or WoS and reads/readership in RG or Mendeley. This interpretation is in line with similar studies, notably Asemi and Heydari (2018).

Table 33 below shows a poor positive relationship between RG and all three bibliographic databases. The relationship between RG and GS is better than that of the two other databases. However, data shows the relationship between RG and the bibliographic databases in earlier years from 2006 to 2012 stronger than the later years. The expectation of the researcher was that the relationship would be stronger in the later years given that RG is a fairly new academic social network founded in 2008 (ResearchGate, 2019), meaning that older documents only started to accumulate reads later than the new ones. Overall, the Spearman correlations between GS citations and RG reads was 0.365, between RG and Scopus it was 0.287 and between RG and WoS it was 0.295. As pointed out, this reflects a weak positive relationship between RG reads and the three bibliographic databases. However, the correlations were significant at the 0.01 level in all instances.

The generally poor relationship between RG and the three bibliographic databases was not surprising. A cursory look at the data shows that in some instances, there were much more citations than RG reads. An extreme but not isolated example is that of a document with 438 GS citations but zero RG reads in 2006. There were stronger Spearman's correlations between Mendeley readership data and the three bibliographic databases with Scopus showing a stronger positive relationship at 0.603 while that between Mendeley readership and GS citations was 0.592 followed by 0.505 for Mendeley readership and WoS. Interestingly, Mendeley readership show a strong relationship with citations in all years in GS and Scopus. Only in three years was the relationship between citations in WoS and Mendeley readership weaker, which are 2011, 2015 and 2017. The relationship between Mendeley readership and WoS was moderate to strong in 2013 owing to inexplicable patterns where some documents had a lot more citations than reads. An extreme example is that of a document that had 163 citations in WoS but only 47 readership in Mendeley. All in all a total of 47 documents out of 262 shared documents had more citations than

Mendeley readership in 2013. The correlations were significant at the 0.01 level in all instances between Mendeley readerships and GS, Scopus and WoS citations.

Table 33: Spearman's correlations (rho) between RG reads and Mendeley readership and GS, Scopus and WoS citations

Year	RG reads & GS citations*	RG reads & Scopus citations*	RG reads & WoS citations*	Mendeley readership & GS citations*	Mendeley readership & Scopus citations*	Mendeley readership & WoS citations*
2006	0.567	0.382	0.452	0.569	0.580	0.522
2007	0.579	0.549	0.646	0.661	0.684	0.508
2008	0.604	0.574	0.488	0.658	0.624	0.623
2009	0.513	0.388	0.434	0.670	0.678	0.650
2010	0.557	0.441	0.488	0.592	0.625	0.546
2011	0.485	0.350	0.390	0.640	0.667	0.495
2012	0.503	0.500	0.357	0.680	0.648	0.584
2013	0.354	0.239	0.209	0.629	0.602	0.499
2014	0.364	0.268	0.260	0.615	0.619	0.520
2015	0.283	0.304	0.325	0.512	0.598	0.450
2016	0.285	0.322	0.323	0.548	0.554	0.398
2017	0.416	0.253	0.273	0.551	0.620	0.481
2006-2017	0.365	0.287	0.295	0.592	0.603	0.505

***p is less than 0.05 at 0.01 significance level**

4.8 Summary

This chapter presented and analysed the data of the bibliographic study. In a nutshell, the data shows that more and a variety documents produced by NWU's rated researchers were in GS than the other two databases (WoS and Scopus). GS output also accumulated more citations from NWU's rated researchers compared to the two commercial bibliographic databases. NWU's B-rated researchers had better average citation rates than both P and A-rated researchers in two of the three databases (GS and WoS). P-rated researchers had better average citation rates in Scopus followed by B-rated researchers. The majority of citations were accumulated from leading international journals. NWU's rated researchers prefer Mendeley to RG as they have more profiles from the former compared to the latter. However, RG documents had much more reads than Mendeley readership. Mendeley readership relates strongly with citations from all three bibliographic databases while the same cannot be said about RG reads which correlates poorly with two of them (Scopus and WoS), and moderately with GS.

Chapter 5: Discussion of findings

5.1 Introduction

The preceding chapter analysed and presented the data in response to the objectives and questions of the study. This chapter provides an interpretative discussion of the main findings of the study in relation to the published literature in GS, Scopus, WoS, RG, and Mendeley to determine the impact of researchers. The main purpose of this study was to examine the research impact of the NWU's NRF-rated researchers from 2006 to 2017. Specifically, this study sought to establish the production of research output, and the academic and societal impact of those output. The discussions of this study are aligned to the study's specific objectives, which are set to:

- Establish the research output of rated researchers at NWU in GS, Scopus and WoS.
- Determine the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Compare the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Establish a list of core journals in which the rated researchers publish.
- Assess the visibility of the rated researchers' output at the NWU in academic social media sites (ResearchGate and Mendeley).
- Determine the relationship between academic impact and societal impact of the research output of rated researchers at NWU.

5.2 Research output of NWU's rated researchers in GS, Scopus and WoS

Publication output can be used as a measure of evaluating research performance of institutions and departments or units (Kahn, 2011; Kerchhoff, 2017), individual researchers (Onyancha and Ocholla, 2009) and countries (Medina, 2015; Sooryamoorthy, 2018). By studying trends, patterns and types of research output, researchers, institutions and countries can compare and benchmark themselves with their peers as well as identify their strengths and weaknesses. The research output of NWU's rated researchers in this chapter are discussed under three sub-headings, namely: number of output in GS, Scopus,

and WoS; types of output in GS, Scopus and WoS; and Research output according to the rating category.

5.2.1 Number of outputs in GS, Scopus and WoS

Tables 7, 9 and 11 in Chapter 4 reflect that NWU's rated researchers produced more output in GS (8276) compared to Scopus (5536) and WoS (5003). This is not surprising as several studies buttress these findings (Vieira and Gomes, 2009; Onyancha and Ocholla, 2009; Harzing and Alakangas, 2016; Kerchhoff, 2017; Martín-Martín *et al.*, 2018). Studies attribute this to the fact that GS indexes both academic (peer-reviewed) and non-academic (non-peer-reviewed) output (Onyancha and Ocholla, 2009; Kerchhoff, 2017; Martín-Martín *et al.*, 2018) while Scopus has a broader coverage of academic journals and a variety of documents compared to WoS (Vieira and Gomes, 2009). This, however, may differ by disciplines (Adriaanse and Rensleigh, 2013). Research production followed similar patterns in all three databases. Generally, research production increased in the later years when compared to the earlier in all three databases. The increased production is in line with trends in research production in South African public universities (Kahn, 2011; Pouris, 2012; Simpson and Gevers, 2016; Sooryamoorthy, 2018; DHET, 2018). The DHET (2018) attributed this increase to three possible reasons: the increase in the number of academic staff with doctorates, the ability of researchers to attract funding locally and internationally, and the research strategies of the universities. However, the increase could also be attributed to the expansion of the databases themselves (Harzing and Alakangas, 2016). Kerchhoff (2017) also noticed a gradual increase of output at the University of the Western Cape's PLAAS unit from 1995 to 2015. The research production was low in the first years from 1995 to 1999 and higher from 2013 onwards. Kerchhoff (2017) concluded that the number of researchers in the earlier years compared to later years at PLAAS might have had an influence on the increased production. Although the annual increase in NWU's rated researchers in all years from 2006 to 2017 was one of the factors that could be attributed to the increase in production in this study, the average production per rated researcher also increased from 2013 onwards. Therefore, the increased production could also be attributed to three other factors:

(1) The NWU research strategy encourages the increase of research output at the university as well as the recruitment and retainment of rated researchers (NWU, 2012);

(2) NWU was still involved in the finalisation of a very complex merger of two different institutions in the earlier years, therefore, the University had not secured the necessary stability to focus on research matters;

(3) During this period, the DHET subsidy was increased to cover a broad range of publications (Kahn, 2011).

GS also shows more variety in terms of types of output compared to both Scopus and WoS. Again, this could be attributed to the type of documents indexed by the three databases with GS also indexing information from non-peer-reviewed documents such as theses and dissertations, inaugural lectures, patents and other documents (Meho and Yang, 2007; Onyancha and Ocholla, 2009; Kerchhoff, 2017; Martín-Martín *et al.*, 2018). The fact that researchers are publishing output that have impacts beyond the academy should be seen as a positive sign by public policy makers and university managers alike. It reflects the willingness of researchers to produce research that impacts the lives of people and addresses the socio-economic challenges faced by the country.

In terms of common records between the three databases, there were 3117 (37.7% of all GS documents, 56.3% of all Scopus documents, and 62.3% of all WoS documents) records shared between the three databases. There were 361 records shared between WoS and Scopus only, 264 between WoS and GS only, and 257 between Scopus and GS only. Ultimately, there were 3999 documents shared either between all three databases or between two of those databases. WoS has a higher percentage of shared documents (62.3%) between all three databases followed by Scopus at 56.3% and then 37.7% for GS. Close to 74.8% of all documents in WoS are shared either with both GS and Scopus or with one of the two. Scopus shared close to 67.5% of all output with either both or one of the two databases (GS and WoS) while the percentage of shared documents in GS is close to 44%.

These results slightly differ from those of Martín-Martín *et al.* (2018) who found that GS was able to find 95% of all WoS documents and 92% of all Scopus documents. The findings of this study indicate that GS would be able to find 67.5% of NWU's rated researchers' output indexed in WoS, and 61% in Scopus. Kerchhoff (2017), on the other hand, found only 20% common records between GS and Scopus. However, Kerchhoff's (2017) study was conducted in a research entity that produces more or less the same number of grey literature and academic output. The fact that GS can be able to find more

than 67% of output in WoS and 61% in Scopus supports assertions made in previous studies for it to be considered for research evaluation especially in African universities that do not have the means to subscribe to the commercial databases (Onyancha and Ocholla, 2009).

5.2.2 Types of output in GS, Scopus and WoS

Figures 6 and 7, and Table 11 show that with regards the types of output, NWU's rated researchers published in a variety of documents in GS than any other database. They published in more than 21 types of documents in GS including 6 696 articles in journals, 885 books and book chapters, 463 conference proceedings, and 232 publications in grey literature such as: reports of various kinds, working papers, inaugural lectures, posters, patents, theses and dissertations, among others. This is expected as GS indexes more document types compared to Scopus and WoS (Meho and Yang, 2007; Onyancha and Ocholla, 2009; Kerchhoff, 2017; Martín-Martín *et al.*, 2018). The availability of grey literature on publications of rated researchers in GS suggests that NWU's rated researchers' products had broader impacts beyond the academy as already pointed out earlier (SFI, 2015; Bracken, 2015; Kousha and Thelwall, 2017).

Previous studies have shown that unlike the other two databases, GS may assist to showcase broader impacts of researchers and research. Kousha and Thelwall (2017), for example, are of the view that citations of patents in GS may reflect the commercial impact of academic research. The overwhelming majority of output were published as journal articles in all three databases (see: Figure 6, 9 and Table 11 in Chapter 4). In percentage terms, there were 81% of output that came from journals in GS, 89% in Scopus and more than 99% in WoS. Kerchhoff (2017) and Martín-Martín *et al.* (2018) also found similar to this study though the percentage of journals to other output were lower in the study of the former. Kerchhoff (2017) found the percentage of journals to other types of documents in the PLAAS study to be 60% (GS) and 52% (Scopus). There are three reasons why journals dominate the research output in this study. Firstly, experienced researchers have a preference for journals to other forms of publications. Secondly, publications in journals are widely accepted as the most appropriate and speedy form of disseminating novel research findings by most researchers (DHET, 2018). DHET (2018) points out that, globally, the bulk of research output are in the form of journal articles. Thirdly, the majority of research output subsidised by DHET are from journals (DHET, 2018). In fact the DHET

policy on research output excludes several types of books from output eligible for government subsidy such as textbooks, professional handbooks, reference books, dictionaries and encyclopaedias, and works of fiction (DHET, 2015a). Novels and other creative works are, however, now covered under the 2015 "Draft Policy on the Evaluation of Creative Output and Innovations Produced by Public Higher Education Institutions" (DHET, 2015b). Because this policy is relatively new, its impact was not clarified in this study though its availability is supported by the number of non-traditional academic output in GS. The dominance of output from journals in WoS and Scopus was expected as these two databases mostly index journals more than any other forms of publication.

5.2.3 Research output according to the rating category

The overwhelming majority of output emanated from C-rated researchers in all three databases. This is not surprising as C-rated researchers form 68% of NWU's rated researchers during this period. In a study on the progression and transformation of NRF-rated researchers at universities in South Africa, Breetzke and Hedding (2019) noticed that the whole NRF rating system is dominated by C-rated researchers. However, 1 164 C-rated researchers produced 5 439 (4.7 per researcher on average) documents in GS, 3780 in Scopus (3.5 per researcher on average), and 3279 in WoS (2.8 per researcher on average). This compares poorly to the averages of 188 B-rated researchers who produced 1 130 in GS (6 output on average per researcher), 763 in Scopus (4.1 output on average per researcher), and 823 in WoS (4.4 output on average per researcher). P-rated researchers performed better on average than all other rating categories of researchers in all three databases in terms of research production followed by A-rated researchers in WoS and Scopus, and B-rated researchers in GS. These findings concur with Cherry and Gibbons (2007), Marais (2007), Inglesi-Lotz and Pouris (2011), and Fedderke (2013) who found that NRF ratings correspond very well with the research productivity, though the difference between A and B-rated researchers is not always easy to discern. Fedderke (2013) also found a correlation between a high rating and attainment of a higher rating in subsequent ratings. The same was also noticed in this study as the two C-rated researchers who had more output and citations in 2012 to 2014 attained a B-rating in subsequent ratings, and Y-rated researchers who had a high production rate in previous years attained C, B and a P-rating. However, some B-rated researchers who constantly performed better than A-rated researchers in output and citations had not attained an A-rating by 2017.

Fedderke (2013) also noted that the probability of getting a B-rating is higher than that of getting an A-rating even when a researcher has better scholarly output and impact than some A-rated researchers in the same field. This is perhaps one of the reasons why the number of A-rated researchers at NWU and elsewhere has remained stagnant (Breetzke and Hedding, 2019). Though no conclusions can be reached based on the low number of A-rated researchers in this study, it is possible that career record rather than just the seven years indicated by the NRF play a huge role in A-ratings. In the main, it takes many years for a researcher to be internationally acclaimed. It is also possible that A-rated researchers do not publish as much as they did in the early years of their careers as they may focus on mentoring novice researchers, may be members of several journal editorial boards, and even editors of esteemed journals. Despite a few successes indicated above with young researchers who went on to attain C-ratings, generally, Y-rated researchers achieved lower averages which were 4.5 per Y-rated researcher in GS, 2.3 in Scopus, and 2.1 in WoS. These results support Kaniki, Schirge, Maepa, Netshifhefhe, Di Santolo & Tsebe's (2008) assertion that as the future top research cohort of the country, these researchers need a lot of support.

5.3 Research impact of NWU's rated researchers' output in GS, Scopus and WoS

Literature indicates that incidences of citations of an academic document or researcher can be used as a proxy to determine the quality and impact (Fairclough and Thelwall, 2015). The assumption of counting citations to determine impact is that the more attention a document or researcher receives in the form of citations, the better the academic influence, quality and impact.

5.3.1. Citation trends in GS, Scopus and WoS for NWU's rated researchers' output

The data in Table 13, 15 and 17 in Chapter 4 shows that there were 108 279 citations of NWU's rated researchers in GS, 71 137 in Scopus, and 60 174 in WoS. GS, therefore, had much more citations that Scopus and WoS. This is not unique to this study as various other authors noticed a similar trend in their studies (Onyancha and Ocholla, 2009; Kerchhoff, 2017; Martín-Martín *et al.*, 2018). The high number of citations in GS can be attributed to several factors. GS had more documents than the two other databases (Scopus and WoS). Secondly, GS also counts citations from non-peer-reviewed documents such as non-peer-reviewed conferences papers, reports, theses and dissertations, and other documents

(Onyancha and Ocholla, 2009; Kerchhoff, 2017; Martín-Martín *et al.*, 2018). Thirdly, Scopus and WoS only count citations from output indexed in those two databases (Onyancha and Ocholla, 2009). The average citation per research output stood at 13.1 per output in GS, 12.9 in Scopus, and 12 in WoS. The average for authors were 63.4 (GS), 41.7 (Scopus) and 35.3 (WoS). This is better than that of Iranian researchers who obtained 4.1 and 2.49 citations per output in Scopus and WoS respectively (Erfanmanesh and Didegah, 2013). However, the Iranian study covered all Iranian researchers including the novice researchers while this is focused on what can be regarded as elite researchers at the NWU. This study compares well with Kerchhoff (2017) who determined that output of the PLAAS unit at the UWC were cited just more than 21.5 on average in GS and 15.2 per output in Scopus. The differences in citation averages between the NWU's rated researchers' output and that of PLAAS researchers can be explained by recognising that the Kerchhoff study covered a 20-year period. The top cited documents in years in all databases are exactly the same although they have different citation numbers. The most cited researchers are the same persons across all three databases in 9 of the 12 years. Only in one year (2016) are the most cited authors different in each database. In the other two years, there is the same most cited rated researcher in both GS and Scopus in 2010, although it is different in WoS. In 2013, Scopus and WoS share one most cited rated researcher although a different researcher has more citations in GS. This predicts some form of relationship between the three databases at least as far as the top cited output and researchers are concerned. This means that a well cited document or researcher in GS and/or Scopus is likely to also be well cited in WoS and vice-versa.

In their study, Martín-Martín, Orduna-Malea, Harzing & López-Cózar (2017) confirmed that GS can predict highly cited documents in WoS and Scopus meaning that highly cited documents in GS are also likely to be highly cited in the two databases albeit with different citation numbers. Similar to output, the citations in all databases (GS, Scopus and WoS) followed three to four year patterns. They are higher in the first three years and lowest in the last two. This could be attributed to citation delay (Priem, 2014; Fairclough and Thelwall, 2015). Generally, citations take a number of years to accumulate. Overall, 2016 (24.4% of 8276) of all documents published by NWU's rated researchers did not receive a citation in GS, there were 1653 (29.9% of 5536) uncited output in Scopus and 1812 (36.2% of 5003) in WoS. As in the number of citations, the percentages of uncited documents between the three databases is a reflection of the breadth and depth of their coverage of

documents with GS indexing more documents than Scopus and WoS. Regarding the uncited documents, these results compare very well with Erfanmanesh and Didegah (2013) and Trapp (2016). In comparing the impact of Iranian researchers in Scopus and WoS, Erfanmanesh and Didegah (2013) also found that about 35% of total publications in Scopus were not cited compared to 47% in WoS. On the other hand, while studying the citation trends of the journal *Australasian Physical and Engineering Sciences in Medicine*, Trapp (2016) determined the proportion of uncited articles stood at 37% for WoS, 29 % for Scopus, and 19 % for GS. These results point to more difficulties for researchers to get citations in WoS indexed documents than the other two databases.

5.3.2 Impact in GS, Scopus and WoS according to rating category

Tables 8, 10 and 12 in Chapter 4 provide a summary of the impact of rated researchers by rating category. When average citations per author are considered, B-rated researchers outperformed all other categories in GS and WoS but came second to P-rated researchers in Scopus. Due to their low numbers, it is difficult to determine the extent of influence of A-rated and P-rated researchers, although their performance in this study suggests that they generally accumulated lesser citations than some B-rated researchers. Cherry and Gibbons' (2007) and Kerchhoff's (2017) findings were also somewhat similar to those of this study. In comparing the impact of seven rated zoology researchers, Cherry and Gibbons (2007) were able to determine that one B-rated researcher had more citations in WoS than an A-rated researcher although the former had slightly less output compared to the later. In Kerchhoff (2017), a P-rated researcher had more citations on average than a B and C-rated researcher. P-rated researchers, therefore, are able to give A and B-rated researchers a run for their money when it comes to citations or even outdo them. In this study, C-rated researchers are responsible for more than 50% of citations across the three databases, although their percentage of citations in all three databases is lower than their percentage number. In Cherry and Gibbons' (2007) C-rated researchers also had considerably lower citations than both the B and A-rated researchers. In tandem with the case of output, Y-rated researchers underperformed in all three bibliographic databases. Y-rated researchers are promising young researchers in their fields (Kaniki *et al.*, 2008) therefore it is to be expected that collectively they do not compare well with the internationally recognised B-rated and A-rated researchers. These results concur with Cherry and Gibbons (2007) and Fedderke and Goldschmidt (2015). Fedderke and Goldschmidt (2015) studied if the

amount of research funding led to high academic impact between the A-rated, B-rated, and C-rated researchers who hold research chairs and found that A-rated and B-rated research chairs had better impact than C-rated research chairs. Therefore, they found a strong correlation between highly-funded highly-rated NRF-rated researchers and academic impact (Fedderke and Goldschmidt, 2015)

5.4 Core Journals where NWU's rated researchers published

The results of this study suggest that the overwhelming majority of citations were from journals. This is similar to a study of the PLAAS researchers by Kerchhoff (2017) who found that the majority of citations from those researchers' output were from journals though the numbers were lower at 60% for WoS and 52% for Scopus. Although the subject of predatory publications did not form part of this study, it was interesting to note that the notorious *Mediterranean Journal of Social Sciences* was number 206 on the list of preferred journals where rated researchers published with 100 citations in GS. *MJSS* was number 324 on the list of most preferred journals in Scopus with 33 citations. The reason why rated researchers published quality articles worthy of citations in this journal is because it was on the list of accredited journals by DHET until November 2014, after which the Department decided to controversially de-accredit it retrospectively (Carnelley, 2015; Mouton and Valentine, 2017). The presence of this journal in a prominent position in the list of most preferred journals where rated researchers published is a reminder of the dangers of predatory publishing to research practices and the country at large (Mouton and Valentine, 2017). It points to a need for researchers to be fastidious of where they publish or from which journals to cite. Table 21, 22, and 23 reflects that 98.3% of citations in GS were from journal articles, 96.4% of citations in Scopus were from journals, and 99.7% of citations in WoS were from journals. The results were somewhat surprising. Given that GS had a wider variety of documents (see: Figure 5, 8 and Table 11) than Scopus, it was expected that more citations in Scopus would emanate from journals compared to GS. The results of this study are different from those of Martín-Martín *et al.* (2018) who found that close to half of citations of different fields in their study were from other types of documents in GS. However, the profile of researchers in Martín-Martín *et al.* (2018) was different from that of this study as the researchers in this study are the elite researchers in their institution who had already completed their theses and dissertations. Theses and

dissertations accumulated a lot of citations (22% in Business Economics & Management and 37% in Chemical & Material Sciences) in Martín-Martín *et al.* (2018).

These results also show that just more than or close to one-third of all citations in all three databases came from 1% of journal titles. These were deemed the most preferred journals where NWU's rated researchers published. This supports the principle of Bradford's Law of Scattering which states that a small group of journals account for a majority of important and influential research in a given field (Pouris, 2006). All those journals were not published in South Africa except the *South African Journal of Industrial Psychology* which appeared as one of the most preferred journals in GS. This confirms the findings of Marais (2007) who found that NRF-rated researchers have a preference for international journals to local ones. Marais (2007) attributed this to the fact that the NRF rating system is internationally benchmarked. Therefore, rated researchers may perceive increasing the international profile of their portfolio of journal articles as foremost in deciding where to publish. This can also be attributed to the fact that the South African *Journal of Industrial Psychology* is indexed by Scopus which makes it an international level journal. It was observed in this study that in cases where internationally recognised researchers (A and B-rated researchers) published in local journals they tended to publish in those local journals that are at international level and indexed by Scopus and WoS. The fact that only a handful of South African journals are indexed by these international databases (Mouton, Boshoff & Tijssen, 2006) can be another contributing factor as to why international journals dominate the list as rated researchers prefer to publish their quality research in these journals. The choice of South African international level journals is currently very limited for them.

There were 473 journal titles that were common among the three databases (GS, Scopus and WoS). This means that 34.7% (473 out of 1363) of all journal titles in GS were also in Scopus and WoS, 47.5% (473 out of 996) of all journal titles in Scopus also appear in GS and WoS, and 55.6% (473 out of 851) of all journal titles in WoS were also in GS and Scopus. GS and Scopus shared 902 journal titles which equals to 66.2% of 1363 journal titles in GS and 90.6% of 996 journal titles in Scopus. GS and WoS shared 845 journal titles which equals to 62% of 1363 journal titles citing NWU's rated researchers in GS and 99.3% of 851 journal titles in WoS. Scopus and WoS shared 621 titles between them. This is close to 62.4% of 996 journal titles citing NWU's rated researchers in Scopus and 73%

of 851 journal titles in WoS. These results further confirm Martin-Martin *et al.'s* (2018) findings that GS appears to capture most of the information in both WoS and Scopus with substantially more coverage than the two other bibliographic databases. These results also support the use of GS as an evaluation tool especially for local journals as GS indexes substantially more local journals than the two other bibliographic databases. These results, therefore not only support the suggestions to use GS as a supplementary research evaluation tool in Africa and other developing countries (Onyancha and Ocholla, 2009) but also as a collection development tool. GS has more representation of local journals than Scopus and WoS.

5.5 Societal impact of the research output of NWU's rated researchers

Altmetrics are social media indicators that are used to evaluate and measure research impact (Roemer and Borchardt, 2015). There were two social media platforms used in this study, RG and Mendeley. Specifically, the RG reads and Mendeley readership was used as a proxy to determine the social impact of researchers. Priem (2014) maintains that social media indicators like reads and readership can be used to determine social impact of research. The discussions are divided into visibility of NWU's rated researchers in RG and Mendeley, and reads of NWU's rated researchers in RG and Mendeley.

5.5.1 Visibility in RG and Mendeley

Chapter 4, Tables 25, 26, 27 and 28 as well as Figures 15 and 16 reflect the extent of penetration of RG and Mendeley by NWU's rated researchers. Sixty-four percent (1091 of 1707) of all NWU's rated researchers (2006-2017) had RG profiles while the percentage for Mendeley was 84.5% (1443 of 1707). Out of the 1091 profiles in RG, 9.5% (or 104 of 1091) of the researchers had profiles that were not populated or partially populated while the status of 19 profiles in Mendeley could not be determined as they were restricted to those who follow the researchers. Unpopulated profiles are not peculiar to this study (Nández and Borrego, 2013; Martín-Martín *et al.* (2016), Shrivastava and Mahajan, 2017). While analysing the RG profiles of the University of Delhi's (India) physics researchers, Shrivastava and Mahajan (2017) found that 28.32% of their profiles were not populated. A similar observation was made by Martín-Martín *et al.* (2016) who researched the bibliometrics and altmetrics of several academic social media platforms, including

Mendeley, and determined that Mendeley had a high number of profiles but 17% of them were basically empty with no output uploaded. Unpopulated profiles may affect the visibility and impact of researchers and research. Although those researchers are identifiable when one searches their names in RG or Mendeley, their research remains only partially available or obscure. Restricting one's profile limits the accessibility of research. However, the results of this study are better than Nández and Borrego (2013) who, while studying the use of social media for academic purposes among twelve Catalan universities, noticed that just a quarter of users upload at least one publication to their profile on Academia.edu meaning that the majority did not. The overall penetration levels of 64% compare well with those of Banshal, Singh, Kaderye, Muhuri & S´anchez (2018). They are way higher than those reported by Stachowiak (2014) and Onyancha (2015) but lower than those of Elsayed (2016) and Kerchhoff (2017). Banshal *et al.* (2018) found that 61% of articles from India in WoS are also in RG. In a study at the Nicolaus Copernicus University in Poland, Stachowiak (2014) reported that close to 14% of researchers at that university had RG profiles. Onyancha (2015) on the other hand found that NWU had 761 output in RG overall.

Eighty-two percent of researchers at six Arab Universities indicated that they had active RG profiles (Elsayed, 2016). Similarly, Kerchhoff (2017) found that 86% of PLAAS researchers who responded to a survey indicated that they had an RG profile. If Onyancha's results are to be taken into account, then the number of NWU's output in RG increased considerably since that study was conducted. In this study, the proportion of researchers with Mendeley and RG profiles generally increased in the last three years (2015-2017) compared to the seven earlier years (2006-2012). This can be attributed to the fact that both social media sites are relatively new having been launched in 2008 (Bhardwaj, 2017). Some of the new documents, therefore, were automatically linked to researchers' profiles immediately after publication. These patterns suggest that the penetration levels of RG among NWU's rated researchers would reach the same levels as those of Elsayed, 2016) and Kerchhoff (2017) in the next few years. Close to 85% (1443 of 1707) of NWU's rated researchers have Mendeley profiles although 19 of them have opted to hide their output from those who are not their followers. This means that rated researchers at NWU have embraced Mendeley more than RG with the former having 1473 profiles compared to RG's 1091 profiles. This could reflect the level of trust senior researchers place on established publishing companies like Elsevier that own Mendeley compared to RG which is not

associated with an established publishing house. It may reflect the discomfort of these researchers with the extent of openness shown by RG versus Mendeley. With regards numbers, these results rebut those of Batooli *et al.* (2016) and Bhardwaj (2017) who determined that RG was more popular than Mendeley at the Kashan University of Medical Sciences in Iran and the University of Delhi in India. It is possible that the calibre of the respondents in this study and those of Batooli *et al.* (2016) and Bhardwaj (2017) plays a role in these marked differences between the extents of usage of Mendeley versus RG. This study focussed on a group of elite researchers at the NWU.

5.5.2 Reads in RG and Mendeley

According to the figures in Tables 29 and 31 in Chapter 4, there were 676 919 reads of NWU's rated researchers' output in RG to 142 621 reads in Mendeley from 2006 to 2017. This means that there were almost 5 times the number of reads in RG than Mendeley. The average read per output in RG was 112.3 and 83.6 in Mendeley. The reason for the higher numbers of reads in RG compared to Mendeley readership can be explained by how the two academic social media platforms conduct their counts. Reads in RG are counted each time somebody (whether logged in or not) opens a summary or full-text, or downloads one of the publications in RG while Mendeley readership counts the number of times someone saves a document to their Mendeley library or profile (Martín-Martín *et al.*, 2016). This makes RG reads easier to accumulate scores, compared to Mendeley readership where a researcher must have shown an intent to further revisit and utilise the document. The size of the two platforms (RG and Mendeley) may also play a role with RG generally having much more members than Mendeley (Martín-Martín *et al.*, 2016). Thelwall and Kousha (2017) concur pointing out that due to its size, RG views of articles could reflect their wider readership better than Mendeley readership counts.

The B-rated researchers had the highest number of readerships per researcher, followed by P-rated researchers, A-rated researchers, C-rated researchers, Y-rated researchers, and L-rated researchers. These results agree with those of other studies. Batooli *et al.* (2016) found that between 1997 and 2014, 395 Scopus indexed articles by researchers from the Kashan University of Medical Sciences accumulated 20,799 reads in RG while 234 articles in Mendeley were read 901 times. The average read per output, therefore, stood at 52.7 in RG and 3.9 in Mendeley. Other researchers, Asemi and Heydari, (2018), determined that

164 Iranian researchers' output from 1989 to 2015 had accumulated 35516 readership in Mendeley and 64697 reads in RG.

Another interesting finding of this study is that the trends in terms of average number of reads per output by age were similar between the two platforms. Generally, older documents attracted less readership than the newer ones. Thelwall and Kousha (2017) also found that older articles in RG attract, on average, fewer reads than the newer articles. This suggests more social impact of new documents in both RG and Mendeley compared to the older ones. This can be attributed to the fact that both RG and Mendeley are relatively new platforms (Bhardwaj, 2017) therefore new documents have the advantage of being "born" into them sometimes even before they are published in pre-print format. The older documents, on the other hand, had to be uploaded years after they had been published. By then they may have lost the novelty and "excitement factor" of a new publication to readers. Thelwall and Kousha (2017) also attributes this to a natural preference for reading more current studies by researchers.

5.6 Relationship between academic impact and societal impact of the research output of NWU's rated researchers

Citations in GS, Scopus and WoS were then compared with reads in RG and Mendeley. There were more than 6 times the number of reads in RG than GS citations, almost 10 times the number of reads in RG than Scopus citations, and more than 11 times the number of reads in RG than WoS citations. The ratio of citations to readership was better in Mendeley; for each citation in GS, Scopus and WoS, there were just more than 1.3, 2 and close to 2.4 readerships in Mendeley. These ratios further confirm that reads in academic social media platforms (RG and Mendeley) do not always translate to citations in bibliographic databases and not every output that is read is cited (Fairclough and Thelwall, 2015). For each article or document written, researchers would have consulted or read more documents that what is reflected by citations. Even documents that end up being cited may have been read or viewed several times before they are eventually cited.

- Table 33 in Chapter 4 is dedicated to studying the Spearman correlations between citations from the three bibliographic databases (GS, Scopus and WoS), and RG and Mendeley. Generally, there are positive relationships between the citations on

all three databases and RG and Mendeley reads. The positive relationships support previous studies that claimed a positive relationship between citations on all three or one of the bibliographic databases and the two or one of the academic social media platforms (RG and Mendeley). Those studies include Costas, Zahedi & Wouters (2014), Ortega (2015) and Asemi and Heydari, (2018), who found weak to moderate positive relationships between RG and/or Mendeley and one or some of the bibliographic databases. Studies that found strong positive relationships include Onyancha (2015), Batooli *et al.* (2016) and Zahedi and Haustein (2018). In this study, the relationship between RG and the three bibliographic databases is positive but weak. However, the relationship between RG and the bibliographic databases is stronger in earlier years from 2006 to 2012 compared to later years. This might be a result of how citations and reads are accumulated. While reads accumulate almost immediately, citations experience a lag whereby they start to accumulate only after a few years (Priem, 2014; Fairclough and Thelwall, 2015). Perhaps, after both the citations and reads normalise, the relationship between the two becomes stronger. Thelwall (2017: 1723) somewhat concurs pointing out (in reference to Mendeley readership) that "using older data gives more statistically powerful insights into the underlying relationship between citation counts and reader counts." Overall, the relationship between GS citations and RG reads was 0.365, between RG and Scopus it was 0.287 and between RG and WoS it was 0.295. This means that there is a better but still weak positive relationship between RG reads and GS citations while that between RG and WoS/Scopus is worse. This finding is reinforced by Thelwall and Kousha's (2017) who also determined that RG correlated most strongly with GS citations. The stronger relationship between RG and GS may be a consequence of the two indexing peer-reviewed and more non-peer-reviewed output. Orduna-Malea, Martín-Martín, Thelwall & Delgado López-Cózar (2017) point out that like in GS, authors can index articles, presentations, reports, working papers, raw data and other documents in RG. There were strong positive relationships between Mendeley readership data and the three bibliographic databases with Scopus showing a stronger positive relationship at 0.603 while that between Mendeley readership and GS citations was 0.592 followed by 0.505 for WoS. These results, therefore, agree with Fairclough and Thelwall (2015) and Thelwall (2017). Fairclough and Thelwall (2015) postulated that it may be safe to assume that Mendeley readership counts can reasonable

predict academic impact as several studies have shown them to correlate well with citation counts in bibliographic databases. Thelwall (2017) further determined that the relationship between Mendeley readerships appear strongest with Scopus compared to the other databases. This may be as a result of the two databases (Scopus and Mendeley) being owned by Elsevier after the purchase of Mendeley by Scopus in 2013 (Bhardwaj, 2017). It is also important to note that the p-value was less than 0.05 at 0.01 significant levels in all instances. According to Rumsey (2011), generally, Spearman's correlations are significant when the p-value is less than 0.05. This study, therefore, finds that, there is significant relationships between citations in GS, Scopus and WoS, and the reads and readerships in RG and Mendeley although the strength of these relationships differ from database to database.

5.7 Summary

Chapter 5 discussed the results in Chapter 4 and outlined how they compare to the available literature. The main areas discussed include research output of NWU's rated researchers in GS, Scopus and WoS, and their impact followed by discussion of the visibility and impact of NWU's rated researchers in RG and Mendeley. Thereafter, the relationship between the three bibliographic databases and the two academic social media platforms was examined. The biggest realisation was that, generally, the findings of this study compare very well with recent and relevant literature. There are a few areas of the study that require further investigation and extrapolation such as whether relationships between the bibliographic databases and the academic social media indicators (RG and Mendeley) used in this study mature once the citation and readership rates normalise. No evidence of this could be found in the extensive literature consulted. The results of this study have implication for universities and scholarly communication, library policies and practice, researchers and funding bodies. The implications of these results will be discussed under implications in Chapter 6.

Chapter 6: Summary, Conclusion, Implications and Recommendations

6.1 Introduction

The previous chapter provided a detailed discussion of the main results and related them to published literature. This chapter provides the summary, conclusion, implications and recommendations of this study.

This study used bibliometrics and altmetrics to determine the impact of NWU's rated researchers from 2006 to 2017. Three main bibliographic databases (GS, Scopus and WoS) and academic social media platforms (RG and Mendeley) were used to determine both the academic and social impact of rated researchers. The study used citations on the main bibliographic databases to determine academic impact while reads and readerships in the academic social media platforms were used to determine social impact. In order to respond to the main purpose of this study, the following objectives were formulated, which are set to:

- Establish the research output of rated researchers at NWU in GS, Scopus and WoS.
- Determine the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Compare the research impact of the rated researchers' output at the NWU in GS, Scopus and WoS.
- Establish a list of core journals in which the rated researchers publish.
- Assess the visibility of the rated researchers' output at the NWU in academic social media sites (ResearchGate and Mendeley).
- Determine the relationship between academic impact and societal impact of the research output of rated researchers at NWU.

6.2 Summary of the findings

The summary of this study is divided according to the objectives reflected in Chapter 1. For purposes of this summary, objectives 2 and 3 of the study were combined into one.

Establish the research output of NRF-rated researchers at NWU in GS, Scopus and WoS

- It was found that 8276 documents were produced in GS, 5536 in Scopus and 5003 on WoS
- The trends in production increased gradually in all three databases (GS, Scopus and WoS)
- GS showed publications in a variety of sources with 81% from journals, 11% from conference papers, 5% from books and book chapters, and 3% from other sources.
- Eighty-nine percent of publications in Scopus emanated from journals, 8% from conference proceedings and 3% from books and book chapters.
- Ninety-nine percent of all outputs on WoS came from journals, while 0.5% came from conference papers.
- Sixty-six percent of all outputs in GS and WoS were published by C-rated researchers, the figure was 68% for Scopus.
- On average, B-rated researchers outperformed all categories in GS, while P-rated researchers performed better in Scopus and WoS.
- There were 3117 (37.7%) of all GS documents, 56.3% of all Scopus documents, and 62.3% of all WoS documents records shared between the three databases.

Determine and compare the research impact of the rated researchers at the NWU in GS, Scopus and WoS

- There were 108 279 citations of NWU's rated researchers in GS, 71 137 in Scopus, and 60174 on WoS
- Overall 2016 (24.4% of 8 276) of all documents published by NWU's rated researchers did not receive a citation in GS, there were 1653 (29.9% of 5 536) uncited output in Scopus and 1 812 (36.2% of 5003) on WoS.
- B-rated researchers achieved considerably higher average citations than all rated researchers in GS and WoS.

Establish a list of cited core journals in which the NWU's rated researchers publish

- More than 98% of citations in GS were from journal articles, 96.4% of citations in Scopus were from journals, and 99.7% of citations in WoS were from journals.

- Just more than one-third of all citations in all three databases came from 1% of journal titles.
- The list of the top one-third cited journals is dominated by international journals except for the *South African Journal of Industrial Psychology* which appeared as one of the most cited journals in GS.

Assess the visibility of the rated researchers at the NWU in academic social media sites (RG and Mendeley)

- Sixty-four percent (1091 of 1707) of all NWU's rated researchers (2006-2017) had RG profiles although 104 (9.5% of 1091) of those researchers had profiles that were not populated or partially populated.
- Close to 85% (1443 of 1707) of NWU's rated researchers have Mendeley profiles although 19 of them have opted to hide their output from those who are not their followers.
- There were 676 919 reads of NWU's rated researchers' output in RG to 142 621 readerships in Mendeley

Determine the relationship between academic impact and societal impact of the research output of rated researchers at NWU

- There were more than 6 times the number of reads in RG than GS citations, almost 10 times the number of reads in RG than Scopus citations, and more than 11 times the number of reads in RG than WoS citations.
- The ratio of citations to readership was better in Mendeley, for each citation in GS; Scopus and WoS, there were just more than 1.3, 2 and close to 2.4 reads in Mendeley.
- Overall, the relationship between GS citations and RG reads is 0.365, between RG and Scopus it was 0.287 and between RG and WoS it was 0.295.
- There were strong positive relationships between Mendeley reads and the three bibliographic databases with Scopus showing a stronger positive relationship at 0.603 while that between Mendeley readership and GS citations was 0.592 followed by 0.505 for WoS.

6.3 Conclusions

The conclusion of this study is aligned to its objectives. In this conclusion, however, objectives 2 and 3 of the study are combined to avoid repetition. The conclusions are based on the findings in Chapter 4.

Establish the research output of NRF-rated researchers at NWU in GS, Scopus and WoS

The results of this study show that during the period covered (2006-2017) rated researchers were significantly productive. Most of their output emanated from GS, followed by Scopus and WoS. The increase in production output could be interpreted as the ultimate affirmation of the Department of Higher Education and Training's Research Output Policies and the strategies of universities to increase research output in the country (NWU, 2012; DHET, 2015a). Publications in GS showed a greater variety compared to the two other bibliographic databases used in this study although Scopus fared better than WoS.

The researchers did not only publish academic documents but also non-peer-reviewed sources such conference proceedings, inaugural lectures, patents, policy documents and other grey literature. This shows strong maturity of research in the country as researchers realise the importance of research that has broader impact beyond the academy. It is also commendable that rated researchers were able to produce output such as patents and policy. It also shows that the quality of the country's researchers is improving and at par with that of other countries as some of the documents produced were of international interest for organisations such as FAO and the UN. GS's unique coverage of a large variety of documents places it as a prime bibliographic database for the evaluation of research beyond the academy as done by other researchers previously (SFI, 2015; Bracken, 2015; Kousha and Thelwall, 2017).

Regarding the publication trends, the number of publications, together with the average number of output per researcher, increased across the three bibliographic databases all attributed to the increased number of rated researchers. It is possible, therefore, that the number of rated researchers in any given university may be used as one of the strongest

indicators of research output in that university as ratings apparently stimulate output (Inglesi-Lotz and Pouris, 2011). This supports the drift to target an increase in the number of rated researchers in South African universities, including NWU as one of the pivotal research strategies for institutions of higher learning. Another interesting result was that P-rated researchers produced more output on average than all categories of rated researchers including the A and B-rated researchers. This may be interpreted to mean the future of research in the country is guaranteed as P-rated researchers are young scholars who have have significant potential to become leading voices and authorities in their fields. However, there are very few P-rated researchers compared to Y-rated researchers another category of young researchers whose output did not perform very well in this study. Despite the stellar performance of P-rated researchers, the average performance of Y-rated researchers should be a worrying sign for the future of research in the country. WoS showed greater percentage of common records with the other databases followed by Scopus and GS mainly because of the size of the former, which had the smallest number of output by NWU's rated researchers. GS, however, was able to find 67.5% of NWU's rated researchers' output indexed in WoS, and 61% in Scopus. This attests the strength in research evaluation on GS, especially given that it is accessible free of charge compared to the rest of commercial databases.

Determine and compare the research impact of the NWU's rated researchers' output at the NWU in GS, Scopus and WoS.

A citation analysis of the NWU's rated researchers' citations in GS, Scopus, and WoS reflected similar trends as the output. There were more citations in GS, followed by Scopus and WoS in the last place. GS also reflected citations in grey literature such as theses and dissertations, reports, policy documents and patents. This confirms an earlier submission that GS could be used to evaluate research impact beyond the academy.

Citations across the three databases also followed similar trends and patterns. They followed three to four year trends, with the first three to four years (2006-2009) accumulating more citations than the last two to three years (2015-2017). The highly cited documents were common amongst the three databases albeit with different citation numbers. There was a higher percentage of documents that did not receive citations in WoS followed by Scopus and then GS. B-rated researchers accumulated more citations on

average in two of the three databases (GS and WoS) than all rating categories, including the P and A-rated researchers while P-rated researchers performed the same in Scopus.

These results show that highly cited documents in one main bibliographic database are likely to be also highly cited in the other. Therefore, researchers who are interested in research evaluation can use one of the three databases to study highly cited documents across the three databases. These results reaffirm previous studies in the area, notably by Onyancha and Ocholla (2009) and Martin-Martin *et al.* (2018). The former advised that GS could be used as a supplementary database for research evaluation in developing countries when it is not possible to access commercial databases. However, in cases where researchers have access to all three databases, they should be advised to use all three to evaluate research. Martin-Martin *et al.* (2018) pointed out that GS appears to be a superset of WoS and Scopus, with substantial extra coverage. Through these results, the use of all three databases for research evaluation and NRF-ratings is supported.

Establish a list of core journals in which NWU's rated researchers publish

Regarding core journals as outlets for research publications, it was concluded that NWU's rated researchers overwhelmingly preferred journals to other forms of scholarly communication and dissemination in all three bibliographic databases (GS, Scopus and WoS) used in this study. The study was able to determine that just more than one third of all journal citations in all three bibliographic databases came from a few journals. The results of this study also showed that NWU's rated researchers preferred international journals to local ones, possibly to strengthen their international profiles.

It is worrying that the most preferred journals in all three bibliographic databases, (except one in GS) are published outside Africa. This calls for a deliberate action by government, researchers and universities to encourage journal editors to work towards getting their journals indexed by international databases as most rated researchers, especially at higher levels of ratings, tended to prefer journals that are indexed in WoS or Scopus even when they published in a local journal. Gevers, Mati, Mouton, Page-Shipp, Hammes & Pouris (2006) also made a similar recommendation in their report on strategic approaches to research publishing in South Africa. Although predatory publishing is outside the scope of this study, it was concerning to find that the notorious *MJSS* appeared in a prominent position in the list of most cited journals by NWU's rated researchers. These results,

therefore, are a reminder to all academics to be diligent and meticulous about where they publish their work.

Assess the visibility of the rated researchers at the NWU on academic social media sites

This study examined the profiles of rated researchers on two academic social media platforms RG and Mendeley. The results indicated that NWU's rated researchers are more visible in Mendeley compared to RG. The reasons include the fact that the latter is owned by Elsevier, a publishing company that has a reputation for quality artefacts within the academy. However, significant percentages of the researchers have profiles that are not active on both databases. There were significantly more reads in RG than Mendeley which was determined to be in line with previous studies in the area. There were two possible explanations for this. Reads in RG are counted each time somebody (whether logged in or not) opens a summary or full-text, or downloads one of the publications in RG while Mendeley readership counts the number of times someone saves a document to their Mendeley library or profile (Martín-Martín *et al.*, 2016). RG is bigger in size than Mendeley therefore there are more scholars and readers to interact with the documents compared to the latter (Martín-Martín *et al.*, 2016). It could be logically concluded that based on these results, RG has a higher social impact than Mendeley though the former is better at predicting academic impact. Librarians who interact with researchers who would like to predict future academic impact of their documents are advised to consider Mendeley readerships with some level of confidence compared to RG reads.

Determine the relationship between academic impact and societal impact of the research output of NWU's rated researchers

In comparing citations in GS, Scopus, and WoS to reads in RG and readership in Mendeley, it was concluded that generally there was a positive relationship between the citations of the three bibliographic databases and the reads and readerships of the two academic social media platforms. However, the positive relationship was weak between the three databases and RG. It was found to be positive and strong between Mendeley readership and all three databases but strongest with Scopus compared to GS and WoS. The generally poor relationship between citations and reads in RG are a reminder that researchers do not always read documents for purposes of citations. Articles and other documents are

sometimes read, for purposes of gaining insights, knowledge, or simply for interest's sake. Some of the output may be read in the course of preparation for classes not necessarily for publications. As pointed out in the discussion, GS and RG tend to index similar types of documents hence the stronger relationship. On the other hand, Scopus and Mendeley are owned by the same publishing house (Elsevier) therefore Mendeley and Scopus likely have some unconscious or conscious bias towards documents published by Elsevier. Alternatively, the two may share common indexing.

This study further concludes that NWU's rated researchers have had commendable academic and social impact for the university though it was difficult to discern if ratings have a causal effect or if researchers were rated because of their prior high production rates. This researcher suspects a combination of the two as Y and C-rated researchers who had higher impact received higher ratings in the subsequent years. There is also evidence in literature that a rating can also lead to more production levels (Inglesi-Lotz and Pouris, 2011).

This study has shown that the majority of rated researchers have profiles in the two academic social media platforms used in this study. This augurs well for the visibility and impact of research conducted at the university. However, the results also indicated that the researchers do not always take full advantage of the potential benefits of these platforms by either leaving their profiles inactive, partially populated or applying restrictions thereby missing out on the potential benefits of making one's research visible in the public domain (Nández and Borrego, 2013; Kerchhoff, 2017; Onyancha, 2018).

The results also showed that a significant number of rated researchers at NWU do not have either an RG or Mendeley profile or both meaning that their research may not have the maximum exposure expected to generate the necessary social impact. Based on the results of this study, it can be inferred that reads on academic social media platforms (in this case RG) do not always predict citations. Researchers do not always read documents for purposes of citations. Articles and other documents are sometimes read for purposes of gaining insights, knowledge, or simply for interest's sake. Although some social academic media indicators (in this case Mendeley readership) could be better at predicting future academic impact than others, research evaluators should always bear in mind that altmetrics are independent of citations. They reflect wider impacts of research rather than

predict its academic impact. As predictors of academic impact therefore they should be used with caution.

6.4 Implications of this study

These results have wider implications for the North-West University, other universities in South Africa and Africa, researchers, the government and higher education policy makers, and the NRF. This appears to be the first study to provide insights into the scholarly and social impact of rated researchers at NWU, and the University Management could use the results of this study as evidence of the success of their research policy to increase research output as well as train, recruit and retain rated researchers. However, the results show that targeting certain categories over others (such as preferring A-rated researchers over B-rated researchers in institutional strategy) may not always yield the desired results. Universities should rather focus on highly productive rated researchers irrespective of their rating status at the time of recruitment.

This study also forms the basis for other universities in the country to encourage their staff to apply for NRF ratings. These results could also be used by university managers to showcase the value of an NRF rating to the community of practice, specifically university researchers. These results point to the importance of constant self-evaluation by researchers to ensure that they have balanced profiles across the three main bibliographic databases that are also considered for NRF ratings. The use of all three main bibliographic databases in research evaluations is supported.

South African journal editors need to strive towards improving the quality of local journals to that of international standards so that more local journals are indexed by Scopus and WoS (Mouton *et al.*, 2006). That way they would avoid a situation where many journals published in South Africa are not indexed in Scopus and WoS (Onyancha and Ocholla, 2009). These results support the use of GS together with the two other bibliographic databases to evaluate research in South Africa and Africa generally. These results point to the relevance of GS in evaluating research beyond the academy as the portal provides a broader coverage of research such as patents (commercial impact), policy briefs and various government reports (policy impacts), water reports (environmental impacts), theses and dissertations completed and supervised by researchers (educational impacts),

music items and artefacts (cultural impacts), newspaper opinions and articles (public impacts) and others.

Conclusively, these results support the initiatives by DHET to consider subsidising research that has demonstrable impact beyond the academy. The thrust of the "Draft Policy on the Evaluation of Creative Output and Innovations Produced by Public Higher Education Institutions" is therefore endorsed by the results of this study (DHET, 2015b). The fact that researchers contribute in research that seeks to improve the general welfare of the population (beyond the academy) is positive assurance for the custodians of the NDP of the country who look up to researchers and research per se to solve the country's socio-economic problems (South Africa, 2012; Adam *et al.*, 2015).

These results point to the relevance of the rating system used in the country although the peer-review mechanism mainly used to rate researchers could be complemented by using impact indicators such as the number of outputs and citation impact of such output (Fedderke, 2013; Callaghan, 2018). That way, there are bound to be some objective measures upon which to base ratings (Fedderke, 2013; Callaghan, 2018). These results support the call made by Kaniki and various other researchers (2008) for young researchers (Y-rated) to be urgently incentivised to protect the future of research in the country. These results confirm social media indicators pointing to wider research impacts and wider access by many different groups of people including the members of the society at large. They point to research that is no only accessible to researchers and those who have access to their research but to the society at large. These results support altmetrics indicators such as views as complementary to citations rather than as simple predictors of potential citations of documents

6.5 Recommendations

The recommendations of this study are set to remedy the concerns highlighted in the findings and conclusion. The recommendations of this study are divided into four subsections: recommendations pertaining to academic librarians, recommendations pertaining to researchers, recommendations pertaining to institution, and recommendations pertaining to the NRF.

6.5.1 Recommendations pertaining to academic librarians

Onyancha (2018) reasoned that academic librarians (can) play a critical role in bibliometrics and altmetrics. Most of the recommendations listed below may also appear in the Onyancha study.

Academic librarians should keep abreast of developments in the academic social media sphere

The results of this study highlighted that 36% and 15% of NRF-rated researchers at NWU do not have RG and Mendeley profiles, respectively. Among those with profiles 9.5% (or 104 of 1091) of the researchers had profiles that were not populated or partially populated in RG while the status of 19 profiles in Mendeley could not be determined as they were restricted to those who follow the researchers. This finding challenges libraries to play a bigger role in assisting researchers to create and populate their profiles. Therefore, academic librarians themselves should always keep up with the fast developing academic social media trends. Only knowledgeable academic librarians will be able to promote, recommend, and assist researchers navigate the different social media platforms.

Develop knowledge of different altmetrics and bibliometrics

In line with the results highlighted above which point to a significant number of researchers not owning RG and Mendeley profiles, academic librarians should develop knowledge and understanding of the different metric indicators and how they are used by the wider research community in order to be at the forefront of promoting them to the researchers. Librarians can do so by attending workshops, seminars, symposia, and conferences where such matters are discussed. Academic librarians can also organise knowledge transfer workshops among themselves and share their knowledge of bibliometrics and altmetrics. Academic librarians should also read literature in this area to develop their knowledgebase.

Create personal profiles in the different academic social media platforms

The results of this studies showed that these platforms have beneficial effects for the societal impact of researchers. Academic librarians, therefore, must themselves be visible in different academic social media platforms in order to undertand the benefits of these platforms. Being visible themselves will assist the librarians achieve two things: they will

be in the environment where the researchers are, and they will understand the benefits and challenges of each of these platforms. Being on these platforms assists the librarians to develop the necessary expertise to educate others.

Organise researcher profiling and research visibility workshops

Academic librarians who have developed high levels of expertise in certain academic social media platform/s must then organise workshops to educate researchers and postgraduate students as they navigate through the maze of academic social media platforms. This researcher is aware that some libraries, including the NWU Library and Information Service (NWU LIS), have been involved in such activities for the past few years (Makate, 2019). Onyancha (2018) also highlights several other libraries in South Africa that run these workshops, including libraries at the Universities of Cape Town, Pretoria, Zululand, Pretoria and Stellenbosch.

Academic libraries can enlist the services of external experts to conduct workshops on altmetrics and bibliometrics

Experts from industry or other academic libraries could be called upon to assist where necessary. As part of NWU LIS strategy, for example, the library enlists the services of World Wide Information Services (WWIS) representing WoS and Scopus to conduct bibliometrics workshops in all three of its campuses, annually (Makate, 2019). Likewise, experts in altmetrics can be identified and requested to conduct workshops. This will benefit the university in the long run as it will ensure that researchers' research is visible in social media platforms.

Conduct advocacy campaigns and other activities that seek to increase profiling and visibility among researchers

Academic librarians are strategically placed to take a leading role in promoting profiling and visibility among researchers and postgraduate students. Where necessary, researchers and postgraduate students should be assisted in creating profiles in different academic social media platforms for visibility and impact purposes. NWU LIS is currently involved in campaigns to assist researchers create ORCID and Scopus profiles. Reports of the extent of profiling in those two platforms were sent to the office of the Vice-Chancellor: Research

and Innovation. Another example of advocacy relates to creating LibGuides such as the one created by Denise Nicholson (2019) at the Wits University providing information about altmetrics and bibliometrics. For its part, NWU maintains a research support page that has a section on measuring research and impact (NWU LIS, 2019).

Library managers can ensure that researcher profiling is part of faculty liaison librarians' job description

Academic social media should form part of each faculty liaison librarian's job description and performance areas. If academic librarians are there to support research, then as part of their jobs contemporary academic librarians should be able to advise researchers about these platforms as part of faculty liaison.

Keep up-to-date subscriptions to various bibliometrics and altmetrics platforms and databases

Onyancha (2018) advises that libraries must ensure that they keep their subscriptions to the various bibliometrics and altmetrics databases up-to-date to ensure access for researchers for self-evaluation purposes.

Conduct research and publish about different aspects of altmetrics and bibliometrics

Academic librarians are not always involved in activities that support researchers but they could also be researchers themselves. As such, Onyancha (2018) postulates that librarians must also consider conducting altmetrics and bibliometrics studies.

Assist faculties and departments with bibliometrics and altmetrics reports

Faculties and departments sometimes conduct faculty and departmental research evaluations. Faculty liaison librarians should play the role of experts when it comes to evaluations based on bibliometrics and altmetrics databases and platforms. An example of how faculty and department can rely on an academic librarian for evaluation is that of the current researcher who was involved in drawing bibliometrics reports for the Education Faculty at the Mafikeng Campus of the NWU for purposes of their annual research awards for most cited paper, most recognised paper internationally, most productive researcher and other categories.

Use bibliometrics and altmetrics indicators to make some management decisions as well as prove the value of libraries

Earlier in Chapter 1 of the study, it was pointed out that bibliometrics assist librarians make collection development decisions. They can indicate usage patterns of materials in the library. Bibliometrics can help the librarians to track publishing output and its impact (Thomson Reuters, 2008:2). Libraries in South Africa are faced with financial challenges that necessitate that decisions are taken based on scientific and objective indicators. Bibliometrics and altmetrics can and do assist libraries to decide which resources or types of resources to prefer and which ones to discard or cancel. Bibliometrics and altmetrics can also help libraries to prove their value to the universities that are concerned about value for money. Using bibliometrics and altmetrics, librarians can collect a list of journals cited by their researchers and use it for collection development decisions.

6.5.2 Recommendations pertaining to researchers

The purpose of publishing research is to ensure maximum exposure and accessibility of a researcher's publications and contributions to scholarship. According to Nández and Borrego (2013), academic social media offer researchers new and innovative ways to get in touch with other researchers, to disseminate research output, and to follow other researchers' activities.

All researchers should ensure that they register in various social media platforms in order to make their research visible

Researchers should ensure that they have active academic social media profiles in at least three or four platforms. This is possible, as most of these platforms do not require that a researcher be hands-on as they are able to link your profile and research from other platforms. The researchers should open up their profiles for public viewing instead of applying access restrictions as shown by the high percentage of researchers at NWU that restrict access to their RG and Mendeley profiles. Researchers should be aware that there is not much point in keeping an academic social media profile when it is not accessible to the majority of other researchers and the public.

Researchers should have a publicly available Open Researcher and Contributor ID (ORCID) for name disambiguation and visibility of their research

Although ORCID did not form a direct part of this study, the struggles experienced in sourcing researchers' publishing data convinced the researcher that having a publically available ORCID will assist in ensuring the visibility of researchers' research in GS, Scopus and WoS. Researchers must register for ORCIDs and ensure that these are publicly available for maximum exposure, visibility and impact. Universities must instruct all their researchers to register for an ORCID as it is a requirement of many publishers and top research funders including the NRF (ORCID, 2015-2019; NRF, 2017d). In fact, having an ORCID is also a requirement of the NRF for purposes of a rating (NRF, 2017d). ORCIDs assist in significant ways with research evaluations.

Researchers must constantly check their profiles in different bibliographic databases

Researchers should ensure that they have balanced profiles in all three main bibliographic databases for purposes of a rating. The current researcher is aware of senior researchers who only realise at the stage of application for an NRF rating that they do not have a good research profile (if any at all) in WoS and Scopus. To avoid this, researchers must constantly check their profiles to ensure that they maintain balanced profiles across the three main bibliographic databases at the early stages of their careers. The findings of this study wherein a huge number of citations emanate from GS serves to underline this point.

6.5.3 Recommendations pertaining to universities

Nández and Borrego (2013) postulates that institutional support is lacking when it comes to assisting researchers to register and use the various academic social media platforms. However, universities that encourage their staff to be active on these platforms would reap the benefits associated with the visibility and impact of the institutions' research such as attaining higher rankings at institutional level.

Constantly track, evaluate and measure research conducted by its researchers

If institutions aim to improve their own rankings and to improve the number of NRF ratings among its researchers, then they should constantly use the three bibliographic databases to

evaluate and benchmark themselves against their peers. These can be done biannually or once in every three years.

Encourage use of metrics in evaluating their researchers

During researcher awards, institutions should award researchers based on different levels of metrics including number of output, citations, and international collaborations or inter-institutional collaborations. They should also link some of the research awards to the main bibliographic databases. There could be awards for the most output in WoS indexed journals and most output in Scopus indexed journals. This would in turn encourage researchers to publish in journals indexed by those databases.

Pass mandatory policies for researcher profiling and ORCID

Institutions can work with one or two profiling organisations and make it mandatory for researchers to have at least two researcher profiles in academic social media platforms. They could also initiate altmetrics based awards such as most viewed article in Mendeley, RG or any other academic social media platform. That all researchers must have ORCIDs is long overdue in institutions of higher learning. Institutions should issue similar mandates along the lines of the NRF statement on ORCID (NRF, 2017d) to coerce researchers to register. Alternatively, they can use the NRF statement on ORCID as a basis for such a mandate.

6.5.4 Recommendations pertaining to the NRF and DHET

The NRF and DHET are a critical components of research evaluation in South Africa both as funders and custodians of research completed in higher education in the country. Regarding the NRF and DHET, the following are recommended:

Consider the quantity and quality of output and impact of research

The NRF must consider the number of outputs and their impact in allocating ratings. Further, they should also consider where the research is published. It could be specified that A-rated researchers must publish at least an “X” number of papers within “Y” number of years in WoS quartile 1 journals for them to defend their rating. Similar specifications can be made with the other categories. That way, the ratings will benefit the research

ranking of the country both quantitatively and qualitatively. The DHET must consider subsidies based on the quality and impact of journals where researchers published. This would in turn encourage researchers to publish in high impact journals. Journals that remain on the list of accredited journals for more than a certain number of years without making it into the international databases could be de-accredited for a number of years as chastisement.

Regular assessment, evaluation and benchmarking of the country's research

The NRF and DHET must commission research to assess and evaluate the quality, quantity and impact of research conducted in the country. This could be done using different evaluation methods such a peer-review, bibliometrics, and altmetrics. The research strategies of the country would then be informed by these research evaluation reports that can be done once after three years.

Provide support and incentivise young researchers

The findings of this study showed that only a handful of young researchers go on to attain higher rankings in future. South Africa has an ageing cohort of researchers (Webbstock and Sehoole, 2016). In order to sustain and improve, the system needs to train, recruit and retain young promising researchers such as the Y-rated ones. However, Kaniki *et al*. (2008) found that only 50% of Y-rated researchers remained in the system. A quarter of the researchers who remained felt unsupported. The NRF and DHET, therefore, should invest heavily in the development, training, and retention of young researchers, especially the promising Y-rated ones to protect the future of research in the country.

6.6 Suggestions for further studies

Comparative studies of rated versus non-rated researchers - This study did not compare the research output of rated researchers to non-rated researchers, therefore, a study that compares the two is recommended.

In-depth studies of rated researchers at all South African universities – This study focussed on rated researchers at the NWU. Due to low numbers of A and P-rated researchers at this university, it was difficult to make concrete conclusions based on those low numbers.

Visibility of rated researchers and all other researchers in other academic social media and researcher profiling platforms– This study used only two academic social media platforms; it might be interesting to establish and confirm the visibility of rated researchers and all other researchers in other academic social media and researcher profiling platforms such as Google Profiles, Academia.edu, and ORCID, among others.

Studies on impact of rated researchers beyond the academy – Research does not only impact the academy but it has wider impacts beyond the academy. Currently, very few studies have been carried out in South Africa to establish out how rated researchers impact policy, health, culture and other social aspects. More studies along the lines of the NRF's socio-economic impact studies of research are required (NRF, 2015).

Studies on the impact of predatory publishers in South Africa – This study did not set to study the practice of predatory publishing in any detail; the presence of the notorious *MJSS* on the most cited journals was concerning, therefore, more studies along the lines of Mouton and Valentine (2017) are required in South Africa. The studies could focus on the extent of citations and referencing of these journals.

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Appendix A: Certificate of language editing

NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT
UNIBESITI YA BOKONE-BOPHIRIMA

Office: 0183892451

SCHOOL FOR LANGUAGE EDUCATION, FACULTY OF EDUCATION **Cell: 0729116600**

Date: 24th June, 2019

TO WHOM IT MAY CONCERN

CERTIFICATE OF EDITING

I, Muchativugwa Liberty Hove, confirm and certify that I have read and edited the entire proposal, **A bibliometrics study of the research impact of the National Research Foundation-Rated researchers in the North-West University, South Africa (2006 - 2017)** by **Siviwe Bangani,** student number 37402889, submitted in fulfilment of requirements for **MASTER'S degree** in the subject **INFORMATION SCIENCE** at the **University of South Africa.**

Siviwe Bangani was supervised by **Professor O.B. Onyancha**

I hold a PhD in English Language and Literature in English and am qualified to edit such a thesis for grammatical correctness, cohesion and coherence. The views expressed herein, however, remain those of the researcher/s.

Yours sincerely

Dr M.L.Hove (PhD, MA, PGDE, PGCE, BA Honours – English)

NORTH-WEST UNIVERSITY
NOORDWES-UNIVERSITEIT
UNIBESITI YA BOKONE-BOPHIRIMA

Appendix B: UNISA Ethical Clearance

UNISA

University of South Africa Research Ethics Review Committee
(COLLEGE OF HUMAN SCIENCE)

FORM 3: 2017

Research ethics application form for Research NOT Involving Human Participants, including CONCEPTUAL RESEARCH within the Unisa context.

Research NOT involving Human Participants is defined as such if:

- there is NO interaction or intervention with living individuals to obtain data, and
- the data collected cannot be linked in any way to identifiable individuals (living or dead).

IF YOU ANSWER 'YES' TO THE QUESTIONS BELOW, PLEASE CONTINUE FILLING IN THIS FORM.
IMPORTANT:
IF YOU ANSWERED 'NO' TO QUESTION (a) STOP COMPLETING THE FORM.
IF YOU ANWER 'YES' TO QUESTION (b), HOWEVER, YOU ARE CONVINCED THAT THE STUDY FITS THIS APPLICATION TYPE, JUSTIFY THE REASON IN THE COMMENTS SECTION.
IN THE ABSENCE OF A VALID JUSTIFICATION, STOP COMPLETING THIS FORM (see note below).

The proposed study entails:	YES	NO
a) NO interaction or intervention with living individuals; and	>	
b) the data collected cannot be linked in any way to identifiable individuals (living or dead) OR *is not in the public domain*	X	

COMMENTS: The information sort is available in the public domain as it is published research outputs.

NOTE: For research that involves direct human participant involvement or a combination of direct human participant involvement and the collection of secondary information, complete Form 1.

For research that involves indirect human participant involvement through the use of secondary data, complete Form 2.

Previous application number *Applicants should indicate a previously allocated application number in case of a resubmission*	
Date submitted	

If you have any questions about or require assistance with the completion of this form, please contact your supervisor (master's or doctoral students), or the Research Ethics Administrator of the URERC (012 429 3677 or urerc@unisa.ac.za). The Deputy Chairperson can be contacted on vnaerR@unisa.ac.za

UNISA

This Section is for Office Use Only

APPLICATION NUMBER	2018-CHS-0039
DATE (DD/MM/YYYY)	11/06/2018
PRINTED NAME (CHAIR OR DESIGNEE)	Prof A-H Maharaj-Mudaly
DESIGNATION	Chair
RESEARCH MEETS THE DEFINITION FOR RESEARCH NOT INVOLVING HUMAN PARTICIPANTS	Yes ☑ No ☐
RISK LEVEL	Negligible ☐ More that negligible ☐
DECISION (approved, referred back, disapproved)	Approved
REVIEWER COMMENTS IF APPLICABLE	
APPROVAL SIGNATURE (CHAIR OR DESIGNEE)	
DATE SIGNED	14 June 2018
DATE OF ISSUING APPROVAL OR FEEDBACK LETTER	14 June 2018
DATE OF ETHICS REVIEW COMMITTEE RATIFICATION/REPORTING	
PERIOD FOR WHICH APPROVAL IS VALID (Valid only as long as approved procedures are followed)	From: To: 13 June

PRIVACY INFORMATION:

The information you provide on this form is collected for the primary purpose of assessing your research ethics application. This information will also be entered into a database to assist with administration, correspondence, and statistical analyses. These records are accessed by the Unisa Research Ethics Review Ethics office bearers and members of committee. Records will be made available to authorised third parties should the need arise. All records are kept in a manner that will ensure confidentiality and secure indefinite storage after the expiry of the term of approval. Although this information is not usually disclosed to other individuals, there may be some circumstances that require the information to be disclosed.

UN SA

THE PROPOSED RESEARCH

By signing below, I Siviwe Bangani I declare as follows:

a)	I completed all the sections of this form that are relevant to the proposed research study.	☑ Agree
b)	I have acquainted myself with UNISA's code on research ethics expressed in the UNISA Policy on Research Ethics.	☑ Agree
c)	I shall conduct the research in strict accordance with the approved proposal. I acknowledge that the approval is valid as long as approved procedures are followed.	☐ Agree
d)	I shall notify the UREC in writing if any changes to the research are proposed that may affect the ethicality of the research.	☐ Agree
e)	I can the confidentiality of records pertaining to the research if needed	Agree
f)	I shall not use the research and information in a manner that is detrimental to any individual or institution unless it can be scientifically justified.	☐ Agree
g)	I shall uphold research integrity and refrain from conduct that may taint the integrity of science, including, but not limited to plagiarism, fabrication and falsification of data.	☑ Agree
h)	I shall take the necessary steps to warrant that co-researchers, if applicable, familiarise themselves with the Unisa Policy on Research Ethics	N/A Agree

Signing of declaration _____ 07/06/18

Name in Print Siviwe Bangani_____Signature_____ Date signed 07 June 2018

Applicant_____Siviwe Bangani

Approved by supervisor (if applicable)

To my knowledge the student has addressed all aspects in his/her application for research ethics approval set forth in the University of South Africa's Policy for Research Ethics. I confirm that the form is complete. I will ensure that the student notify the committee in writing if any changes to the research are proposed that may affect any of the study-related risks for the research participants. Subsequently, I approve the submission and recommend that approval is granted for the research.

Form 3 CHS Approved by CHS ETHICS COMMITTEE 21.02.2018
(page4)

UN SA

THE PROPOSED RESEARCH

By signing below, I Siviwe Bangani I declare as follows:

a) I completed all the sections of this form that are relevant to the proposed research study.	☑	Agree
b) I have acquainted myself with UNISA's code on research ethics expressed in the UNISA Policy on Research Ethics.	☑	Agree
c) I shall conduct the research in strict accordance with the approved proposal. I acknowledge that the approval is valid as long as approved procedures are followed.	☐	Agree
d) I shall notify the UREC-HC in writing if any changes to the research are proposed that may affect the ethicality of the research.	☐	Agree
e) I can the confidentiality of records pertaining to the research if needed		Agree
f) I shall not use the research and information in a manner that is detrimental to any individual or institution unless it can be scientifically justified.	☐	Agree
g) I shall uphold research integrity and refrain from conduct that may taint the integrity of science, including, but not limited to plagiarism, fabrication and falsification of data.	☑	Agree
h) I shall take the necessary steps to warrant that co-researchers, if applicable, familiarise themselves with the Unisa Policy on Research Ethics	)	N/A Agree

Signing of declaration _____ 07/06/18

Name in Print Siviwe Bangani_____Signature_____ Date signed 07 June 2018

Applicant_____Siviwe Bangani

Approved by supervisor (if applicable)

To my knowledge the student has addressed all aspects in his/her application for research ethics approval set forth in the University of South Africa's Policy for Research Ethics. I confirm that the form is complete. I will ensure that the student notify the committee in writing if any changes to the research are proposed that may affect any of the study-related risks for the research participants. Subsequently, I approve the submission and recommend that approval is granted for the research.

Form 3 CHS Approved by CHS ETHICS COMMITTEE 21.02.2018
(page4)

UNISA

Abridged CV of co-supervisor (Insert copy of the CV here)	Please insert an abridged CV that explicitly provides evidence of: - Experience relevant to the proposed research - Qualifications relevant to the proposed research - Publications and other research outputs

SECTION 2: DETAILS OF PROPOSED RESEARCH

**Proposal to be submitted in case of postgraduate student applications, as well as evidence of proposal acceptance by a relevant scientific committee.*

**Place an 'x' in the box provided*

2.1	Will the research project at any stage involve living human participants?

Yes	
No	X

2.2	Will the research project at any stage report on identifiable private information of individuals (living or dead) that is not in the public domain?

Yes	
No	X
Comments:	

2.3	Indicate the anticipated duration of the research project for which the application should be valid

Start Date	01 August 2018
End Date	30 September 2019

2.4	Title of the research project
A bibliometrics study of the research impact of the National Research Foundation-Rated	

S. V.

1.1	Details of main researcher (referred to as the applicant)			
Title	Full name & Surname	Staff / student no:	Department/Unit:	Email address
Mr	Sivive Bangani	37402889	Human Sciences	Mobile: 0783777945 Work: 018 3892922
Abridged CV of main researcher (Insert copy of the IV here)	Please insert an abridged CV that explicitly provides evidence of: - Experience relevant to the proposed research - Qualifications relevant to the proposed research - Publications and other research outputs			

1.2	Supervisor if the application is made by a student				
Title	Full Name & Surname	Staff /student no	Department/Unit	Contact numbers	Email address
				Mobile: Work:	
Abridged CV of supervisor (Insert copy of the CV here)	Please insert an abridged CV that explicitly provides evidence of: Experience relevant to the proposed research Qualifications relevant to the proposed research Publications and other research outputs				

1.3	Co-supervisor if the application is made by a student* * if applicable				
Title	Full Name & Surname	Staff / student no	Department/Unit	Contact numbers	Email
				Mobile: Work:	

UNISA

researchers in the North-West University, South Africa (2006 0 5

2.5 Provide a lay/non-technical summary in about 500 words [This requirement should be met by all applicants]
(Research problem, aim, anticipated outcomes and research design in nontechnical language)
Please note that postgraduate student proposals must have received prior approval by a relevant (Higher Degrees Committee/Scientific committee)

The National Research Foundation (NRF) believes that its rating system is a valuable tool to benchmark the quality and impact of research completed in South Africa with international standards. Public Universities in South Africa have been the main beneficiaries and enablers of the NRF-rating system. University strategies in South Africa explicitly state the increase of NRF-rated researchers as one of their main research. Universities believe that there is a possible relationship between the higher percentage of NRF-rated researchers and a university's ranking by the international ranking agencies. Through their active participation in the system, universities provide a positive justification for the rating of researchers. As a result, public universities in the country are in a constant race to retain and attract more NRF-rated researchers. The North-West University has not been immune from this race as its current strategy seeks to promote the participation of academics in the National Research Foundation's rating system by considering it for promotion, performance management agreements, through training, development and coaching, and by recruiting NRF-rated researchers (North-West University, 2017:79).

Despite the strategies to attract, produce, and retain NRF-rated researchers, the current researcher could not find any study that sought to determine the impact of these researchers at public universities in South Africa but specifically at the NWU. Using the bibliometrics and altmetrics research methods, the aim of this study, therefore, is to find out the impact of the NRF rated researchers including the level of productivity of these researchers, and what the impact and visibility of their research is. Bibliometrics as a research method uses quantitative approach in the form of statistical and mathematical analysis to describe and evaluate academic research outputs in order to determine their impact (Norton, 2010: 131). Bibliometrics studies utilise certain impact measures including: citation analysis, altmetrics, co-word analysis, bibliometric coupling, co-citation analysis and others (Stickney, 2009: 40). Crucially, they can easily be used

Form 3 CHS Approved by CHS ETHICS COMMITTEE 21.02.2018
(page 8)

to determine the productivity, impact and influence of research, research outputs and institutions. Altmetrics on the other hand refer to web and social media indicators accumulated by individual outputs that are used to measure the societal impact of research, research outputs, research publications, researchers and institutions.

2.6	Based on the above, classify your research project based on the anticipated degree of risk. *[The researcher completes this section. The EPC critically evaluates this classification to protect participants' rights]* Please mark 'X' in the box provided

2.6.1 Negligible risk	X
2.6.2 More than negligible risk	

2.7	Briefly justify your choice/classification:
	The documents that will be analysed are published documents.

2.8	Provide any additional information in the block below.
	None

Appendix C: List of rated researchers at NWU (2006-2017)

List of NRF-rated researchers at NWU (2006 - 2017)					
2006					
A	**B**	**C**	**L**	**P**	**Y**
H Moraal (Harm)	RA Burger (Adri)	JJ Bergh (Kobus)	HM Huisman (Magda)	SES Ferreira (Stefan)	CB Brink (Tiaan)
M Potgieter (Marius)	BC Raubenheimer (Christo)	C Nel (Carisma)	C Rautenbach (Christa)		HJM van Deventer (Hans)
	OC de Jager (Okkie)	JC Breytenbach (Jaco)			AS Coetzee-Van Rooy (Susan)
	JWH Swanepoel (Jan)	DW Oliver (Douglas)			FH van der Westhuizen (Francois)
	GP Greyvenstein (Gideon)	OSL Bruinsma (Dolf)			L Jansen van Rensburg (Linda)
	AA van Dijk (Albie)	IJ Oosthuizen (Izak)			PDR van Heerden (Riekert)
	HH Vorster (Esté)	WAM Carstens (Wannie)			HM Krieg (Henning)
		M Petersen (Mark)			GB van Huyssteen (Gerhard)
		SS Cilliers (Sarel)			AJ van Rooy (Bertus)
		AE Pienaar (Anita)			AE Schutte (Alta)
		JH de Ridder (Hans)			Maboeta, M
		GJ Pienaar (Gerrit)			
		JJ du Plessis (Jeanetta)			
		JJ Pienaar (Kobus)			
		W du Plessis (Willemien)			
		JA Robinson (Robbie)			
		HJG du Plooy (Heilna)			
		S Rothmann (Ian)			
		JL du Preez (Jan)			
		PG Rousseau (Pieter)			
		LH du Preez (Louis)			
		JJA Smit (Jan)			
		CGD K du Toit (Jat)			
		L Stander (Leonie)			

		RC Everson (Ray)			
		H Strydom (Herman)			
		JH Fourie (Jan)			
		PD Theron (Pieter)			
		HS Geyer (Manie)			
		J van den Berg (Johnnie)			
		LJ Grobler (LJ)			
		APS van der Merwe (Andries)			
		BH Harvey (Brian)			
		DJ van der Walt (Johan)			
		JC Jerling (Johann)			
		JL van der Walt (Johann)			
		PC van der Westhuizen (Philip)			
		AF Kotze (Awie)			
		L van Rensburg (Leon)			
		HF Kotze (Harry)			
		HF van Rooy (Herrie)			
		GHJ Kruger (Gert)			
		JM van Rooyen (Johannes)			
		HS Krüger (Salome)			
		CS Venter (Christine)			
		W Liebenberg (Wilna)			
		HM Viljoen (Hein)			
		AP Lötter (Antoon)			
		W Viviers (Wilma)			
		NP Maake (Nhlanhla)			
		JM Vorster (Koos)			
		SF Malan (Sarel)			
		HCM Vosloo (Manie)			
		SE Materechera (Simeon)			
		FB Waanders (Frans)			
		M McPherson (Michael)			
		DP Wissing (Daan)			
		WA Naude (Wim)			
		MP Wissing (Marie)			

2007					
A	**B**	**C**	**L**	**P**	**Y**
Moraal, H	Burger, RA	Bergh, JJ	Bezuidenhout, CC	Ferreira, SES	Brink, CB
Potgieter, M	De Jager, OC	Blignaut, S	Huisman, HM		Jansen van Rensburg, L
	Greyvenstein, GP	Breytenbach, JC	Malan, L		Loots, DT
	Raubenheimer, BC	Bruinsma, OSL	Rautenbach, C		Maboeta, M
	Swanepoel, JWH	Carstens, WAM			Mostert, K
	Van Dijk, AA	Cilliers, SS			Petzer, JJ
	Van Rooy, HF	De Jongh, PJ			Pienaar, J
	Vorster, HH	De Ridder, JH			Pieters, M
		Du Plessis, JJ			Saayman, A
		Du Plooy, HJG			Siebert, SJ
		Du Preez, JL			Schutte, AE
		Du Preez, LH			Van Deventer, HJM
		Du Toit, CDGDK			Van Huyssteen, GB
		Engelbrecht, P			Van Rooy, AJ
		Everson, RC			Kotze, AF
		Fourie, JH			Stander, L
		Geyer, HS			Strydom, C
		Grobler, LJ			Strydom, H
		Harvey, BH			
		Jerling, JC			
		Kellner, K			
		Kotze, HF			
		Krieg, HM			
		Kruger, GHJ			
		Kruger, HS			
		Liebenberg, W			
		Maake, N			
		Malan, SF			
		Materechera, SE			
		McPherson, M			
		Naude, WA			
		Neomagus, HWJP			
		Oliver, DW			
		Oosthuizen, IJ			
		Petersen, M			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, JJ			
		Robinson, JA			
		Rothmann, S			
		Rousseau, PG			
		Smit, JJA			
		Smuts, CM			

		Stander, L			
		Theron, PD			
		Van den Berg, J			
		Van der Merwe, APS			
		Van der Walt, DJ			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Van Rensburg, L			
		Van Rooyen, JM			
		Venter, CS			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vosloo, HCM			
		Waanders, FB			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolmarans, CT			

2008					
A	**B**	**C**	**L**	**P**	**Y**
Moraal, H	Burger, RA	Bergh, JJ	Bezuidenhout, CC	Ferreira, SES	Brink, CB
Potgieter, M	De Jager, OC	Blignaut, S	Huisman, HM		Jansen van Rensburg, L
	Greyvenstein, GP	Breytenbach, JC	Malan, L		Loots, DT
	Grobler, JJ	Carstens, WAM	Rautenbach, C		Mamabolo, RL
	Raubenheimer, BC	Cilliers, SS	Sewlall, H		Maboeta, M
	Swanepoel, JWH	De Jongh, PJ			Monyeki, MA
	Van Dijk, AA	De Ridder, JH			Mostert, K
	Van Rooy, HF	Du Pisani, J			O'Neill, FH
	Vorster, HH	Du Plessis, JJ			Petzer, JJ
	Van den Berg J	Du Plessis, W			Pienaar, JJ
	Van der Walt, DJ	Du Plooy, HJG			Pieters, M
		Du Preez, JL			Saayman, A
		Du Preez, LH			Siebert, SJ
		Du Toit, CDGDK			Schutte, AE
		Engelbrecht, P			Van Deventer, HJM
		Everson, RC			Van Huyssteen, GB
		Fourie, JH			Van Rooy, AJ
		Geyer, HS			Vorster, N
		Greeff, M			Mashele, HP
		Harvey, BH			
		Jerling, JC			
		Kellner, K			
		Kotze, HF			
		Krieg, HM			
		Kruger, GHJ			
		Kruger, HS			
		Liebenberg, W			
		Malan, SF			
		Materechera, SE			
		Naude, WA			
		Neomagus, HWJP			
		Oliver, DW			
		Oosthuizen, IJ			
		Van Rensburg, L			
		Van Rooyen, JM			
		Van der Merwe, APS			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Venter, CS			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vosloo, HCM			
		Waanders, FB			

		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolmarans, CT			
		Petersen, M			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, JJ			
		Robinson, JA			
		Rothmann, S			
		Rousseau, PG			
		Roux, C			
		Saayman, M			
		Smit, JJA			
		Smuts, CM			
		Stander, L			
		Strydom, C			
		Strydom, H			
		Theron, PD			
		Van der Walt, JL			

2009					
A	**B**	**C**	**L**	**P**	**Y**
Moraal, H	Burger, RA	Bergh, JJ	Bezuidenhout, CC	Ferreira, SES	Gericke, JW
Potgieter, M	De Jager, OC	Blignaut, S	Huisman, HM		Krügell, WF
	Gouws, JS	Breytenbach, JC	Malan, L		Loots, DT
	Greyvenstein, GP	Brink, CB	Sewlall, H		Maboeta, M
	Grobler, JJ	Carstens, WAM			Mamabolo, RL
	Swanepoel, JWH	Cilliers, SS			Mashele, HP
	Van den Berg J	Coetzee Van Rooy, AS			Monyeki, MA
	Van der Walt, DJ	De Jongh, PJ			Mostert, K
	Van Dijk, AA	De Ridder, JH			O'Neill, FH
	Van Rooy, HF	Du Pisani, J			Petzer, JJ
	Vorster, HH	Du Plessis, JJ			Pienaar, JJ
		Du Plessis, W			Pieters, M
		Du Plooy, HJG			Engelbrecht, P
		Du Preez, JL			Saayman, A
		Du Preez, LH			Schutte, AE
		Du Toit, CDGDK			Siebert, SJ
		Everson, RC			Van der Merwe, M
		Fourie, JH			Van Deventer, HJM
		Greeff, M			Van Huyssteen, GB
		Grobler, LJ			Van Rooy, AJ
		Harvey, BH			Vorster, N
		Huizenga, JM			Weldon, C
		Jansen van Rensburg, L			Schutte, R
		Jerling, JC			Smuts, CM
		Kotze, AF			Stander, L
		Krieg, HM			Strydom, C
		Kroeze, J			
		Kruger, GHJ			
		Kruger, HA			
		Kruger, HS			
		Liebenberg, W			
		Materechera, SE			
		Neomagus, HWJP			
		Oliver, DW			
		Oosthuizen, IJ			
		Petersen, M			
		Pienaar, AE			
		Pienaar, JJ			
		Rautenbach, C			
		Robinson, JA			
		Roos, V			
		Rothmann, S			
		Rousseau, PG			
		Roux, C			
		Roux, JC			
		Saayman, M			

		Schutte, AE			
		Smit, JJA			
		Stander, L			
		Strydom, C			
		Strydom, H			
		Theron, PD			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Van Rensburg, L			
		Van Rooyen, JM			
		Venter, CS			
		Viljoen, HM			
		Visser, JA			
		Viviers, W			
		Vorster, JM			
		Vorster, N			
		Vosloo, HCM			
		Waanders, FB			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wolmarans, CT			
		Wolmarans, CT			

2010					
A	**B**	**C**	**L**	**P**	**Y**
Moraal, H	Burger, RA	Barnard, E	Bezuidenhout, CC	Ferreira, SES	Gericke, JW
Potgieter, M	De Jager, OC	Bergh, JJ	Huisman, HM		Jansen van Rensburg, L
	Gouws, JS	Blignaut, S	Malan, L		Krügell, WF
	Greyvenstein, GP	Breytenbach, JC	Sewlall, H		Loots, DT
	Grobler, JJ	Brink, CB			Maboeta, M
	Labuschagne, LE	Carstens, WAM			Mamabolo, RL
	Lombaard, F	Cilliers, SS			Monyeki, MA
	Swanepoel, JWH	Coetzee Van Rooy, AS			Mostert, K
	Van den Berg J	De Jongh, PJ			O'Neill, FH
	Van der Walt, DJ	De Ridder, JH			Petzer, JJ
	Van Dijk, AA	Du Pisani, J			Pienaar, JJ
	Van Rooy, HF	Du Plessis, JJ			Pieters, M
	Vorster, HH	Du Plessis, W			Retief, FP
		Du Plooy, HJG			Saayman, A
		Du Preez, JL			Schutte, AE
		Du Preez, LH			Siebert, SJ
		Du Toit, CDGDK			Van der Merwe, M
		Engelbrecht, P			Van Deventer, HJM
		Everson, RC			Van Huyssteen, GB
		Fourie, JH			Van Rooy, AJ
		Greeff, M			Vorster, N
		Grobler, LJ			Frank, GF
		Harvey, BH			Roux, JC
		Huizenga, JM			Saayman, M
		Jerling, JC			
		Kellner, K			
		Kotze, AF			
		Kotze, HFnary			
		Krieg, HM			
		Kroeze, J			
		Kruger, GHJ			
		Kruger, HA			
		Kruger, HS			
		Liebenberg, L			
		Liebenberg, W			
		Materechera, SE			
		Mostert, K			
		Neomagus, HWJP			
		Oliver, DW			
		Oosthuizen, IJ			
		Petersen, M			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, JJ			
		Rautenbach, C			

		Robinson, JA			
		Roos, V			
		Rothmann, S			
		Rousseau, PG			
		Roux, C			
		Smit, JJA			
		Smuts, CM			
		Stander, L			
		Strydom, C			
		Strydom, H			
		Theron, PD			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Van Rensburg, L			
		Van Rooyen, JM			
		Venter, CS			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vosloo, HCM			
		Waanders, FB			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wolmarans, CT			

2011					
A	**B**	**C**	**L**	**P**	**Y**
Moraal, H	Burger, RA	Bergh, JJ	Huisman, HM	Ferreira, SES	Jansen van Rensburg, L
Potgieter, M	Gouws, JS	Blignaut, S			Monyeki, MA
	Grobler, JJ	Bouwman, H			Mostert, K
	Harvey, BH	Breytenbach, JC			N'Da, DD
	Labuschagne, LE	Brink, CB			Maboeta, M
	Lombard, F	Bunt, JR			Schutte, AE
	Moori, J	Carstens, WAM			Siebert, SJ
	Piketh, SJ	Cilliers, SS			Van Deventer, HJM
	Swanepoel, JWH	Coetzee-van Rooy, AS			Van Huyssteen, GB
	Van den Berg, J	De Jongh, PJ			Van Rooy, AJ
	Van der Walt, DJ	De Ridder, JH			
	Van Dijk, AA	Du Pisani, JA			
	Van Rooy, AJ	Du Plessis, J			
	Van Rooy, HF	Du Plessis, W			
	Venter, F	Du Plooy, HJG			
	Vorster, HH	Du Preez, JL			
		Du Preez, LH			
		Du Toit, CDGDK			
		Ebenso, E			
		Everson, RC			
		Ferreira, SES			
		Fourie, JH			
		Greeff, M			
		Grobler, LJ			
		Hamman, JH			
		Huisman, HM			
		Huisman, HW			
		Huizenga, J-M			
		Babalola, OO			
		Khalique, MCM			
		Kotze, AF			
		Krieg, HM			
		Kruger, GHJ			
		Kruger, HA			
		Kruger, HS			
		Liebenberg, W			
		Maboeta, M			
		Malan, L			
		Materechera, SE			
		Mukuddem-Petersen, JJ			
		Neomagus, HWJP			
		Odendaal, BJ			
		Oliver, DW			
		Olowo, OJ			
		Oosthuizen, IJ			
		Petersen, MA			

		Petzer, JP			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, J			
		Pienaar, JJ			
		Pieters, M			
		Rautenbach, C			
		Retief, FP			
		Robinson, JA			
		Roos,V			
		Rothmann, S			
		Rousseau, PG			
		Roux, CD			
		Roux, JC			
		Saayman, A			
		Saayman, M			
		Scholtz, W			
		Schutte, AE			
		Schutte, R			
		Sewlall, H			
		Smit, NJ			
		Smuts, CM			
		Stander, AL			
		Strydom, C			
		Strydom, H			
		Theron, L			
		Theron, PD			
		Van der Merwe, M			
		Van der Walt, JL			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Van Deventer, HJM			
		Van Huyssteen, GB			
		Van Rensburg, L			
		Van Rooyen, JM			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vorster, N			
		Vosloo, HCM			
		Waanders, FB			
		Weldon, C			
		Weyers, ML			
		Winde, F			

		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wolmarans, CT			

2012					
A	**B**	**C**	**L**	**P**	**Y**
Moraal, H	Burger , RA	Bergh, JJ	Wood, LA	Kotze, LJ	Claassens, S
Potgieter, M	Du Plessis, LM	Blignaut, S	Surujlal, J		Davel, MH
	Gouws, JS	Bouwman, H			Du Plessis, LH
	Harvey, BH	Breytenbach, JC			Frank, GF
	Labuschagne, LE	Brink, CB			Gericke, JW
	Lombard, F	Bunt, JR			Krugell, WF
	Moori, J	Carstens, WAM			Kruger, H
	Piketh, SJ	Cilliers, SS			Monyeki, MA
	Swanepoel, JWH	Coetzee-van Rooy, AS			N'Da, DD
	Van den Berg, J	Du Preez, JL			Ngole, VM
	Van der Walt, DJ	Du Plessis, J			Retief, FP
	Van Dijk, AA	Du Plessis, W			Schoeman, IM
	Van Rooy, AJ	Du Plooy, HJG			Taylor, JC
	Van Rooy, HF	Du Preez, JL			Van der Merwe, M
	Venter, F	Du Toit, CDGDK			Vorster, N
	Vorster, HH	Ebenso, E			Weldon, C
		Everson, RC			De Jongh, PJ
		Fourie, JH			De Ridder, JH
		Greeff, M			Du Pisani, JA
		Grobler, LJ			
		Hamman, JH			
		Huisman, HM			
		Huisman, HW			
		Huizenga, J-M			
		Idemudia, ES			
		Jerling, JC			
		Kellner, K			
		Khalique, MCM			
		Koornhof, HP			
		Kotze, AF			
		Krieg, HM			
		Kruger, A			
		Kruger, GHJ			
		Kruger, HS			
		Liebenberg, W			
		Loots, DT			
		Lubbe, MS			
		Manson, AH			
		Materechera, SE			
		Meihuizen, NCT			
		Mostert, K			
		Mukuddem-Petersen, JJ			
		Nel, A			
		Neomagus, HWJP			
		Odendaal, BJ			
		Oliver, DW			
		Oosthuizen, IJ			

		Petersen, MA			
		Petzer, JP			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, J			
		Pienaar, J			
		Pienaar, JJ			
		Pieters, M			
		Rautenbach, C			
		Retief, FP			
		Robinson, JA			
		Roos,V			
		Rothmann, S			
		Rousseau, PG			
		Roux, CD			
		Roux, JC			
		Saayman, A			
		Saayman, M			
		Scholtz, W			
		Schutte, AE			
		Schutte, R			
		Sewlall, H			
		Smit, NJ			
		Smuts, CM			
		Stander, AL			
		Stewart, L			
		Strydom, C			
		Strydom, H			
		Terblanche, JE			
		Theron, L			
		Theron, PD			
		Van der Merwe,			
		Van der Merwe, M			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Van Deventer, HJM			
		Van Huyssteen, GB			
		Van Rensburg, L			
		Van Rooyen, JM			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vorster, N			
		Vosloo, HCM			

		Waanders, FB			
		Weldon, C			
		Wepener, V			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wolhuter, CC			
		Wolmarans, CT			

2013					
A	**B**	**C**	**L**	**P**	**Y**
Haynes, RK	Böttcher, MB	Babalola, OO	Surujlal, J	Venter, C	Cilliers, EJ
Moraal, H	Burger, RA	Blignaut, S	Wood, LA		Claassens, S
Potgieter, MS	Du Plessis, LM	Bouwman, H			Davel, MH
	Gouws, JS	Breytenbach, JC			Du Plessis, JL
	Harvey, BH	Brink, CB			Du Plessis, LH
	Labuschagne, LE	Bunt, JR			Du Preez, P
	Moori, J	Carstens, WAM			Gericke, JW
	Piketh, SJ	Cilliers, SS			Gouws, R
	Swanepoel, JWH	Coetzee-van Rooy, AS			Havemann-Nel, L
	Van den Berg, J	Du Plooy, HJG			Krugell, WF
	Van der Walt, DJ	Du Preez, LH			Kruger, H
	Van Dijk, AA	Du Toit, CG			Kruger, M
	Van Rooy, AJ	Ebenso, E			Matthee, M
	Van Rooy, HF	Everson, RC			Mawire, A
	Venter, F	Ferreira, SES			Monyeki, MA
	Vorster, HH	Fourie, H			N'Da, DD
		Fourie, JH			Ngole, VM
		Froneman, JD			Retief, FP
		Greeff, M			Schoeman, IM
		Greyling, SF			Schutte, R
		Grobler, LJ			Stieger, N
		Hamman, JH			Taylor, JC
		Huisman, HM			Ter Horst, S
		Huisman, HW			Van der Merwe, M
		Huizenga, JM			Vorster, N
		Idemudia, ES			Weldon, C
		Jerling, JC			Jerling, JC
		Jonker, CS			Kellner, K
		Koornhof, HP			Khalique, CM
		Kotze, AF			Kotze, LJ
		Krieg, HM			
		Kruger, A			
		Kruger, GHJ			
		Kruger, HA			
		Kruger, HS			
		Liebenberg, W			
		Loots, DT			
		Lubbe, MS			
		Maboeta, MS			
		Malan, L			
		Manson, AH			
		Materechera, SA			
		Mbenga, B			
		Meihuizen, NCT			
		Milne, PJ			
		Mostert, K			
		Mukuddem-Petersen, J			

		Munyati, C			
		Nel, A			
		Neomagus, HWJP			
		Ngwenya, TL			
		Odendaal, BJ			
		Oduaran, AB			
		Oliver, DW			
		Olowu, OJ			
		Oosthuizen, IJ			
		Palamuleni, M			
		Petersen, M			
		Petersen, MA			
		Petzer, JP			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, J			
		Pienaar, JJ			
		Pieters, M			
		Rautenbach, C			
		Robinson, JA			
		Roos, V			
		Rossouw, JP			
		Rothmann, S			
		Rousseau, PG			
		Roux, C			
		Roux, CD			
		Saayman, A			
		Saayman, M			
		Scholtz, W			
		Schutte, AE			
		Sewlall, H			
		Smit, JJA			
		Smit, NJ			
		Smuts, CM			
		Stander, AL			
		Stander, L			
		Stewart, L			
		Strauss, DFM			
		Strydom, CA			
		Strydom, H			
		Terblanche, JE			
		Terre'blanche, G			
		Theron, LC			
		Theron, PD			
		Van der Merwe, APS			

		Van der Merwe, SP			
		Van der Waldt, G			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Van Deventer, HJM			
		Van Huyssteen, GB			
		Van Rensburg, L			
		Van Rooyen, JM			
		Van Schalkwyk, PL			
		Van Schoor, G			
		Venter, CS			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vosloo, HCM			
		Waanders, FB			
		Wepener, V			
		Westhuizen, FH			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wolmarans, CT			

2014					
A	**B**	**C**	**L**	**P**	**Y**
RK Haynes	Böttcher, MB	Babalola, OO	Surujlal, J	Venter, C	AA Du Plessis, AA
H Moraal	Burger, RA	Balfour, RJ	Wood, LA		Agbor, AAA
MS Potgieter	du Plessis, LM	Barnard, E			Cilliers, EJ
	Gouws, JS	Barnard, S			Claassens, S
	Harvey, BH	Bergh, JJ			Davel, MH
	Labuschagne, LE	Bessarabov, DG			DD N'Da, DD
	Lombard, F	Beukes, JP			Du Plessis, JL
	Moori, J	Blignaut, AS			Du Plessis, LH
	Piketh, SJ	Bouwman, H			Du Preez, P
	Swanepoel, JWH	Brink, CB			Fosso, E
	Van den Berg, J	Bunt, JR			Gericke, JW
	Van der Walt, DJ	Buys, PW			Gouws, R
	Van Dijk, AA	Carstens, WAM			Havemann-Nel, L
	Van Rooy, HF	Cilliers, SS			Khumalo, IP
	Venter, F	Coetzeevan, AS			Krugell, WF
	Vorster, HH	De Beer, DJ			Kruger, H
		De Ridder, JH			Kruger, M
		De Wet, FW			Legoabe, LJ
		Du Pisani, JA			Matthee, M
		Du Plessis, J			Mawire, A
		Du Plessis, W			Ngole, VM
		Du Plooy, HJG			Oukouomi, SC
		Du Preez, JL			Petzer, A
		Du Preez, LH			Retief, FP
		Du Toit, CG			Schoeman, IM
		Ebenso, E			Schutte, R
		Eita, JH			Stieger, N
		Everson, RC			Taylor, JC
		Ferreira, SES			Ter Horst, S
		Fourie, H			Thekisoe, MMO
		Fourie, JH			Van der Merwe, M
		Froneman, JD			Koornhof, HP
		Greeff, M			Kotze, AF
		Greyling, SF			Kotze, LJ
		Hamman, JH			
		Heystek, J			
		HS Kruger, HS			
		Huisman, HM			
		Huisman, HW			
		Idemudia, ES			
		Janse van Vuren, JH			
		Jerling, JC			
		Jordaan, PJ			
		Kellner, K			
		Khalique, CM			
		Krieg, HM			
		Kruger, A			

		Kruger, GHJ			
		Kruger, H			
		Kruger, HA			
		Kruger, M			
		Liebenberg, W			
		Loots, DT			
		Lubbe, MS			
		Maboeta, MS			
		Malan, L			
		Manson, AH			
		Materechera, SA			
		Matthee, M			
		Mbenga, BK			
		Meihuizen, NCT			
		Mentz, E			
		Milne, PJ			
		Mlambo, V			
		Monyeki, MA			
		Monyeki, MA			
		Mostert, K			
		Munyati, C			
		N'Da, DD			
		Nel, A			
		Neomagus, HWJP			
		Ngwenya, TL			
		Odendaal, BJ			
		Oduaran, AB			
		Oliver, DW			
		Olowu, OJ			
		Oosthuizen, IJ			
		Palamuleni, ME			
		Petzer, JP			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, J			
		Pienaar, JJ			
		Pieters, M			
		Prof LC Theron, LC			
		Rautenbach, C			
		Retief, FP			
		Robinson, JA			
		Roos, V			
		Rooy			
		Rossouw, JP			
		Rothmann, S			

		Roux, CD			
		Saayman, A			
		Saayman, M			
		Salawu, AS			
		Schutte, AE			
		Schutte, R			
		Smit, NJ			
		Smuts CM			
		Spanier, FA			
		Stewart, L			
		Stieger, N			
		Strauss, DFM			
		Strydom, CA			
		Strydom, H			
		Ter Horst, S			
		Terblanche, JE			
		Terre'blanche, G			
		Theron, PD			
		Van der Merwe, SP			
		Van der Waldt, G			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van Deventer, HJM			
		Van Huyststeen, GB			
		Van Niekerk, D			
		Van Rooyen, JM			
		Van Schalkwyk, PL			
		Van Schoor, G			
		Viljoen, FP			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vorster, N			
		Vosloo, HCM			
		Waanders, FB			
		Wepener, V			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wood, LA			

2015					
A	**B**	**C**	**L**	**P**	**Y**
RK Haynes	Avdeenkov, AV	Allison, JS	Wood, LA	Kotze, LJ	AA Du Plessis, AA
H Moraal	Barnard, E	Amoateng, AY	Surujlal, J	Venter, C	AA Du Plessis, AA
MS Potgieter	Boettcher, MB	Babalola, OO			Agbor, AAA
	Burger, RA	Balfour, RJ			Bahadur, I
	Du Plessis, LM	Bergh, JJ			Chitimira, H
	Ebenso, E	Bessarabov, DG			Cilliers, EJ
	Ferreira, SES	Beukes, JP			Claassens, S
	Gouws, JS	De Beer, JJJ			Coetzee, D
	Harvey, BH	De Jongh, PJ			Davel, MH
	Labuschagne, LE	De Ridder, JH			DD N'Da, DD
	Lombard, F	De Waal, E			De Beer, LT
	Moori, J	De Wet, FW			Du Plessis, JL
	Pienaar, JJ	Drewes, JE			Du Plessis, LH
	Piketh, SJ	Du Pisani, JA			Du Preez, P
	Schutte, AE	Du Plessis, J			Gericke, JW
	Smit, NJ	Du Plessis, W			Gidelew, AA
	Swanepoel, JWH	Du Plessis, Y			Gouws, R
	Ueckermann, EA	Du Plooy, HJG			Havemann-Nel, L
	Van den Berg, J	Du Preez, JL			Ngole, VM
	Van der Walt, DJ	Du Preez, LH			Olivier, JAK
	Van Dijk, AA	Du Toit, CGDK			Onwudiwe, DC
	Van Rooy, HF	Eita, JH			Oukouomi, SC
	Venter, F	Everson, RC			Petzer, A
	Vorster, HH	Fourie, H			Retief, FP
		Fourie, JH			Schoeman, IM
		Froneman, JD			Schutte, R
		Gericke, JW			Stieger, N
		Greeff, M			Taylor, JC
		Greyling, SF			Ter Horst, S
		Hamman, JH			Thekisoe, MMO
		Heystek, J			Van der Merwe, M
		Huisman, HM			Moss, SJ
		Huisman, HW			Oladele, OI
		Idemudia, ES			Roestenburg, WJH
		JL Van der Walt, JL			Smit, MH
		Jonker, CS			Stander, MW
		Jordaan, PJ			
		JR Bunt			
		Kellner, K			
		Khalique, CM			
		Kleynhans, EPJ			
		Koornhof, HP			
		Kotze, AF			
		Krieg, HM			
		Kruger, HA			
		Kruger, HS			
		Stewart, L			

		Strauss, DFM			
		Strydom, CA			
		Strydom, H			
		Terblanche, JE			
		Theron, PD			
		Van der Merwe, M			
		Van der Merwe, SP			
		Van der Waldt, DLR			
		Van der Waldt, G			
		Van der Westhuizen, FH			
		Van Deventer, HJM			
		Van Dyk, L			
		Van Huyssteen, GB			
		Van Niekerk, D			
		Van Rooyen, JM			
		Van Schalkwyk, PL			
		Van Schoor, G			
		Van Zyl, LE			
		Viljoen, HM			
		Viviers, W			
		Vorster, JM			
		Vosloo, HCM			
		Waanders, FB			
		Weldon, C			
		Wepener, V			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wood, LA			
		Zulu, CB			

2016					
A	**B**	**C**	**L**	**P**	**Y**
Haynes, RK	Avdeenkov, AV	Allison, JS		Venter, C	Agbor, AAA
Potgieter, MS	Barnard, E	Amoateng, AY		Kotze, LJ	Aucamp, ME
	Boettcher, MB	Babalola, OO			Baumgartner, J
	Burger, RA	Balfour, RJ			Cilliers, EJ
	Du Plessis, LM	Barnard, S			Claassens, S
	Ebenso, E	Bergh, JJ			Du Plessis, AA
	Ferreira, SES	Bessarabov, DG			Du Plessis, JL
	Gouws, JS	Beukes, JP			Du Plessis, LH
	Harvey, BH	Bezuidenhout, CC			Du Preez, D
	Labuschagne, LE	Blignaut, AS			Fosso Kankeu, E
	Lombard, F	Bouwman, H			Gouws, R
	Moori, J	Brink, CB			Havemann-Nel, L
	Pienaar, JJ	Bunt, JR			Khumalo, IP
	Piketh, SJ	Buys, PW			Knobloch-Coetzee, S
	Schutte, AE	Carstens, WAM			Kruger, H
	Smit, NJ	Cilliers, SS			Kruger, M
	Swanepoel, JWH	Coetzee-van Rooy, AS			Le Roux, M
	Ueckermann, EA	Davel, MH			Legoabe, LJ
	Van den Berg, J	De Beer, DJ			Matthee, M
	Van der Walt, DJ	De Beer, JJJ			Mawire, A
	Van Dijk, AA	De Jongh, PJ			Mels, CMC
	Van Rooy, AJ	De Ridder, JH			Middelberg, SL
	Van Rooy, HF	De Waal, E			Motadi, LR
	Venter, F	De Wet, FW			N'Da, DD
	Vorster, HH	Du Pisani, JA			Ngole, VM
		Du Plessis, J			Nienaber-Rousseau, C
		Du Plessis, W			Oukouomi Noutchie, SC
		Du Plessis, Y			Petzer, A
		Du Plooy, HJG			Schoeman, IM
		Du Preez, JL			Stieger, N
		Du Toit, CGDK			Taylor, JC
		Eita, JH			Ter Horst, S
		Everson, RC			Thekisoe, MMO
		Fourie, JH			Uren, KR
		Froneman, JD			
		Gericke, JW			
		Greeff, M			
		Greyling, SF			
		Hamman, JH			
		Heystek, J			
		Huisman, HM			
		Idemudia, ES			
		Janse van Vuren, JH			
		Jerling, JC			

		Jordaan, PJ			
		Kellner			
		Khalique, CM			
		Koornhof, HP			
		Kotze, AF			
		Krieg, HM			
		Kruger, HA			
		Kruger, HS			
		Liebenberg, W			
		Loots, DT			
		Loubser, SI			
		Lubbe, MS			
		Maboeta, MS			
		Maré, LP			
		Materechera, SA			
		Mbenga, BK			
		Meihuizen, NCT			
		Mentz, E			
		Milne, PJ			
		Monyeki, MA			
		Moss, SJ			
		Mostert, K			
		Neomagus, HWJP			
		Odendaal, BJ			
		Oduaran, AB			
		Olela-Otafudu, O			
		Oliver, DW			
		Palamuleni, ME			
		Petzer, JP			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, J			
		Pieters, M			
		Pieters, R			
		Prof A Nel			
		Prof C Munyati			
		Rautenbach, C			
		Retief, FP			
		Robinson, JA			
		Roos, V			
		Rossouw, JP			
		Rothmann, S			
		Saayman, A			
		Saayman, M			
		Salawu, AS			

		Schutte, R			
		Siebert, SJ			
		Smit, N			
		Smuts, CM			
		Spanier, FA			
		Stewart, L			
		Strauss, DFM			
		Strydom, CA			
		Strydom, H			
		Terblanche, JE			
		Terre'blanche, G			
		Theron, PD			
		Van der Merwe, M			
		Van der Merwe, P			
		Van der Merwe, SP			
		Van der Waldt, DLR			
		Van der Waldt, G			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van Deventer, HJM			
		Van Dyk, L			
		Van Huyssteen, GB			
		Van Niekerk, D			
		Van Rooyen, JM			
		Van Schalkwyk, PL			
		Van Schoor, G			
		Viljoen, FP			
		Viljoen, HM			
		Viviers, W			
		Vorster, H			
		Vorster, N			
		Vosloo, HCM			
		Waanders, FB			
		Weldon, C			
		Wepener, V			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wood, LA			
		Zulu, CB			

2017					
A	**B**	**C**	**L**	**P**	**Y**
Haynes, RK	Avdeenkov, AV	Allison, JS		Venter, C	Agbor, AAA
Potgieter, MS	Barnard, E	Amoateng, AY		Kotze, LJ	Aucamp, ME
	Boettcher, MB	Babalola, OO			Baumgartner, J
	Burger, RA	Balfour, RJ			Cilliers, EJ
	Du Plessis, LM	Barnard, S			Claassens, S
	Ebenso, E	Bergh, JJ			Du Plessis, AA
	Ferreira, SES	Bessarabov, DG			Du Plessis, JL
	Gouws, JS	Beukes, JP			Du Plessis, LH
	Harvey, BH	Bezuidenhout, CC			Du Preez, D
	Labuschagne, LE	Blignaut, AS			Fosso Kankeu, E
	Lombard, F	Bouwman, H			Gouws, R
	Moori, J	Brink, CB			Havemann-Nel, L
	Pienaar, JJ	Allison, JS			Khumalo, IP
	Piketh, SJ	Amoateng, AY			Knobloch-Coetzee, S
	Schutte, AE	Babalola, OO			Kruger, H
	Smit, NJ	Balfour, RJ			Kruger, M
	Swanepoel, JWH	Barnard, S			Le Roux, M
	Ueckermann, EA	Bergh, JJ			Legoabe, LJ
	Van den Berg, J	Bessarabov, DG			Matthee, M
	Van der Walt, DJ	Beukes, JP			Mawire, A
	Van Dijk, AA	Bezuidenhout, CC			Mels, CMC
	Van Rooy, AJ	Blignaut, AS			Middelberg, SL
	Van Rooy, HF	Bouwman, H			Motadi, LR
	Venter, F	Brink, CB			N'Da, DD
	Vorster, HH	Bunt, JR			Ngole, VM
		Buys, PW			Nienaber-Rousseau, C
		Carstens, WAM			Oukouomi Noutchie, SC
		Cilliers, SS			Petzer, A
		Coetzee-van Rooy, AS			Schoeman, IM
		Davel, MH			Stieger, N
		De Beer, DJ			Taylor, JC
		De Jongh, PJ			Ter Horst, S
		De Ridder, JH			Thekisoe, MMO
		De Waal, E			Uren, KR
		De Wet, FW			
		Drewes, JE			
		Du Pisani, JA			
		Du Plessis, J			
		Du Plessis, W			
		Du Plessis, Y			
		Du Plooy, HJG			
		Du Preez, JL			
		Du Preez, LH			
		Du Toit, CGDK			

		Eita, JH			
		Everson, RC			
		Fourie, H			
		Fourie, JH			
		Froneman, JD			
		Gericke, JW			
		Greeff, M			
		Greyling, SF			
		Hamman, JH			
		Heystek, J			
		Huisman, HM			
		Huisman, HW			
		Idemudia, ES			
		Janse van Vuren, JH			
		Jerling, JC			
		Jonker, CS			
		Jordaan, PJ			
		Kellner, K			
		Kellner, M			
		Khalique, M			
		Khalique, MCM			
		Koornhof, HP			
		Kotze, AF			
		Krieg, HM			
		Kruger, A			
		Kruger, HA			
		Kruger, HS			
		Liebenberg, W			
		Loots, DT			
		Loubser, SI			
		Lubbe, MS			
		Maboeta, MS			
		Malan, L			
		Maré, LP			
		Materechera, SA			
		Matthee, M			
		Mbenga, BK			
		Meihuizen, NCT			
		Mentz, E			
		Milne, PJ			
		Mlambo, V			
		Monyeki, MA			
		Moss, SJ			
		Mostert, K			
		Mukuddem-Petersen, J			

		Munyati, C			
		Neomagus, HWJP			
		Ngwenya, TL			
		Odendaal, BJ			
		Oduaran, AB			
		Olela-Otafudu, O			
		Oliver, DW			
		Palamuleni, ME			
		Petzer, JP			
		Pienaar, AE			
		Pienaar, GJ			
		Pienaar, J			
		Pieters, M			
		Pieters, R			
		Prof A Nel			
		Prof C Munyati			
		Rautenbach, C			
		Retief, FP			
		Robinson, JA			
		Roos, V			
		Rossouw, JP			
		Rothmann, S			
		Rousseau, PG			
		Saayman, A			
		Saayman, M			
		Salawu, AS			
		Schutte, R			
		Siebert, SJ			
		Smit, JJA			
		Smit, N			
		Smuts, CM			
		Spanier, FA			
		Stander, L			
		Stewart, L			
		Strauss, DFM			
		Strydom, CA			
		Strydom, H			
		Strydom, HA			
		Terblanche, JE			
		Terre’blanche, G			
		Theron, PD			
		Theron, PD			
		Van der Merwe, APS			
		Van der Merwe, M			
		Van der Merwe, P			

		Van der Merwe, SP			
		Van der Waldt, DLR			
		Van der Waldt, G			
		Van der Walt, JL			
		Van der Westhuizen, FH			
		Van der Westhuizen, PC			
		Van Deventer, HJM			
		Van Dyk, L			
		Van Huyssteen, GB			
		Van Niekerk, D			
		Van Rensburg, L			
		Van Rooyen, JM			
		Van Rooyen, PL			
		Van Schalkwyk, PL			
		Van Schoor, G			
		Venter, CS			
		Viljoen, FP			
		Viljoen, HM			
		Viviers, W			
		Vorster, H			
		Vorster, N			
		Vosloo, HCM			
		Waanders, FB			
		Weldon, C			
		Wepener, V			
		Weyers, ML			
		Winde, F			
		Wissing, DP			
		Wissing, MP			
		Wolhuter, CC			
		Wood, LA			
		Zulu, CB			

Appendix D: Common journal titles in GS, Scopus and WoS

Journal	GS	Scopus	WoS
AAPS PharmSciTech	1	1	1
Acarologia	1	1	1
ACS Chemical Neuroscience	1	1	1
Acta Academica	1	1	1
Acta horticulturae	1	1	1
Acta Mathematica Scientia	1	1	1
Acta Theologica	1	1	1
Acta Tropica	1	1	1
Acta Veterinaria Hungarica	1	1	1
Addiction	1	1	1
Advances in Mathematical Physics	1	1	1
Advances in Space Research	1	1	1
African Health Sciences	1	1	1
African Invertebrates	1	1	1
African Journal of Range and Forage Science	1	1	1
African Journal of reproductive health	1	1	1
African Zoology	1	1	1
Agroforestry Systems	1	1	1
AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV	1	1	1
AIDS Patient Care and STDs	1	1	1
AIDS Research and Human Retroviruses	1	1	1
AIDS Research and Therapy	1	1	1
Alcohol	1	1	1
American Economic Review	1	1	1
American Heart Journal	1	1	1
American Journal of Clinical Nutrition	1	1	1
American Journal of Hypertension	1	1	1
Amino Acids	1	1	1
Anatomical Record	1	1	1
Annals of Human Biology	1	1	1
Annals of Nuclear Energy	1	1	1
Annals of Nutrition and Metabolism	1	1	1
Antimicrobial Agents and Chemotherapy	1	1	1
Applicable Analysis	1	1	1
Applied Ecology and Environmental Research	1	1	1
Applied Economics Letters	1	1	1
Applied Mathematical Modelling	1	1	1
Applied Mathematics and Computation	1	1	1
Applied Mathematics Letters	1	1	1
Applied Research in Quality of Life	1	1	1
Applied Spectroscopy Reviews	1	1	1

Applied Stochastic Models in Business and Industry	1	1	1
Applied Surface Science	1	1	1
Aquatic Toxicology	1	1	1
Archives of Environmental Contamination and Toxicology	1	1	1
Archives of Toxicology	1	1	1
Astronomical Journal	1	1	1
Astronomy and Astrophysics	1	1	1
Astroparticle Physics	1	1	1
Astrophysical Journal	1	1	1
Astrophysical Journal Letters	1	1	1
Astrophysics	1	1	1
Astrophysics and Space Science	1	1	1
Atherosclerosis	1	1	1
Atmospheric Chemistry and Physics	1	1	1
Atmospheric Environment	1	1	1
Australian and New Zealand Journal of Psychiatry	1	1	1
Australian Psychologist	1	1	1
Automatica	1	1	1
Behavioural Pharmacology	1	1	1
Beilstein Journal of Organic Chemistry	1	1	1
Biochemical Journal	1	1	1
Biochemical Pharmacology	1	1	1
Biochemical Systematics and Ecology	1	1	1
Biocontrol Science	1	1	1
BioFactors	1	1	1
Bioinorganic Chemistry and Applications	1	1	1
Biologia Plantarum	1	1	1
Biological Psychology	1	1	1
BioMed Research International	1	1	1
Bioorganic and Medicinal Chemistry	1	1	1
Bioorganic and Medicinal Chemistry Letters	1	1	1
Biotechnology and Genetic Engineering Reviews	1	1	1
British Journal of Haematology	1	1	1
Bulletin of Entomological Research	1	1	1
Bulletin of Environmental Contamination and Toxicology	1	1	1
Bulletin of the Iranian Mathematical Society	1	1	1
Bulletin of the World Health Organization	1	1	1
Chemical Research in Toxicology	1	1	1
ChemMedChem	1	1	1
Chemosphere	1	1	1
Child: Care, Health and Development	1	1	1
Clinical and Experimental Hypertension	1	1	1
Clinical Psychology and Psychotherapy	1	1	1
Communications in Nonlinear Science and Numerical Simulation	1	1	1
Communications in Soil Science and Plant Analysis	1	1	1

Communications in Statistics - Theory and Methods	1	1	1
Complex Analysis and Operator Theory	1	1	1
Computer Physics Communications	1	1	1
Computer Speech and Language	1	1	1
Contemporary Clinical Trials	1	1	1
Criminal Justice and Behavior	1	1	1
Crop Protection	1	1	1
Cross-Cultural Research	1	1	1
Culture and Psychology	1	1	1
Current Cancer Drug Targets	1	1	1
Current Medicinal Chemistry	1	1	1
Current Pharmaceutical Biotechnology	1	1	1
Current Protein and Peptide Science	1	1	1
Desalination and Water Treatment	1	1	1
Developmental Neuroscience	1	1	1
Diabetes Care	1	1	1
Diabetes Research and Clinical Practice	1	1	1
Disaster Prevention and Management	1	1	1
Discrete Dynamics in Nature and Society	1	1	1
Disease Markers	1	1	1
Diseases of Aquatic Organisms	1	1	1
Drug Delivery	1	1	1
Drug Development and Industrial Pharmacy	1	1	1
Drug Metabolism Reviews	1	1	1
Early Child Development and Care	1	1	1
Earth-Science Reviews	1	1	1
EBioMedicine	1	1	1
Ecology	1	1	1
Ecology and Society	1	1	1
Economic and Industrial Democracy	1	1	1
Economic Modelling	1	1	1
Ecotoxicology	1	1	1
Ecotoxicology and Environmental Safety	1	1	1
Education and Urban Society	1	1	1
Education as Change	1	1	1
Electrochimica Acta	1	1	1
Electronic Journal of Linear Algebra	1	1	1
Endocrine	1	1	1
Energy and Fuels	1	1	1
Energy Conversion and Management	1	1	1
Energy for Sustainable Development	1	1	1
Entomologia Experimentalis et Applicata	1	1	1
Environment and Planning B: Planning and Design	1	1	1
Environment International	1	1	1
Environmental and Experimental Botany	1	1	1

Environmental Earth Sciences	1	1	1
Environmental Entomology	1	1	1
Environmental Health Perspectives	1	1	1
Environmental Impact Assessment Review	1	1	1
Environmental Pollution	1	1	1
Environmental Research	1	1	1
Environmental Science and Policy	1	1	1
Environmental Science and Pollution Research	1	1	1
Environmental Science and Technology	1	1	1
European Heart Journal	1	1	1
European Journal of Clinical Investigation	1	1	1
European Journal of Clinical Nutrition	1	1	1
European Journal of Drug Metabolism and Pharmacokinetics	1	1	1
European Journal of Human Genetics	1	1	1
European Journal of Medicinal Chemistry	1	1	1
European Journal of Nutrition	1	1	1
European Journal of Pharmaceutical Sciences	1	1	1
European Journal of Pharmaceutics and Biopharmaceutics	1	1	1
European Journal of Pharmacology	1	1	1
European Journal of Preventive Cardiology	1	1	1
European Journal of Taxonomy	1	1	1
European Journal of Tourism Research	1	1	1
European Journal of Work and Organizational Psychology	1	1	1
European Neuropsychopharmacology	1	1	1
European Polymer Journal	1	1	1
Experimental Agriculture	1	1	1
Experimental and Clinical Endocrinology and Diabetes	1	1	1
Expert Opinion on Drug Delivery	1	1	1
Expert Opinion on Drug Metabolism and Toxicology	1	1	1
Expert Opinion on Therapeutic Patents	1	1	1
Express Polymer Letters	1	1	1
Family Relations	1	1	1
Filomat	1	1	1
Finite Fields and their Applications	1	1	1
Folia Parasitologica	1	1	1
Food and Chemical Toxicology	1	1	1
Food and Nutrition Bulletin	1	1	1
Free Radical Research	1	1	1
Frontiers in Microbiology	1	1	1
Frontiers in Psychology	1	1	1
Fuel	1	1	1
Fuel Processing Technology	1	1	1
Geophysical Research Letters	1	1	1
Geoscience Frontiers	1	1	1
Global health action	1	1	1

Gondwana Research	1	1	1
Health and Quality of Life Outcomes	1	1	1
health policy and planning	1	1	1
Hormone and metabolic research = Hormon- und Stoffwechselforschung = Hormones et métabolisme	1	1	1
Human Mutation	1	1	1
Human Psychopharmacology	1	1	1
Hydrobiologia	1	1	1
Hydrometallurgy	1	1	1
Hypertension	1	1	1
Hypertension Research	1	1	1
IEEE Transactions on Industrial Electronics	1	1	1
IEEE Transactions on Magnetics	1	1	1
Indagationes Mathematicae	1	1	1
Industrial and Engineering Chemistry Research	1	1	1
Inflammation	1	1	1
Injury Prevention	1	1	1
Inorganica Chimica Acta	1	1	1
International Food and Agribusiness Management Review	1	1	1
International Journal for Equity in Health	1	1	1
International Journal for Parasitology: Parasites and Wildlife	1	1	1
International Journal of Acarology	1	1	1
International Journal of Antimicrobial Agents	1	1	1
International Journal of Behavioral Nutrition and Physical Activity	1	1	1
International Journal of Biochemistry and Cell Biology	1	1	1
International Journal of Cardiology	1	1	1
International Journal of Clinical Pharmacy	1	1	1
International Journal of Electrochemical Science	1	1	1
International Journal of Energy Research	1	1	1
International Journal of Environmental Research and Public Health	1	1	1
International Journal of Environmental Science and Technology	1	1	1
International Journal of Epidemiology	1	1	1
International Journal of Food Microbiology	1	1	1
International Journal of Food Sciences and Nutrition	1	1	1
International Journal of Human Resource Management	1	1	1
International Journal of Hypertension	1	1	1
International Journal of Mineral Processing	1	1	1
International Journal of Mobile and Blended Learning	1	1	1
International Journal of Modern Physics B	1	1	1
International Journal of Neuropsychopharmacology	1	1	1
International Journal of Obesity	1	1	1
International Journal of Pharmaceutics	1	1	1
International Journal of Phytoremediation	1	1	1
International Journal of Psychophysiology	1	1	1
International Journal of Remote Sensing	1	1	1

International Journal of Thermal Sciences	1	1	1
International Review of Research in Open and Distance Learning	1	1	1
Invertebrate Systematics	1	1	1
Journal for the Study of Religions and Ideologies	1	1	1
Journal of Analytical and Applied Pyrolysis	1	1	1
Journal of Animal Physiology and Animal Nutrition	1	1	1
Journal of Antimicrobial Chemotherapy	1	1	1
Journal of Applied Analysis and Computation	1	1	1
Journal of applied entomology	1	1	1
Journal of Applied Mathematics	1	1	1
Journal of Applied Microbiology	1	1	1
Journal of Applied Polymer Science	1	1	1
Journal of Arid Environments	1	1	1
Journal of Astronomy and Space Science	1	1	1
Journal of Atmospheric Chemistry	1	1	1
Journal of Black Psychology	1	1	1
Journal of Cachexia, Sarcopenia and Muscle	1	1	1
Journal of Career Assessment	1	1	1
Journal of Chemical Crystallography	1	1	1
Journal of Chemical Ecology	1	1	1
Journal of Chemical Sciences	1	1	1
Journal of Chemical Technology and Biotechnology	1	1	1
Journal of Chemical Thermodynamics	1	1	1
Journal of Chemistry	1	1	1
Journal of Chromatographic Science	1	1	1
Journal of Chromatography B: Analytical Technologies in the Biomedical and Life Sciences	1	1	1
Journal of Clinical Endocrinology and Metabolism	1	1	1
Journal of Clinical Hypertension	1	1	1
Journal of CO2 Utilization	1	1	1
Journal of Coastal Conservation	1	1	1
Journal of Coastal Research	1	1	1
Journal of Community and Applied Social Psychology	1	1	1
Journal of Computational and Graphical Statistics	1	1	1
Journal of Computational Chemistry	1	1	1
Journal of Computer-Mediated Communication	1	1	1
Journal of Convention and Event Tourism	1	1	1
Journal of Criminal Justice	1	1	1
Journal of Cross-Cultural Psychology	1	1	1
Journal of Empirical Research on Human Research Ethics	1	1	1
Journal of Energy in Southern Africa	1	1	1
Journal of Environmental Management	1	1	1
Journal of Ethnobiology and Ethnomedicine	1	1	1
Journal of Fluorine Chemistry	1	1	1
Journal of General Virology	1	1	1

Journal of Geophysical Research	1	1	1
Journal of geophysical research: space physics	1	1	1
Journal of Group Theory	1	1	1
Journal of Hazardous Materials	1	1	1
Journal of Heat Transfer	1	1	1
Journal of Helminthology	1	1	1
Journal of Industrial and Engineering Chemistry	1	1	1
Journal of Inherited Metabolic Disease	1	1	1
Journal of Liquid Chromatography and Related Technologies	1	1	1
Journal of Literary Studies	1	1	1
Journal of Materials Engineering and Performance	1	1	1
Journal of Medical Genetics	1	1	1
Journal of Medical Virology	1	1	1
Journal of Membrane Science	1	1	1
Journal of Molecular Liquids	1	1	1
Journal of Molecular Modeling	1	1	1
Journal of Morphology	1	1	1
Journal of Nanomaterials	1	1	1
Journal of Nanoscience and Nanotechnology	1	1	1
Journal of Natural History	1	1	1
Journal of Neural Transmission	1	1	1
Journal of Nonparametric Statistics	1	1	1
Journal of Nursing Management	1	1	1
Journal of Nutrition	1	1	1
Journal of Occupational Health Psychology	1	1	1
Journal of Optimization Theory and Applications	1	1	1
Journal of Personality	1	1	1
Journal of Personality and Social Psychology	1	1	1
Journal of Personnel Psychology	1	1	1
Journal of Pharmaceutical Sciences	1	1	1
Journal of Pharmacy and Pharmaceutical Sciences	1	1	1
Journal of Pharmacy and Pharmacology	1	1	1
Journal of Physical Chemistry A	1	1	1
Journal of Physical Chemistry B	1	1	1
Journal of Physical Chemistry C	1	1	1
Journal of Physics D: Applied Physics	1	1	1
Journal of Phytopathology	1	1	1
Journal of Policy Research in Tourism, Leisure and Events	1	1	1
Journal of Positive Psychology	1	1	1
Journal of Psychopharmacology	1	1	1
Journal of Reproductive and Infant Psychology	1	1	1
Journal of Soils and Sediments	1	1	1
Journal of Special Education	1	1	1
Journal of Sports Medicine and Physical Fitness	1	1	1
Journal of Statistical Computation and Simulation	1	1	1

Journal of Teaching in Travel and Tourism	1	1	1
Journal of the Association of Nurses in AIDS Care	1	1	1
Journal of the Geological Society	1	1	1
Journal of the Southern African Institute of Mining and Metallurgy	1	1	1
Journal of the Taiwan Institute of Chemical Engineers	1	1	1
Journal of Theoretical and Computational Chemistry	1	1	1
Journal of Thermal Analysis and Calorimetry	1	1	1
Journal of Third World Studies	1	1	1
Journal of Thrombosis and Haemostasis	1	1	1
Journal of Travel and Tourism Marketing	1	1	1
Journal of Urban Design	1	1	1
Journal of Urban Planning and Development	1	1	1
Journal of Vacation Marketing	1	1	1
Journal of vector ecology	1	1	1
Journal of Virology	1	1	1
Journal of Water and Health	1	1	1
JRAAS - Journal of the Renin-Angiotensin-Aldosterone System	1	1	1
Koedoe	1	1	1
Lancet	1	1	1
Land degradation and development	1	1	1
Language Resources and Evaluation	1	1	1
Latin American Journal of Pharmacy	1	1	1
Leisure Studies	1	1	1
Linear Algebra and Its Applications	1	1	1
Linguistic Review	1	1	1
Lipids	1	1	1
Livestock Science	1	1	1
Lung	1	1	1
Malaria Journal	1	1	1
Malawi Medical Journal	1	1	1
Marine Pollution Bulletin	1	1	1
Materials	1	1	1
Materials Letters	1	1	1
Materials Research Bulletin	1	1	1
Mathematical Problems in Engineering	1	1	1
Medicinal Chemistry Research	1	1	1
Metabolic Brain Disease	1	1	1
Metabolism: Clinical and Experimental	1	1	1
Metallurgical and Materials Transactions B: Process Metallurgy and Materials Processing Science	1	1	1
Microchimica Acta	1	1	1
Mineralium Deposita	1	1	1
Minerals Engineering	1	1	1
Molecular Biology	1	1	1
Molecular Nutrition and Food Research	1	1	1

Molecular Pharmaceutics	1	1	1
Molecular Phylogenetics and Evolution	1	1	1
Molecular Simulation	1	1	1
Molecules	1	1	1
Monthly Notices of the Royal Astronomical Society	1	1	1
Nature	1	1	1
Neurochemical Research	1	1	1
Neuroscience	1	1	1
Neuroscience and Biobehavioral Reviews	1	1	1
New England Journal of Medicine	1	1	1
Nitric Oxide - Biology and Chemistry	1	1	1
Nonlinear Dynamics	1	1	1
Nuclear Engineering and Design	1	1	1
Nutrient Cycling in Agroecosystems	1	1	1
Nutrients	1	1	1
Obesity	1	1	1
Oecologia	1	1	1
OMICS A Journal of Integrative Biology	1	1	1
Operator Theory: Advances and Applications	1	1	1
Optimization Letters	1	1	1
Ore Geology Reviews	1	1	1
Papers in Regional Science	1	1	1
Parasitology	1	1	1
Patient Preference and Adherence	1	1	1
Peptides	1	1	1
Perceptual and Motor Skills	1	1	1
Personality and Individual Differences	1	1	1
Pest Management Science	1	1	1
Pharmaceutical Biology	1	1	1
Pharmacogenomics Journal	1	1	1
Pharmacology Biochemistry and Behavior	1	1	1
Pharmazie	1	1	1
Philosophical Transactions of the Royal Society B: Biological Sciences	1	1	1
Phycological Research	1	1	1
Physical Review D - Particles, Fields, Gravitation and Cosmology	1	1	1
Physical Review Letters	1	1	1
Physiologia Plantarum	1	1	1
Physiology and Behavior	1	1	1
Phytoparasitica	1	1	1
Phytotherapy Research	1	1	1
Plant Physiology and Biochemistry	1	1	1
Planta Medica	1	1	1
PLoS Medicine	1	1	1
PLoS ONE	1	1	1
PLoS Pathogens	1	1	1

Polymer	1	1	1
Positivity	1	1	1
Potchefstroom electronic law journal	1	1	1
Pramana - Journal of Physics	1	1	1
Procedia Computer Science	1	1	1
Professional Development in Education	1	1	1
Progress in Neuro-Psychopharmacology and Biological Psychiatry	1	1	1
Prostaglandins Leukotrienes and Essential Fatty Acids	1	1	1
Protein and Peptide Letters	1	1	1
Psychiatric Clinics of North America	1	1	1
Psychopharmacology	1	1	1
Psychophysiology	1	1	1
Psychosomatic Medicine	1	1	1
Public Administration and Development	1	1	1
Public Health Nutrition	1	1	1
Quaestiones Mathematicae	1	1	1
Qualitative Health Research	1	1	1
Qualitative Research in Psychology	1	1	1
Range Management and Agroforestry	1	1	1
Recent patents on CNS drug discovery	1	1	1
Redox Report	1	1	1
Regulatory Peptides	1	1	1
Reproduction in Domestic Animals	1	1	1
Research in African Literatures	1	1	1
Research in Developmental Disabilities	1	1	1
Research on Chemical Intermediates	1	1	1
Results in Physics	1	1	1
Reviews in Chemical Engineering	1	1	1
Reviews of Environmental Contamination and Toxicology	1	1	1
RSC Advances	1	1	1
Scandinavian Journal of Immunology	1	1	1
School Psychology International	1	1	1
Science	1	1	1
Science of the Total Environment	1	1	1
Scientific Reports	1	1	1
Sensors (Switzerland)	1	1	1
Skin Research and Technology	1	1	1
Social Indicators Research	1	1	1
Soil and Sediment Contamination	1	1	1
Soil and Tillage Research	1	1	1
Soil Biology and Biochemistry	1	1	1
Solar Physics	1	1	1
South African Geographical Journal	1	1	1
South African Journal of Chemistry	1	1	1
South African Journal of Economic and Management Sciences	1	1	1

South African Journal of Economics	1	1	1
South African Journal of Education	1	1	1
South African Journal of Industrial Engineering	1	1	1
South African Journal of Psychology	1	1	1
South African Journal of Science	1	1	1
Southern African Linguistics and Applied Language Studies	1	1	1
Space science reviews	1	1	1
Speech Communication	1	1	1
Stress and Health	1	1	1
Studies in World Christianity	1	1	1
Systematic Parasitology	1	1	1
Technometrics	1	1	1
Test	1	1	1
Tetrahedron Letters	1	1	1
The Lancet	1	1	1
Thermochimica Acta	1	1	1
Tropical Medicine and International Health	1	1	1
Tropical Plant Pathology	1	1	1
Tuberculosis	1	1	1
Turkish Journal of Mathematics	1	1	1
Turkish Journal of Zoology	1	1	1
Urban Ecosystems	1	1	1
Veterinary Research	1	1	1
Virology Journal	1	1	1
Water	1	1	1
Water SA	1	1	1
World Journal of Microbiology and Biotechnology	1	1	1
Zeitschrift fur Naturforschung - Section A Journal of Physical Sciences	1	1	1
ZooKeys	1	1	1
Zootaxa	1	1	1