THE INTERPRETATION AND APPLICATION OF TRIANGULATION IN INFORMATION SYSTEMS RESEARCH

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DEDICATION

I dedicate my work to my son Dilima for the inspiration he brings in my life; “raising you my son is the central experience of my life. You are the greatest source of my self-awareness, and my true fountain of pride and joy. I will forever be your advocate and my love for you is abiding and unconditional”.

DECLARATION

I hereby declare that this thesis, presented to the University of KwaZulu-Natal, is my own original work and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree at this or any other University, except where due acknowledgement has been made in the text.

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ABBREVIATIONS

DITMAST: Data, Investigator, Theoretical, Methodological, Analyst, Space, and Time triangulation

GPS: The Global Positioning System

JAMIA: Journal of the American Medical Informatics Association

IS : Information Systems

ISR: Information Systems Research Journal

MTMM: The Multitrait-Multimethod Matrix

MIS: Management Information Systems

SU: Stellenbosch University

UCT: University of Cape Town

UKZN: University of KwaZulu-Natal

VEER: Validation, Explanation, Enriching, and Refuting

Wits: University of the Witwatersrand

ABSTRACT
THE INTERPRETATION AND APPLICATION OF TRIANGULATION IN INFORMATIONS SYSTEMS RESEARCH

Scholars argue that a single research method is inadequate to investigate a complex phenomenon. As a result, there is growing interest in academic communities in the practicability of mixing research techniques in a process of triangulation. The purpose of this study was to investigate the interpretation and application of triangulation within the disciplines of information systems (IS) at four universities in South Africa; the University of KwaZulu-Natal, the University of Cape Town, the University of the Witwatersrand, and Stellenbosch University. This study employed the exploratory and descriptive research designs, and mixed methods. The target population were academic staff in the IS disciplines. Census and purposive sampling were used to select participants for the quantitative and qualitative study respectively. A sample size of fifty (50) and eight (8) academics was drawn for the quantitative study and qualitative study respectively. Data was collected using document collection, questionnaires, and in-depth interviews. In-depth interviews and documents were analysed using thematic analysis technique. Questionnaires were analysed using the Statistical Package for the Social Sciences (SPSS) version 22.1. The findings show that all (100 per cent) respondents were aware of triangulation. Data source triangulation (100.0 per cent) and methodological (82.4 per cent) are the most known types of triangulation. Methodological (90.2 per cent), investigator (67.0 per cent), data source (65.6 per cent), space (60.8 per cent), theory (52.9 per cent), time (41.1 per cent) and analyst (14.0 per cent) triangulation are the most used in this order. In spite of high respondents' high levels of knowledge of triangulation, the seven types of triangulation are mainly used to validate research findings and explain research problems. There is thus a gap between the knowledge of triangulation and application of triangulation. IS academics find it easy to use data source (65.6 per cent), time (45.3 per cent), methodological (37.0 per cent), investigator (35.0 per cent), time (40.0 per cent), time (29.0 per cent), and space triangulation (23.5 per cent) in this order. Intradisciplinary triangulation is the most used than interdisciplinary triangulation. The findings indicate that academics with doctorates find it easier to use different types of triangulation than those with master's degrees. The findings show that the frequently used type of triangulation is data source (19.0 per cent) and methodological (14.0 per cent). Largely, the study suggests that triangulation should be interpreted as Data source, Investigator, Theoretical, Methodological, Analyst, Space, and Time (DITMAST) triangulation, and to be used to Validate findings, Explain research problem, Enrich research instruments, and Refute findings (VEER). There is need to empower IS academics with knowledge on the interpretation of the different types of triangulation (DITMAST) and their application (VEER) in research.

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CHAPTER ONE

BACKGROUND AND INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

This study investigated the interpretation and application of triangulation in Information Systems (IS) research at four of the top-ranking universities in South Africa. Scholars argue that a single research technique is inadequate to investigate an intricate phenomenon (Creswell and Plano Clark, 2011; Hesse-Biber, 2010; Tashakkori and Teddlie, 2010). As a result, there is growing interest among IS academic communities in the practicability of mixing research techniques using a process of triangulation. The main feature of triangulation is methodological multiplicity that provides broader perspectives than those offered by monomethod designs (Johnson, Onwuegbuzie and Turner, 2007). Taken as a whole, the purpose and central premise of triangulation is that the use of multiple research techniques provides a better understanding of a research problem than either technique alone. In spite of calls for IS triangulation research, the interpretation and application of triangulation remains a neglected study area. As a result, it is not known how triangulation is understood and used in IS research. The purpose of this study was to investigate the interpretation and application of triangulation in IS research at the University of KwaZulu-Natal (UKZN), the University of Cape Town (UCT), the University of the Witwatersrand (Wits) and Stellenbosch University (SUN). The chapter starts by presenting the background to the study, the research problem, the aim of the study, research questions, research objectives, a brief introduction to the research methodology, the research design or blueprint study site, sampling techniques, and data collection and analysis techniques. The chapter also explores the limitations of the study and the definitions of terms and closes with a conclusion.

1.2 BACKGROUND TO THE STUDY

The precise origins of triangulation are not known. However, triangulation was commonly used in ancient Greece (Rugg, 2010). More specifically, triangulation was used in geometry

to determine the location of a fixed point based on the laws of trigonometry (Hammersley, 2008). The laws of trigonometry state that if one side and two angles of a triangle are known, the other two sides and angle can be calculated (Rugg, 2010). Later, triangulation was employed in surveying and navigation (Onwuegbuzie and Leech, 2006). Johnson (2010) stated that triangulation is the principle behind the Global Positioning System technology (GPS). A GPS receiver processes radio signals sent from four different space-based satellites to establish altitude, longitude and latitude (Rugg, 2010). Johnson (2010) argues that, in theory, the signals from three satellites could be used to determine location. However, four satellites are used in order to improve the precision of the measurement (Rugg, 2010).

Triangulation was later extended beyond its mathematical origins in the 1970s when scholars started to use the approach as a sociological research methodology (Denzin and Lincoln, 2011).

Campbell and Fiske (1959) introduced the idea of using triangulation in one study when they published a paper that discussed different ways of validating research findings through the application of what they termed a 'multitrait-multimethod matrix' a technique for measuring several traits simultaneously using several methods. However, Webb, Donald, Campbell, Schwartz and Lee (1966) coined the term 'triangulation' in their studies on nonreactive measures in the discipline of social sciences. Denzin (1978), as cited in Patton (2007), provided a comprehensive explanation of how triangulation can be used as a research strategy comprising four components: a data source that included time and space, investigator, methodological, and theory triangulation, though Denzin only seriously considers the first three types of triangulation.

As mentioned above, given the basic principle of geometry that multiple perspectives allow for greater accuracy, researchers argued that using triangulation or different research techniques in the same study may improve the credibility and validity of research findings (Yin, 2009; Denzin and Lincoln, 2011). Tashakkori and Teddlie (2010) stated that

triangulation allows a study to merge the strengths of research techniques to generate knowledge that can deepen and enhance researchers' comprehension of a phenomenon under study. Triangulation can help to promote new ideas that can provide answers to research problems that are hard to interrogate using one research technique (Creswell, 2009). Denzin (2009) explained that triangulation helps to enrich, refute, confirm and explain the research problem, thus deepening and widening researchers' understanding of a phenomenon (see also Patrick, 2009).

Other scholars stated that triangulation leads to richer findings and higher quality research (Creswell, 2013; Fidel, 2008; Patton, 2007). These findings inspired interest in IS research communities in the use of triangulation to examine the same dimension of a research problem (Johnson and Christensen, 2012).

Triangulation has been employed as a research approach in social sciences research for more than fifty years (Creswell, 2009). In the field of IS, a significant number of researchers have been promoting the use of triangulation as far back as the early 1980s, such as Mingers (2001), Petter and Gallivan (1991), Lee (1991), Robey (1996), and Peng, Nunes and Annansingh (2011).

In spite of sturdy and constant support from some IS researchers (Wand and Weber, 2002; Whitman and Woszczynski, 2003), there is a dearth of research on the interpretation and application of triangulation. Mingers (2003) conducted a literature review on IS studies between 1993 and 2000 and found that only 20 per cent qualified to be regarded as methodological triangulation research (Venkatesh, Brown and Bala, 2013; Fidel, 2008).

The causes of the limited understanding and surprisingly low adoption rate of triangulation in IS research are not known. Some researchers argue that the low application rate of triangulation is due to misunderstanding among researchers in the field of IS as to the actual meaning of triangulation (Dennis and Valacich, 2002; Mingers, 2001). As a result,

triangulation is understood as methodological triangulation, using quantitative and qualitative methods in the same study (Hammersley, 2008; Fink, 2005). Fidel (2008) explained that a lack of a common understanding of the meaning of triangulation in IS research makes it hard for researchers to make a decision as to which triangulation approach would be fitting for different studies.

Mingers (2003) also mentioned that the low application rate of triangulation in IS research is caused by the challenges involved in integrating and making sense of the various facets of triangulation across the entire study. Besides, the researcher a lecturer in Research Methodology has witnessed low levels of the integration of triangulation in theses and research paper reviewed. Therefore, the researcher's interest in research procedures or techniques used to identify, select, process, and analyse information contributed to the decision to conduct this study. It is therefore correct to state that the gap in knowledge in the interpretation and application of triangulation and the low rate of adoption of triangulation in IS research gave rise to this study. For example, there is no study the researcher is aware of that explains triangulation by looking at the different dimensions of triangulation and how triangulation is used in every aspect as proposed in a study. Therefore, the existing understanding and use of triangulation is not clear and characterised by misinterpretations resulting in misapplication on triangulation (Davies, 2012).

1.3 RESEARCH PROBLEM

A review of the literature on IS research on triangulation between 1993 and 2008 indicates that triangulation is generally understood as methodological triangulation (Venkatesh, Brown and Bala, 2013). Even then, Davies (2012) conducted a study that reviewed research methods used in articles published in the Information Systems Research (ISR) Journal. The study found that single methodologies were popular in ISR articles (56 per cent). The findings further show that 44 per cent of articles used mixed methods and only 15 per cent qualified to be regarded as purely methodological triangulation. For example, in Mingers' (2008) study on the articles reviewed, triangulation is misconstrued as methodological triangulation, overlooking other types of triangulation such as investigator, data source, theory, analyst,

space, and time triangulation. Besides, there is no study the researcher is aware of that investigates the interpretation and application of triangulation in IS research in particular institutions of higher learning.

1.4 AIM OF THE STUDY

The aim of the study was to explore the interpretation and application of triangulation in IS research using the Data source, Investigator, Theoretical, Methodological, Analysis, Space and Time (DITMAST) and the Validation of findings, Enriching of research instruments, Explaining of unanticipated research problems, and Refuting of research findings (VEER) triangulation conceptual frameworks as the basis of the investigation. The literature shows that different triangulation concepts developed to explain the meaning of triangulation but there is no agreement on the meaning of triangulation among IS researchers. This study combined different concepts of triangulation to form the DITMAST and VEER triangulation conceptual frameworks used to study the interpretation of triangulation and usage of triangulation in IS research respectively. To the best of the researcher's knowledge, no study has ever been conducted to assess the interpretation and application of triangulation in IS research in institutions of higher learning.

1.5 PURPOSE OF THE STUDY

The main purpose of this study was to assess the phenomenon of triangulation by ascertaining the different types of triangulation and purposes of triangulation in IS research at institutions of higher learning. Specifically, the study investigated the interpretation and use of triangulation focusing on the knowledge, usage, usability and frequency of the use of triangulation among IS academics.

1.6 CONTRIBUTIONS OF THE STUDY

This study is crucial in several ways to researchers, universities, module developers and stakeholders. For research management in South African universities, the findings from this

study provide a more reliable scientific analysis to enable the understanding and use of triangulation in research. In addition, the study serves as a valuable source of information that brings to light the changing nature of triangulation in IS research. It reveals several types of triangulation and usages, as well as providing empirical support for research management planning decisions in numerous vital areas of research operations, to facilitate research that is valid, deep and wide in its understanding of research problems.

For module or course outline developers, the findings of this study provide vital insights and guidance in designing credible outlines for research methodology courses.

For other stakeholders, the study provides important information that will allow lecturers, academic leaders and others to provide useful suggestions for improvement in the interpretation and application of triangulation to promote quality research.

In essence, this study combines both basic and applied research. As basic research, it reveals how triangulation is interpreted and applied in IS research. As applied research, the knowledge generated has been used to integrate the DITMAST and VEER triangulation conceptual frameworks to inform IS research on the interpretation and usage of triangulation respectively. The integrated conceptual frameworks may help IS researchers to respond to the universities' calls for quality assurance in teaching and learning of research methodology, and research conducted by both students and IS academic staff.

1.7 RESEARCH OBJECTIVES

Research objectives provide an accurate description of the specific issues to be achieved in a study. Yin (2009) states that research objectives should be framed in single sentences and should directly tap into the research questions. The main research objective is to understand the interpretation and application of triangulation in Information Systems (IS) research at four

of the top-ranking universities in South Africa broken down in the following sub-research objectives.

- To understand the interpretation and application of data triangulation in IS research at four of the top-ranking universities in South Africa.
- To ascertain the interpretation and application of investigator triangulation in IS research at four of the top-ranking universities in South Africa.
- To ascertain the interpretation and use of theory triangulation in IS research at four of the top-ranking universities in South Africa.
- To understand the interpretation and application of methodological triangulation in IS research at four of the top-ranking universities in South Africa.
- To determine the interpretation and application of analyst triangulation in IS research at four of the top-ranking universities in South Africa.
- To understand the interpretation and application of time triangulation in IS research at four of the top-ranking universities in South Africa.
- To understand the interpretation and application of space triangulation in IS research at four of the top-ranking universities in South Africa.

1.8 RESEARCH QUESTIONS

A research question is a question that a research project sets out to answer. Research questions are informed by the research objectives above. The main research questions is; how do academics' interpret and apply triangulation in Information Systems (IS) research at four of the top-ranking universities in South Africa? The main research question has the following sub-research questions.

- How is data triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?

- How is investigator triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?
- How is theoretical triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?
- How is methodological triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?
- How is analysis triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?
- How is space triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?
- How is time triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?

1.9 METHODOLOGY

The chronological order approach to literature review was used to review the literature on triangulation. The review is divided into different phases: (i) formative, (ii) paradigm debate, (iii) procedural development, (iv) advocacy stage, and (v) triangulation in general, and in IS research. To understand the interpretation of triangulation, the study was underpinned by Denzin, Jick and Patton (1990) and Cohen and Manion's (1997) concepts of triangulation and put together by the researcher into a conceptual framework. The framework states that there are seven types of triangulation: data: investigator, theory, methodological, analyst, space and time (DITMAST). To understand the application of triangulation ideas on the usage of triangulation were assembled to develop a conceptual framework that explains that triangulation in research is used for four purposes: validation, enriching research instruments, explaining research findings, and refuting research findings (VEER) (Patrick, 2009).

This study employed the exploratory and descriptive research designs to realise the objectives of this study. The study used sequential explanatory methodology to underpin the study. The

reason for using sequential explanatory methodology was to ensure that findings generated using qualitative research methodology are used to help explain and understand the research findings gathered using quantitative methodology (Crooks, Schuurman, Cinnamon, Castleden and Johnston, 2011; Farmer, Robinson, Elliott and Eyles, 2006). The study was conducted at four of the top-ranking South African universities: the University of KwaZulu-Natal, the University of the Witwatersrand, the University of Cape Town and Stellenbosch University. The target population for this study were academics in IS disciplines at the four universities under study. In the study, the accessible population were all academics in IS disciplines. Non-probability sampling methods were employed to help select academic staff for inclusion in the sample. The purposive sampling method was used to determine the sample for the qualitative study, and the census sampling method was used to determine the sample for the quantitative study. Fifty academic staff from the four IS disciplines at the University of KwaZulu-Natal, the University of the Witwatersrand, the University of Cape Town and Stellenbosch University participated in the quantitative study. Eight (8) participants, two from each of the four disciplines, was drawn for the qualitative study. Three research techniques were used to collect data: document collection, questionnaires and in-depth interviews.

Data collected using in-depth interviews were analysed using the thematic analysis technique (Braun and Clarke, 2012). Documents collected were analysed using content analysis (Joffe and Yardley, 2004), and data collected using questionnaires were analysed using descriptive and inferential statistics (Creswell, 2013).

1.10 LIMITATION OF THE STUDY

There is one noteworthy limitation in this study: generalisability effects. The generalisability of these research findings is limited because the sample was generated in one discipline, IS. This liability was clear at the outset. However, because the inquiry was intended to generate relatively clear and specific integrated triangulation conceptual frameworks that can be applied to practical experiences, it should be relatively easy to design a series of focused testing studies at the university level to verify and expand the triangulation conceptual frameworks. Future studies would be much more likely to produce findings that are

generalisable to South African universities. Studies should also look at the interaction of the different types of triangulation.

1.11 THE CONCEPTUAL BASIS FOR THE STUDY

This section presents definition of the key concepts used in this study to help understand the research problem and delimitate scope of the study.

- **Interpretation:** is an act of explaining a subject usually to others for understanding (Babbie, 2007). Interpretation requires that the interpreter first understands the piece of text or idea to give a good explanation of the piece (Greene, 2007).

- **Application:** means applying or putting something to a special use. The application of something happens because of its capacity of being usable and relevant to research or people (Bryman, 2007).

- **Data triangulation:** holds that it is possible to collect data from multiple sources and compare the results to offset the limitations of using one data source (Farmer et al., 2006).

- **Investigator triangulation:** explains that using two or more investigators such as observers, researchers or interviewers with varied research training backgrounds in one study to assess the same research problem and compare the results can increase the reliability of research findings (Archibald, 2016).

- **Theoretical triangulation:** uses several theories when studying a phenomenon and comparing the results increases the reliability of the research findings (Denzin, 2012).

- **Methodological triangulation:** uses multiple research methods in one study and comparing the results decreases the weaknesses that stem from using a single research method to examine a phenomenon (Morgan, 2007).

- **Analyst triangulation:** Cohen and Manion (1997) hold that several analysts or analysis techniques can be used to study the same problem and compare the results to increase the quality of the research (Fielding, 2012).

- **Space triangulation:** states that different spaces or places can be used to study one research problem and compare the results to increase the quality of the research (Fielding, 2012).

- **Time triangulation:** explains that it is possible to increase the quality of research by conducting research at different times on the same research problem and comparing the results (Greene, 2007).

- **Participants:** people who play a part in a specific activity (Hesse-Biber, 2010). Creswell (2009) explains that participants are people used by researchers to provide data needed to understand the research problem under study. In the context of this study, the participants are IS academics who participated both in the quantitative and qualitative study.

1.12 SUMMARY

The chapter dealt with the background to the study, the research problem, the aim of the study, research questions, research objectives, and presented a concise introduction to the research methodology; research design, methods, study site, sampling techniques, data collections, and analysis methods. The chapter also presented the limitations of the study, and the definition of terms. Chapter two presents literature review, chapter three the conceptual frameworks

underpinning the study, chapter four the research methodology, chapter five the data presentation, chapter six data analysis and discussion, chapter seven conclusion of the study, and chapter eight contribution of the study to the body of knowledge.

The following chapter presents the literature review.

CHAPTER TWO

LITERATURE REVIEW

HISTORICAL ANALYSIS OF THE ORIGINS OF TRIANGULATION

2.1 INTRODUCTION

This chapter presents a literature review on triangulation. A chronological order approach to literature review was used since the phenomenon of triangulation is seen as existing in isolation from historical practice. This literature review assesses triangulation starting with the first time the concept came to be known in the existing literature, focusing mainly on the evolution in the scholarship of triangulation. The purpose of using a chronological order approach is to place this study in a historical context. This approach was also employed to show how much is known and not known about triangulation and to determine a possible way forward in the interpretation and application of triangulation. Thus, the study reviewed literature in terms of chronological development of triangulation to trace the development of triangulation over a period. The historical development of triangulation cannot be studied without first discussing the phenomenon of mixed methods or methodological triangulation the first type of triangulation. Thus, the historical account of triangulation is divided into the following phases: formative, paradigm debate, procedural development, the advocacy stage of methodological triangulation, and triangulation in general narrowing down the discussion to triangulation in IS research. In addition, the interpretation and usage of triangulation is explored, highlighting the gaps and weaknesses that gave rise to the study (Creswell and Tashakkori, 2007). The next section explores the classic methodological triangulation stages that influenced the development of triangulation in general.

2.2 CLASSIC METHODOLOGICAL TRIANGULATION RESEARCH

The first stage in the development of triangulation is called the classic methodological triangulation research period from 1939–1961 (Ackerly and True, 2010). The first classic methodological triangulation studies include the Hawthorne studies, the end-of-the world cult study and the robber's cave experiment, as discussed below.

2.2.1 The Hawthorne Studies

The earliest studies that successfully used methodological triangulation are the Roethlisberger and Dickson's Hawthorne effects studies conducted in the late 1920s and early 1930s, and the

Warner and Lunt's 1941 "Yankee City" research, and the Whyte's 1943 Street Corner Society (Bernard, 2011; Teddlie and Tashakkori, 2009). Since then, researchers have been using methodological triangulation, which is not necessarily called methodological triangulation, but is sometimes known as mixed methods research.

Roethlisberger and Dickson (1939), conducted the Hawthorne studies; a series of studies on the influence of social and psychological aspects on human behaviour in organisations (see also Denzin and Lincoln, 2011). Specifically, the studies investigated how individuals modify or improve aspects of their behaviour in response to their awareness that people or a management team are observing their activities. The studies were conducted in five stages: (i) the relay assembly test room study, (ii) the second relay assembly group study, (iii) the mica splitting room study, (iv) the interviewing programme, and (v) the bank wiring observation room study (Miles, Huberman and Saldaña, 2014; Emerson, Frietz and Shaw, 2011).

The first, second and third stages explored the effects of different physical conditions of work on human behaviour. The second and third stages were conducted to check on the conclusion of stage one. The fourth stage studied informal group organisation in the workplace, while the fourth and fifth stages emanated directly from the conclusion of the first, second, and third

stage studies on the influence of social needs on human behaviour. Thus, observations that were made in the fourth and fifth studies were analysed and interpreted, taking into account conclusions made in earlier studies. The literature suggests that the Hawthorne studies were the first to use triangulation in the form of methodological triangulation (mixing quantitative and qualitative research methods) to study the same research problem (Lofland, Snow, Anderson and Lofland, 2006). In particular, qualitative research methods were used to complement quantitative research methods. The Hawthorne studies were followed by the end-of-the world cult study.

2.2.2 The End-of-The World Cult Study

Feetinger and Katz (1953) conducted a study titled 'The end-of-the world cult study' in the discipline of psychology (see also Anderson and Braud, 2011). The study was informed by variables from a theory and a hypothesis about the state within which disconfirmation of belief paradoxically increased dedication to cult activities (Anderson and Braud, 2011). Data for the study was collected using participant observations carried out by researchers who pretended to be cult converts. The researchers became actively involved in cult activities as a way familiarising themselves with the cult under study. In the study, cult members were assigned into two groups determined by the independent variables in the study: extent of prior commitment and social support (Babbie, 2010). The experimental study involved results from the two groups. Data collected using observations was analysed using a quantitative research technique (quantification or quantitation – counting and measuring observations and experiences into numbers) and the results where compared with findings from two groups (Vogt, Gardner and Haeffele, 2012). The study was, therefore, a quasiexperiment methodological triangulation that utilised both qualitative and quantitative research techniques. The end-of-the world cult study was followed by the robber's cave experiment.

2.2.3 The Robber's Cave Experiment

Sherif, Harvey, White, Hood and Sherif (1954) conducted a study that investigated intergroup conflict and co-operation. The study operated across the disciplines of sociology and

psychology to examine several assumptions concerning inter-group relations (Saunders, 2010). The experiment comprised twenty-two boys who were divided into groups in such a way as to balance the social, mental and physical talents of the boys. The two groups were given several tasks that required them to work as a team to enhance the bond between the children in the respective groups. After a week, researchers introduced the second stage in which the two groups engaged in a competitive activity and the winners were given prizes while the losers got nothing (Salkind, 2012).

The researchers observed that competitive activities heightened hostility between the two groups. The third stage of the experiment involved activities where the two groups came together to help them reconcile (Pascale, 2011). The fourth stage involved an activity that could not be achieved by one group working alone. What is noteworthy about the robber's cave experiment (quantitative research) is that, though the study was quantitative, the qualitative technique of participant observation was used to collect data for the study.

2.2.4 Analysis of the Three Studies

The three studies presented above indicate the use of different types of methodological triangulation techniques long before the emergence of the methodological triangulation movement. As illustrated above, the first study employed qualitative and quantitative research methods in such a way that they complemented each other in different phases of the study (Saldaña, 2013). For example, the second and third studies mainly used qualitative data gathering instruments, and the data collected were analysed using quantitative techniques (Saldaña, 2013). Elsewhere, qualitative methods were used to explore discoveries arising from a quantitative approach. This clearly shows the application of several research paradigms within one study. The three studies reviewed above show that triangulation, in particular, the use of methodological triangulation, started a long time ago. This stage in the development of triangulation was followed by a period of the multiplication of multiple research method designs from 1959 to date.

2.3 THE USE OF MULTIPLE RESEARCH METHOD DESIGNS AND TRIANGULATION

Following the classic experiments, the initial formal discussion below on methodological triangulation research designs focuses on several scholars and eras.

2.3.1 The Multi-Trait Multi-Method Matrix

Campbell and Fiske (1959) employed the first methodological triangulation method design that used more than one quantitative research technique to study the phenomenon of psychological traits. In the multi-trait multi-method (MTMM) matrix study, more than one quantitative research method was used to ensure that the variance generated by research findings was accounted for by a trait under study and not by the quantitative research methodology used to measure the research problem (Creswell and Plano, 2011; Teddlie and Tashakkori, 2003).

Ferketich, Verran and Moody (1991) added their voice to methodological triangulation, saying that the basic principles of the MTMM matrix are that a test designed to measure the same constructs should have a high correlation among themselves (see also Kaler and Beres, 2010). In addition, a test designed to measure one construct should not correlate with a test measuring other research constructs (Kindon, Pain and Kesby, 2007). Deducing from the argument of the first tenet of the MTMM matrix, convergent validity exists through the support of somewhat strong correlations among measures or the same constructs. Based on the second tenet, discriminant validity exists supported by the presence of small tests measuring other constructs regardless of the method used. In other words, the concept of methodological triangulation, also called ‘multiple operationalism’, was used as a validation method (Kindon, Pain and Kesby, 2007). Johnson and Onwuegbuzie (2004) mentioned that Campbell and Fiske (1959) were the first scholars to show the usage of methodological triangulation for validation purposes.

Later, Webb, Campbell, Schwartz and Sechrest (1986) developed Campbell and Frisk's (1959) idea of multiple research methods further, stating the importance of what is being measured as opposed to validating the research method employed in a study. These authors argued that when two or more independent research measurement processes validate a research proposition, the likelihood that the findings on the proposition can be misinterpreted is considerably reduced (Pascale, 2011). Therefore, if a proposition is studied or measured using different methods and all the methods present the same findings, as those proposed in the proposition, then it is important to have confidence in the findings or the proposition (Saunders, 2010).

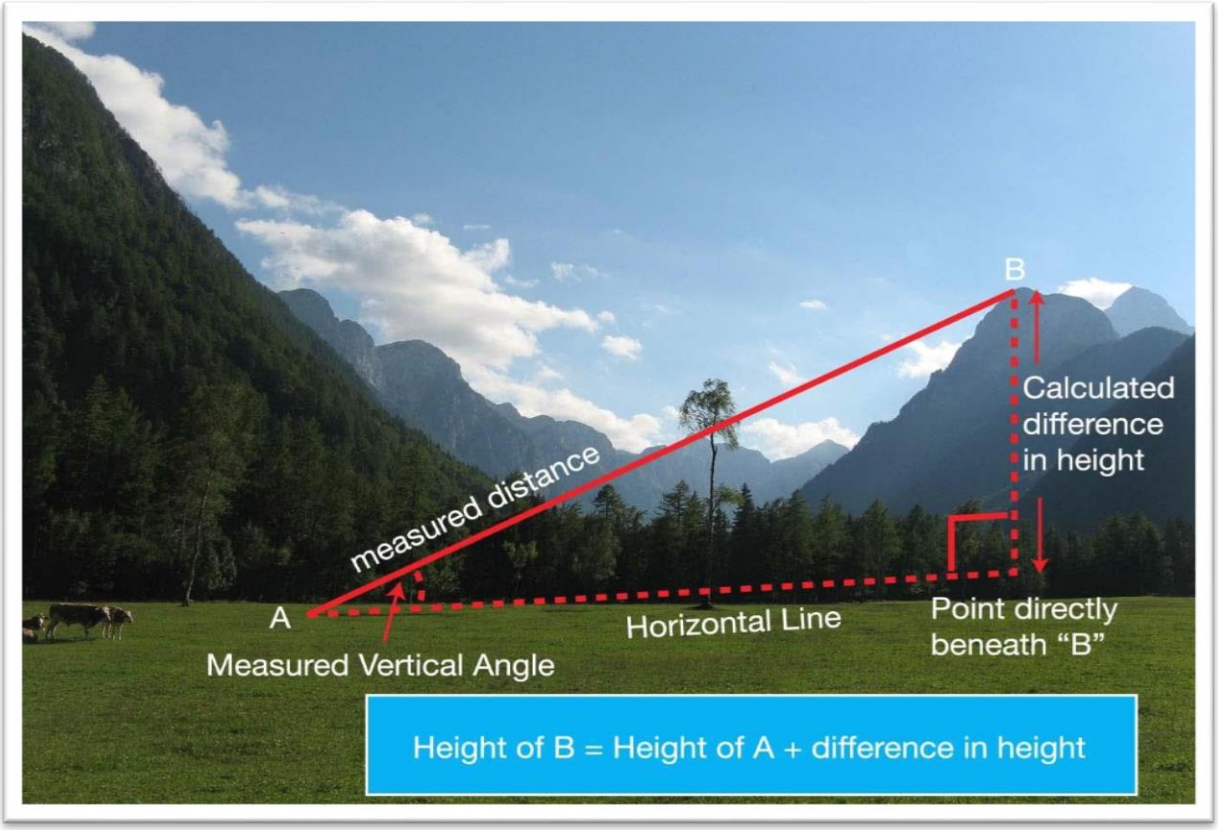
Webb et al. (1966) were the first to coin the word 'triangulation', meaning 'a process of using different methods for validation purposes' (see also Johnson, Meeker, Loomis and Onwuegbuzie (2004:23). Webb et al. (1966) used the word 'triangulation' in the discipline of social sciences to study behaviour using unnoticed observation, which is a type of nonreactive measure (see also Stringer, 2007). Webb et al. (1966) claimed that studies can achieve validity by using different research methods in particular, using nonreactive measures (see also Lofland et al., 2006).

As mentioned earlier, the precise origin of triangulation is not known, although scholars argue that triangulation was employed in the Greek culture of antiquity (Onwuegbuzie and Leech, 2006; Yin, 2009). More specifically, triangulation was employed to ascertain specific points or objects using principles of geometry informed by the laws of trigonometry (Rugg, 2010). The laws of trigonometry maintain that when two angles and one side of a triangle are known, it is possible to calculate the other two angles that are not known and one side (Rugg 2010; Yin, 2009).

Triangulation is used in the field of surveying to measure and map the surrounding environment (Symonds and Gorard, 2010). Informed by triangulation, surveyors measure the angles within a triangle created by three survey positions or points (Yin, 2009). Employing

trigometry and the known length of one side of the triangle and the known two angles makes it possible for surveyors to calculate other sides of the triangle. Surveyors use triangles that have base angles of 45 degrees (Symonds and Gorard, 2010) as shown in figure 2.1 below.

Figure 2.1: Triangulation in Surveying



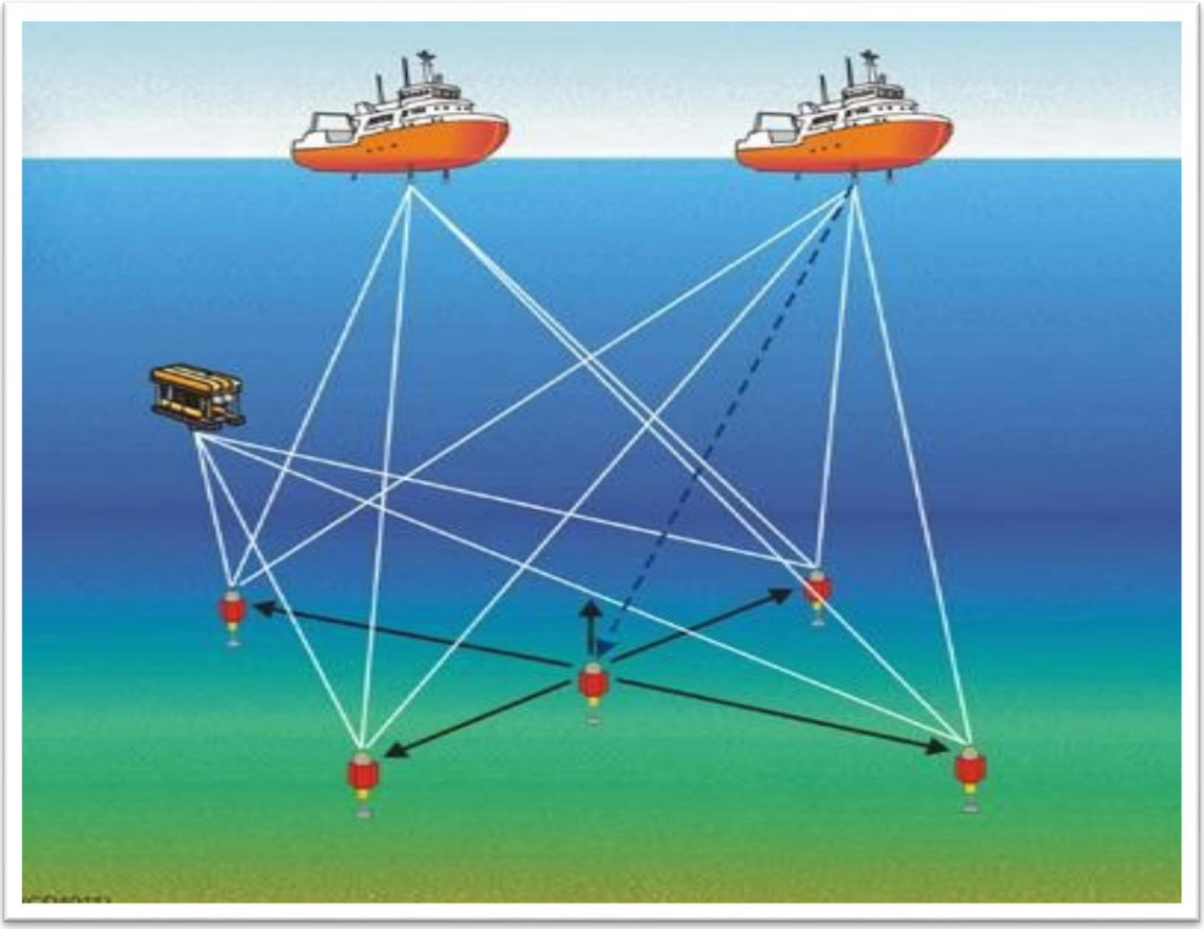
Source: Rugg (2010)

According to Rugg (2010), each of the calculated distances in a triangle is used by surveyors as one side of another, or new triangle, so as to calculate distances to another point that leads to starting a new triangle as supported by Symonds and Gorard (2010). This process is repeated as needed, creating a network of triangles that are linked to the initial point and to the survey control in the place needed (Yin, 2009). Using the angles and distances together

with the initial known position, the latitude and longitude of all points within the triangulation network are determined or calculated using a complex formula. This form of triangulation is used in engineering to determine land maps, boundaries and safe features (Rugg, 2010).

Triangulation is also used in navigation to monitor and control the movement of objects, such as vehicles, craft and ships, from one place to another (Rugg, 2010; Onwuegbuzie and Leech, 2006; and Yin, 2009) as shown in figure 2.2 below.

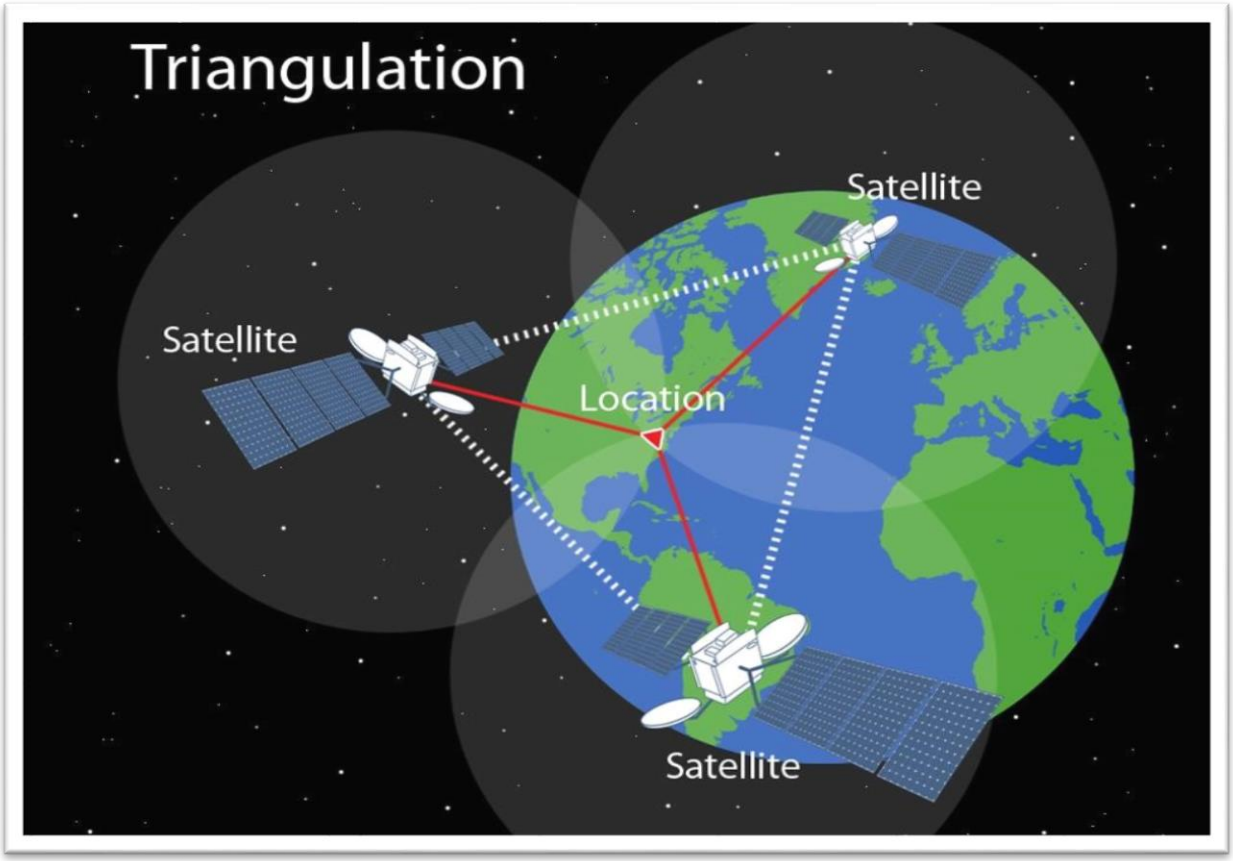
Figure 2.2: Triangulation in navigation



Source: Rugg (2010)

Johnson (2010) argues that the Global Positioning System (GPS) technology is based on the principles of triangulation. When radio signals are sent from four satellites based in space, a GPS receiver processes them to ascertain longitude, latitude and altitude as shown in figure 2.3 below.

Figure 2.3: Triangulation in the Global Positioning System technology

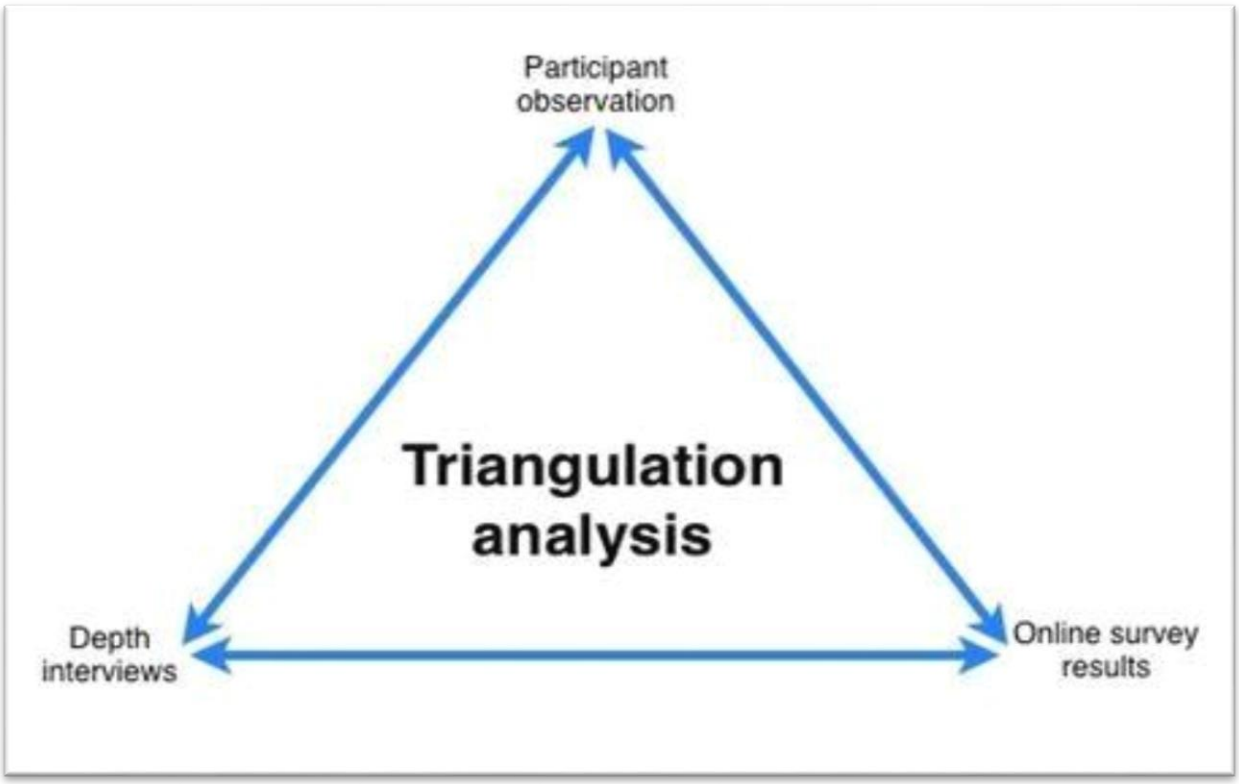


Source: Rugg (2010)

In theory, signals from three satellites could be employed to determine the location of a point or place. However, four satellites are used with the intention of enhancing the accuracy of the measurement (Rugg, 2010).

In a nutshell, triangulation has a mathematical origin that was extended in the 1970s when it was used as a sociological research methodology, combining different research methods in one study exploring one research problem (Denzin and Lincoln, 2011). Taking into account the basic principle of geometry that several views increase accuracy, triangulation was applied in research to increase research quality. Thus, triangulation in this period was understood as a research method whereby different methods were used in one study as demonstrated in the figure 2.4 below.

Figure 2.4: Triangulation in research



Source: Patrick (2009)

Similarly, to mathematical triangulation, researchers stated that using different research strategies may improve the credibility and validity of research findings (Denzin and Lincoln, 2011; Yin, 2009).

Webb et al's (1966) triangulation period was characterised by studies that integrated fieldwork and survey research techniques with the aim of having quantitative methods contribute to field work and the other way round. Sieber (1973) conducted a study that demonstrated how survey methods and fieldwork could be integrated in one study. Sieber (1973) stated that survey methods and fieldwork each made a unique contribution to the research process as supported by Driscoll, Appiah-Yeboah, Salib and Rupert (2007). In agreement, Creswell and Clark (2006) and Hemmings, Beckett, Kennerly and Yap (2013) explained that fieldwork can contribute to the research process by informing the development of a good survey design in the generation of research questions, formulation of the research problems, development of the hypothesis, and identification of appropriate respondents.

Sieber (1973) claimed that fieldwork, especially observations and interviews, can be useful at the data collection stage to generate valuable information on the span of respondent attention, as frames of reference and receptivity of respondents, as well as helping in developing quantitative instruments as also reported in by Yin (2012) and Miles, Huberman and Saldaña, 2014). At the data analysis stage, Suber (1973) stated that fieldwork can help in the analysis and interpretation of data collected using the survey method. Specifically, Sieber (1983) stated that fieldwork can provide a theoretical structure, validate findings from the survey, bring clear understanding of responses that are hard to understand and help in the interpretation of research results.

Sieber (1993) further suggested that surveys could provide information on the statistical profile of the target population. This helps to strengthen the fieldwork research design. The survey method also helps at the data collection stage to ensure that bias is reduced in the selection of informants for fieldwork research (Johnson, Onwuegbuzie and Turner, 2007).

Brewer and Hunter (1989) listed four main types of research methods that could be combined: fieldwork, unobtrusive observation, surveys and experiments. These authors argued that research methods have flaws that are not identical. Therefore, there is a need for a multi-

method approach to deliberately combine different methods in the same study as a strategy for offsetting each research method's limitations and weaknesses (Dezin, 2012).

Brewer and Hunter (1989) mentioned that using several research methods in one study enables the research process to cross-validate and cross-fertilise the research methods (Bergman, 2012). These two authors propounded in detail that findings that are generated using methodological triangulation are easy to accept with great confidence compared to findings generated using single methods as sources of interpretation (Castro, Kellison, Boyd and Kopak, 2010).

The literature in the above section shows the shift in the technical understanding and usage of methodological triangulation from one dominant approach to a broader approach of combining techniques and methods. In other words, the issue of methodological triangulation moved from focusing on issues of corroboration of research findings and reliability of research approaches or methods used in studies, to include the issue of complementarity, inclusiveness, completeness and comprehensiveness (Patrick, 2009). Even then, triangulation at this stage was still understood as a methodological triangulation or a method of mixing different research methods in one study. The MTMM matrix era led to the paradigm debate era discussed below, which started from 1985 to date, beginning with the philosophical paradigm moving into a period when methodological triangulation was established as a distinct research methodology.

2.4 PHILOSOPHICAL PARADIGMS OF METHODOLOGICAL TRIANGULATION

This section deals with the emergence of philosophical paradigms in the development of triangulation.

2.4.1 The Paradigm Debate

Scholars argue that scientific paradigms became famous during the Age of Enlightenment, also known as the Age of Reason, around the 1620s to the 1780s when scholars stressed the importance of reason, analysis and individualism softening the conventional lines of authority (Feilzer, 2010). Studies show that the paradigm debate era emerged due to the argument among scholars that interpretivism and positivism informed the qualitative and quantitative research methods respectively. The crux of the argument was that qualitative and quantitative were incompatible paradigms (Giddings and Grant, 2007). Kuhn (1970) coined the term 'incompatibility of paradigms', which initiated the paradigm debate. He identified two types of science, namely, 'normal science' and 'paradigm'. Normal science, according to Kuhn (1970) is scientific research conducted in the past by scientific communities and accredited as the basis for further scientific research. He defined a paradigm as an accepted form of scientific research practice that includes agreement and commitment to the same type of research methods (Giddings, 2006). Kuhn (1970) argued that there cannot be science without paradigms. Paradigms are thus basic prerequisites for normal sciences and therefore there is no way of talking about and practising a science like research methodology without paradigms (Greene, 2008).

Kuhn (1970), as cited in Giddings and Grant (2007), stated that scientific revolution is dependent on a paradigm change or paradigm shift. He stated that the previous and emerging paradigms are incompatible. This means that it is impossible to use methodological triangulation that combines methods generated from different paradigms (Greene, 2008).

Researchers in support of the discourse of incompatibility argued that qualitative and quantitative research methods were incompatible because of their different methodological and epistemological assumptions (Creswell and Plano Clark, 2011). According to this view, researchers trying to combine quantitative and qualitative research were bound to fail because the two methods were incommensurable (Hesse-Biber, 2010). Scholars who articulated the philosophical contrast between quantitative and qualitative research methods contended that methodological differences reflected different epistemologies, different kinds of research and

representation, and were guided by different genres (Hesse-Biber and Johnson, 2013). According to Greene and Caracelli (2003), the purists contended that it was difficult to combine quantitative and qualitative methods because they represent different stances on the nature of being, existence, becoming or reality, and basic categories of being (ontology). Moreover, according to Howe (2004), quantitative and qualitative methods are based on different views on the nature of knowledge about the world and how knowledge comes into being focusing on the relation of the knower and the known (epistemology). In addition, Feilzer (2010) pointed out that quantitative and qualitative methods are seen to have different purposes and roles in society. Thus, quantitative and qualitative research methods are seen to represent different views on the nature of being, and on how people come to know things or how they attempt to understand the world (Giddings and Grant, 2007).

According to Greene (2008) both quantitative and qualitative purists believed that their respective paradigms were the best for conducting research. However, some members of both groups (qualitative: Campbell and Stanley, 1963; Lincoln and Guba, 1985 and quantitative: Ayer, 1959; Maxwell and Delaney, 2004; Popper, 1959; Schrag, 1992) were united in advocating the proposition that qualitative and quantitative research paradigms were incompatible and their respective methods cannot be combined in research (HesseBiber, 2010).

Howe (2003) explained that the incompatibility thesis is not against methodological triangulation research, as it allows researchers to combine quantitative and qualitative research in the form of a 'disjunctive' combination when their respective methods are used in the same study to underpin different research questions (Hesse-Biber and Johnson, 2013). This implies that the incompatibility thesis is against the use of quantitative and qualitative research methods in the same study to underpin the same research questions and claims that quantitative and qualitative methods have the same epistemological paradigm.

According to Howe (2003), the incompatibility thesis stipulates that:

- A single study may be conducted using methodological triangulation. This means that several methods could be used in one study, as long as the methodological purity of quantitative and qualitative methods are upheld.

- A study with several research questions may be conducted, provided different methods are used to answer different research questions.

  When a study is conducted using one research methodology, only one set of research questions should be used and only one research method (qualitative or quantitative) should be employed.

Thus, the literature in this section shows that purists on both sides were against using methodological triangulation as if the different methods belonged to the same ontological and epistemological paradigm. This reveals challenges in the development of methodological triangulation and triangulation as a whole that resulted in different paradigmatic views.

2.5 PARADIGM STANCES IN METHODOLOGICAL TRIANGULATION RESEARCH

The paradigm debate stage resulted in different stances on the role of philosophy in methodological triangulation research. The first stance stated that paradigms do not guide the actual research decision and was therefore not important (Mertens, 2007). The second stance held that paradigms are key to research and play an important role in the actual inquiry decisions as discussed below.

2.5.1 Paradigms not Key to Social Inquiry

There were two main approaches relating to this stance: the ‘a-paradigmatic’ approach and the ‘substantive theory’. The ‘a-paradigmatic’ approach holds that paradigms are completely unimportant to research practice (Mertens, 2012). Paradigms and methods are seen as independent of each other, ruling out a link between epistemology and methodology.

On the other hand, the ‘substantive theory’ states that paradigms are important as they help researchers to think better during the research process, but they have no direct influence on research practice (Morgan, 2007). This approach does not rule out the role of paradigms in the research process but removes the excessive restrictions of adhering to epistemology. In supporting the substantive theory, Greene and Caracelli (2003) said that it allows decisions to be made, based not on the agreement with philosophical assumptions, but rather on the capability to advance the substantive research agenda (see also Onwuegbuzie and Leech, 2006).

Greene and Caracelli (2003) also claimed that the nature of the constructs being investigated in a study inform researchers’ fieldwork decisions. The proponents of the substantive theory contended that philosophical assumptions and understandings are some of the many factors that influence the decisions of researchers in a research process (Petty, Thomson and Stew, 2012).

Greene (2007) stated that the multiple factors that influence the decisions of researchers in a study are ‘mental models’ that guide researchers (see also Tashakkori and Teddlie, 2010). These models include: disciplinary perspectives; substantive theory; methodological traditions; the philosophy of science, education and training; political factors; contextual factors; and personal interests. Thus, the literature examined so far shows that the discourse on paradigms had an effect on the adoption and usage of methodological triangulation towards the development of triangulation.

2.5.2 Central Role of Paradigms and Guide to Social Inquiry

Three main arguments relating to this stance are discussed below. The first group of researchers (the 'purists') argued against methodological triangulation, the second group argued for methodological triangulation, and the third group proposed an alternative method to justify the process of methodological triangulation.

2.5.2.1 The Purists' Stance

According to scholars such as Lincoln and Guba (1985), purists argued against mixing research methods in a study (see also Teddlie and Tashakkori, 2009). They considered the assumptions of quantitative and qualitative research to be fundamentally incommensurable (Barone and Eisner, 2012). They reasoned that each research methodology represented a unique and coherent whole system of a research methodology that should be revered and preserved (Greene, 2009). Kuhn first promoted this view however, he later discarded it (Ivankova, 2015; Denzin and Lincoln, 2013). Advocates of the purist view held that methodological triangulation research was not feasible because of different ontological foundations informing qualitative and quantitative research methods. For example, Guba and Lincoln (2005) stated that the ontological position of the qualitative approach is relativism, which holds that reality is subjective and thus differs from one individual to another (see also Denzin and Lincoln, 2013). Besides, human realties are negotiated by our five senses. Thus, human reality is individually constructed so there are as many realities as there are people.

As Grix (2004:83) put it, 'reality is not independent from human knowledge'. On the other hand, quantitative methodology is informed by positivism, which reduces reality or the complex by making it simpler and controlling research variables – something that is difficult to do in interpretivist research (Brannen, 2005). This is because some variables are hidden from the researcher and are only revealed when their impacts are manifest, reinforcing the purists' opposition to methodological triangulation research.

2.5.2.2 The Complementary Strengths Stance

Advocates of the complementary strengths stance argued that quantitative and qualitative research methods have different important assumptions (Anderson and Braud, 2011). However, these different methodological and important assumptions are not fundamentally incompatible (Johnson and Christensen, 2012), but are valuable, and should be preserved to uphold the integrity of each method without restricting the expansion of the scope of studies. Moree (1991) and Sten (1994) supported the complementary strength stance arguing that research methods used in different paradigms should be kept separate from each other (see also Tashakkori and Teddlie, 2010). The underlying reason for continuing to implement research methods within different paradigms is to avoid compromising the validity of each research method (Saunders, 2010). Besides, advocates of the complementary strength stance believed that there was a need to take precautions when using methodological triangulation to ensure that mixing research methods does not adulterate and weaken the methods (Singleton and Straits, 2005).

Thus, the complementary strengths stance requires that different paradigms employed in research should be kept separate, but it is not clear how these research paradigms could be employed in a methodological triangulation study. Besides, advocates of this stance agreed that research paradigms are part of the many factors that influence the decisions that guide research processes (Sprague, 2005). While research paradigms are not seen as the key factors that influence methodological triangulation research decisions, they do have some influence on these decisions (Yu, 2003).

2.5.2.3 The Dialectic Stance

Advocates of this stance argued that researchers can employ multiple paradigms in their methodological triangulation research. According to Teddlie and Tashakkori (2003), different paradigms have something unique to offer such that combining paradigms enables research to generate information that provides a comprehensive and greater understanding of research problems. To explain the dialectic paradigms stance, Greene (2007) said that this

stance does not solely seek convergence of research findings as insight, but rather to generate a deeper understanding of the research by juxtaposing different issues, views, perspectives and stances. Greene and Caracelli (2003) explained that mixed methods involves juxtaposing ideas rather than opposing ideas.

Thus, the dialectic and the complementary strengths stances promoted a 'compatibility thesis' as opposed to the incompatibility thesis (Bernard, 2002). This meant that different paradigms could be employed in one study (Maxwell, 2012).

2.5.2.4 The Alternative Paradigm

The alternative paradigm, or pragmatism, led to the development of the philosophical framework defined by metaphysical paradigms explained research from a broader perspective and caused very few controversies (Phillips, 2004). The central issue in this paradigm debate was that researchers should find mutual adjustment between philosophical assumptions and research practice, which appeals to both practitioners and researchers (Johnson and Onwuegbuzie, 2004). This made research an ever-reflective activity and growing endeavour but did not impose any methodological approaches on researchers regarding their research processes. However, researchers such as Greene (2008) argued that pragmatism does not specifically explain how different paradigms and methods can be employed in alternative paradigm studies. Johnson, Onwuegbuzie and Turner (2007) who stated that pragmatism was a progressive research approach, but lacked clear guidelines on how the approach can be put into practice in a research process, support the idea of pragmatism. In addition, Lieber (2009) argued that the usage and purpose of pragmatism was not clearly explained to researchers and practitioners, partially giving rise to this study that investigated the interpretation and application of triangulation. The methodological triangulation movement followed several years of 'paradigm wars'.

2.6 METHODOLOGICAL TRIANGULATION 'MOVEMENT'

After several years of 'paradigm wars', a 'mixed method' or methodological movement emerged trying to address the standoff between traditional paradigms (Driscoll et al., 2007). Three issues were prominent in this movement. Scholars in this school criticised the incompatibility thesis, as well as the purists' view that qualitative and quantitative methods were incompatible, and promoted the view of pragmatism and established methodological triangulation as a new research method at the same level as qualitative and quantitative methods (Denzin, 2012; Hammersley, 2008). Thus, the methodological triangulation movement can be traced back to the researchers who advocated for the compatibility thesis, who maintained that quantitative and qualitative research methods could be combined to study a phenomenon. This marked the official recognition of methodological triangulation as a standalone method for studying a phenomenon using more than one option to collect data, and has since been used as within-and across methodological triangulation. The IS discipline was not spared from the effects of the emergence of methodological triangulation and triangulation in general, as discussed below.

2.7 TRIANGULATION IN IS RESEARCH

Scholars argue that the debate on triangulation in the IS discipline started in the 1980s. Keen sparked the debate when he criticised IS research as lacking a core theory. Keen (1980) led the scientific debate, which was followed by a debate on metatheoretical lenses and philosophical perspectives that shaped IS research work (see also Oates, 2009). Studies show that IS research was dominated by the logical positivist model of science, hence an emphasis on quantitative research methodology (Oates, 2009). In other words, quantitative research methodology was found to be dominant in IS research because of the positivist paradigm informing research (Jokonya, 2016).

Positivism holds that the tenet of logical empiricism and scientific progress in the field of study starts with the manipulated observation of reality (Venkatesh, Brown and Bala, 2013). Therefore, observations of reality promoted by positivism were believed to give researchers

an image that is close to the real life situation from which IS researchers generated an *a priori* approach or model of the phenomenon to be studied (Teddlie and Tashakkori, 2009). According to positivist philosophy, a researcher generates a hypothesis from the model and the hypothesis undergoes empirical testing (Warfield, 2010). When a study is conducted to test the hypothesis and data is found to support the hypothesis, then the hypothesis is not rejected (Saunders, Lewis and Thornhill, 2008). In support of this view, Anderson (1983), an IS scholar added that science progresses through the process of testing the hypothesis and accumulating several instances that confirm those obtained under wide-ranging conditions and situations.

To summarise, traditional IS research is informed by the philosophy of positivism that states that the only trustworthy knowledge is generated through a researchers' observation, also called 'senses' that involve measurements (Oates, 2009). Hence, in IS research, the part played by a researcher was limited to data gathering and analysis using what was believed to be an objective approach, and produced quantifiable observations reducing data into statistics (Agerfalk, 2013).

Peng, Nunes and Annansingh (2011) pointed out that, since IS research went along with the empiricist view that knowledge comes from people's experiences, researchers should be detached from their study, and there was no space for people's interests in a positivist study. Thus, IS studies mainly adopted a deductive approach (Venkatesh, Brown and Bala, 2013).

2.7.1 IS 'Pacifiers'

A group of IS researchers called the 'pacifiers' emerged, who argued that the positivist philosophy had several limitations, particularly when employed in social sciences research (Morgan, 2007). IS researchers pointed out that the positivist philosophy had its foundation in deductive statistical methods in that observations of several positive instances were generalised into universal statements of truth (Warfield, 2010). For this reason, IS 'pacifiers' such as Long (1985) argued that the strict deductive approach to research is often not suitable

because the process of speculation and development of a prior hypothesis are critical in an effort to build a theory (see also Morgan, 2007).

The ‘pacifiers’ also advised against the positivist philosophy that the empiricist research method is founded on the rationale of pure observation, which is not possible to achieve especially in social sciences (Peng, Nunes and Annansingh, 2011). This is linked to a wide range of research issues including cause, effect, time and space, which are not based on experience over-relied on by positivists as an effective cradle of knowledge (Teddlie and Tashakkori, 2009).

The ‘pacifiers’ also argued that it was not true, as held by positivism, that all people’s processes are a variation of individual’s actions or interactions (Caruth, 2013). In other words, there are deeper underlying factors to people’s behaviour than what is seen through their actions. Therefore, there is also a need for a method that combines the positivist and interpretivist methods to dig deeper into a phenomenon and gain a better understanding of a research problem (Teddlie and Tashakkori, 2009).

The research philosophy of positivism was also criticised for relying on the *status quo*. Thus, some IS scholars argued that the results in positivist research were, for the most part, descriptive, therefore positivist IS studies failed to provide insight into questions of the how, when and why of the phenomenon (Fidel, 2008; Bryman, 2007). Therefore, the positivist approach influenced IS research to focus on the need to employ good research tools and techniques that would help the fallible nature of the human mind rather than focusing on the interpretation of assumptions (Jason, Rebecca and Onwuegbuzie, 2011).

The explanation above on the long tradition of positivist IS research is depicted in Falconer and Mackey’s (2001) study which revealed that the research principles used in IS research were informed and developed from systems theory, which led to the emerging of a strong

positivist bias in understanding IS research problems. Kauber (1986) pointed out that the positivist approach influenced IS research to be predominantly quantitative in approach. IS scholars explained that research approaches in the IS discipline were informed by the research skills and knowledge of the early IS researchers who migrated from other disciplines with mainly positivist backgrounds, and therefore engaged in predominantly quantitative research (Fidel, 2008; Mingers, 2001). This is in agreement with a finding by Caruth (2013) that the term 'mixed methods' was missing from books on IS research methods, including works by the leading lights in IS research methodology: Pickard (2007), Powell and Connaway (2004), Gorman and Clayton (1997), Boyce et al. (1994), Gustafson and Smith (1994), Emery (1993), Losee and Worley (1993), and Mellon (1990).

A study by Orlikowski and Baroudi (1991) reported that 97 per cent of IS research was informed by the positivist epistemology. The same study indicates that only three per cent of the studies employed the interpretative research approach. Similarly, Powell (1999) reviewed literature on library and information science research from 1980 to 1985 and found that only three per cent of the studies used mixed methods research. Davies (2012) conducted a study that reviewed research methodologies in articles published in three Information System journals (Information Systems Research (ISR); Journal of the American Medical Informatics Association (JAMIA), and Management Information Systems (MIS) between 2005 and 2007. The study found that single methodologies were more popular with ISR articles (56 per cent) and JAMIA (66 per cent) MISQ (47 per cent) in particular quantitative research methodology. The study found that 44 per cent of articles in ISR, 53 per cent of articles in MISQ, and 34 per cent of articles in JAIMA used mixed methods research methodology.

These findings were in agreement with Julien and Duggan's (2000) review of 439 articles in the discipline of information systems from the 1980s and 1990s, which found an increase in triangulating methods.

A study by Mingers (2003) that reviewed IS studies published between 1993 and 2000 found that 20 per cent of the studies published employed mixed methods. The same trend was seen in the discipline of information science when Fidel (2008) reviewed 465 information science articles published for major library and information science that found that 17 per cent of the articles used mixed methods.

In spite of the predominantly quantitative approach used in IS research, in the 1980s the phenomenon of methodological triangulation gained ground. IS Scholars such as Williamson (2002) and Glazier and Powell (1992) talked about the concept of mixed methods often without using the terms ‘mixed methods’ or ‘methodological triangulation research’.

Gorman and Clayton (2005) are believed to be the first IS scholars to introduce the term ‘methodological triangulation research’ in their work in a heavily positivist environment. These two scholars distinguished between the phenomena of mixed methods and methodological triangulation. They emphasised that mixed methods is the integration of quantitative and qualitative research methods, while triangulation is using multiple research technques to study a phenomenon (Denzin, 2012).

Insights into and support of methodological triangulation were provided by several IS scholars. For example, Sonnenwald and Livonen (1999) developed a broad conceptual framework to guide IS researchers on how to select methods in methodological triangulation and mixed methods research. Bishop, Neumann, Star, Merkel, Ignacio and Sandusky (2002) showed how they used mixed methods that they dubbed triangulation. Similarly, Williams and Gunter (2006) used the term triangulation when reporting on a study that used both quantitative and qualitative research methods in a deep log analysis. The usage of methodological triangulation and mixed methods was not clear, but methodological triangulation gained momentum and led to the emergence of cross-paradigm accommodators (Venables and Baskerville, 2012). To some extent, it is the lack of clarity on triangulation that influenced the researcher to conduct this study.

2.7.2 Paradigm Accommodators

Research by scholars such as Barrell and Morgan (1979) informed most of the IS efforts to use methodological triangulation research (see also Tremblay, Hevner and Berndt, 2010). These two IS researchers identified four main groups of IS researchers: (i) positivists who reject paradigmatic research, (ii) positivists who use mixed methods from a positivist perspective, (iii) positivists who made an effort to mix positivist and non-positivist methods, and (iv) positivists whose research work was informed by the positivist philosophy (see also Siau and Rossi, 2007). Generally, IS researchers can be categorised as within-paradigm accommodators and cross-paradigm accommodators (Peffers, Tuunanen, Rothenberger and Chatterjee, 2007).

Within-paradigm accommodators were informed by Jick's (1979 and 1983) works, which explained why methodological triangulation should be used in research. The within-paradigm accommodators held that methodological triangulation should be within the chosen paradigm, for example, using only in-depth interviews, focus group discussions and observation to study the same research issue. However, discussion about qualitative research methodology was from a positivist perspective, an indication that qualitative research methodology was not treated as an equal partner in mixed methods research (Orlikowski and Iacono, 2001).

Cross-paradigm accommodators were a group of IS researchers who used methodological triangulation but without taking into consideration the issue of ontology. The group did thus not allow the debate on the nature of being of knowledge, and on quantitative and qualitative to override research (Morse and Niehaus, 2009). Cross-paradigm accommodators were IS

'liberals' who used different research instruments, for example, in-depth interviews, focus group discussions and observation from the qualitative paradigm with a questionnaire or survey from the quantitative paradigm in the same study. In other words, they incorporated research instruments from qualitative and qualitative methods.

Studies show that the rapid emergence of new technology and the complex array of information technology created challenges for several companies in relation to their comprehension of Information Technology (IT) capabilities, usage, practices and impacts (Mingers, 2001; Kolfschoten, and de Vreede, 2009). The availability of the internet, the proliferation of social media and the development of different IT devices transformed IT into an important aspect of people's lives (Koh, Ang and Straub, 2004). These rapid changes in technology presented problems for IS researchers that could not be explained by the existing theories, nor did existing findings offer an adequate explanation of several phenomena of interest (Hirschheim and Klein, 2003). This gave rise to a need to use different methods to study the new research problems, thus methodological triangulation provided an opportunity for IS researchers to deal with the current situation which was not understood due to lack of up-to-date insight into the phenomenon (Hevner, March, Park and Ram, 2004).

IS researchers who advocated for methodological triangulation suggested that the method is able to address confirmatory and exploratory research questions underpinning the study at the same time (Teddlie and Tashakkori, 2009). Based on evidence that methodological triangulation research can be used to underpin confirmatory and exploratory research questions, IS researchers used the quantitative research approach to generate a deep understanding of the research problem under study (Hevner et al., 2004). Therefore, the quantitative research method is useful for the development of theories (Walsham, 2006).

In addition, the quantitative research method was used to underpin IS confirmatory research studies, such as studies aimed at testing theories or models (Gregor and Jones, 2007). IS researchers stated that methodological triangulation is able to explore and confirm a phenomenon within the same study (Arnott, 2006). A good example is an exploratory qualitative study that was conducted by Keeney to understand the people's perceptions of ecommerce. The study used interviews to unearth factors on pros and cons of e-commerce. An exploratory research was appropriate and necessary because very little was known about ecommerce (Keeney, 1999). This study was followed by several confirmatory quantitative studies that tested theories and models on the adoption and usage of e-commerce (Gefen,

Karahanna, and Straub 2003; Koyfan, 2002). Though these were separate studies, Pavlon and Fygenson (2006) conducted a mixed method study on the adoption and usage of ecommerce. The first stage of the study was an exploratory study on the beliefs that influenced peoples' decisions to adapt e-commerce using open-ended research questions. Since e-commerce was a new phenomenon in mid-2005, studies were not able to comprehend factors that influenced the adoption of e-commerce. Payton and Fygenson (2006) adapted all the factors generated from the exploratory studies and developed a model which they tested using a confirmatory quantitative study. Thus, IS researchers believed that methodological triangulation research has the ability to provide stronger reference than what would be provided when a researcher is using one method (Teddie and Takkhokone 2009). Greene and Garacellin (1997), said that combining quantitative and qualitative methods offers deep insight into the research problem studied. Sale, Lohfeld and Brazil (2002) said that methodological triangulation enables studies to offset the limitation certain methods have by themselves (Bergman, 2011). IS researchers explained that methodological triangulation had capacity to leverage the complementary strengths and weaknesses of both quantitative and qualitative research methods that are non-overlapping (Venkatesh, Brown and Bala, 2013).

Researchers also revealed that methodological triangulation offered in-depth insight into the phenomenon studied compared to what one of these research methods can offer when used alone (Johnson and Turner, 2003). Therefore, methodological triangulation helped IS researchers to make more accurate and better inferences. Bowling (2009) said that methodological triangulation research allows IS research to make meta-inference thereby achieving an integrative view of the findings. Fidel (2008) advocated for the use of methodological triangulation because the approach offered a holistic and high quality perspective for understanding research problems. Other IS researchers explained that methodological triangulation research offered an assortment of different and complementary views (Venables and Baskerville, 2012). Huysmans (2013) stated that IS researchers embraced methodological triangulation because the method enabled studies to generate contradicting and complementary findings (see also Abdullah, Sadiq and Indulska, 2010). The divergent findings were used as the basis to re-examine research assumptions and conception frameworks underpinning methodological triangulation research methods

(Brannen, 2005). Findings from methodological triangulation research enabled researchers to generate information that enriched people's understanding of the phenomena under study and also helped them to evaluate the boundary conditions of research problems, thereby opening more research opportunities (Bryman, 2006). Venkatesh, Morris, Carlson, Davis and Walton (2003) and Lapointe and Roward (2005) contended that IS researchers embraced methodological triangulation because the method helped to generate complementary findings that were valuable in enabling research to generate substantive theories. These theories were believed to provide a holistic view of research problems and more insight into the relationship of different components of the themes.

Thus, the literature shows that IS researchers embraced methodological triangulation for several purposes, including completeness, complementarity, development, expansion, compensation, corroboration, compensation and diversity (Fidel, 2008; Mingers, 2001).

Scholars have explained that the acceptance of methodological triangulation in IS research resulted in a proliferation of different types of triangulations, such as investigator, analyst, theory, and others discussed below (Gorman and Clayton, 2005; Williamson, 2002). This change was followed by a change in research issues whereby IS researchers, apart from engaging in research on technological issues, conducted research on other issues including organisational and managerial, which created space for IS researchers to use triangulation.

2.8 UNDERSTANDING OF TRIANGULATION IN IS RESEARCH

Historically, the phenomenon of triangulation is a novel concept in social science and humanities research (Denzin, 2012). As established earlier in this chapter, triangulation can be traced back to Campbell and Fiske, in 1969, from the discipline of psychology, who were the first to conduct a study that used methodological triangulation (Bryman, 2007). Webb et al. (1966) were the first to coin the word 'triangulation', meaning the use of different techniques to enhance research processes. Later, in 1978, Denzin expanded the notion of triangulation by explaining four types of triangulation (Collins, Onwuegbuzie and Sutton,

2006). Denzin (2012) explained that triangulation is a good research practice as it allows researchers to use different research techniques to improve research quality (see also Creswell and Plano-Clark, 2007).

After triangulation was expanded, IS scholars in this era maintained that, regardless of the epistemology or paradigm researchers work from, it is critical to use triangulation in one study as it helps to understand criticism from different research communities (Denzin and Lincoln, 2005; Giddings and Grant, 2007).

In addition to methodological triangulation (the first type of triangulation to be documented in detail) discussed above, the other well-documented type of triangulation was data source triangulation.

2.8.1 Data Source Triangulation

Data source triangulation is a research technique whereby multiple data sources are used to study one research problem (Denzin, 2012). This method can be implemented using, for example, several participants in a study to provide the data needed for the study. Rugg (2010) explained that data source triangulation involves using different sources of information such as questionnaires, focus group discussions, in-depth interviews and observations in one study (Giddings, 2006). Denzin (2012) went on to expand the idea of data source triangulation to include space and time as critical factors that should be considered they are able to help validate research results (see also Giddings, 2006). IS researchers such as Agerfalk (2013) added his voice arguing that for data source triangulation to be effective the study should involve the use of different times, spaces, and persons. However, very little is known about data source triangulation and its application in research (Giddings, 2006). This may be true in the context of the interpretation of data source triangulation because data source triangulation is extensively use. The section below discusses investigator triangulation.

2.8.2 Investigator Triangulation

Denzin (2012) explained that investigator triangulation involves the use of different researchers in one study. More than with other types of triangulation, scholars argued that investigator triangulation is built into the research process because, in most instances, it requires more than one researcher to, for example, collect data for a study (Denzin, 2012; Greene, 2008). Davies (2012) conducted a study on Information Systems Research Journal assessing the number of authors per journal article and found that 28 per cent of the articles were written had two authors and 19 per cent had three authors. However, several scholars, including IS scholars, are concerned about the lack of clarification on how several investigators are brought on board to form a viable research team (Mertens, 2012; Yin. 2009; Giddings, 2006). Peng, Nunes and Annansingh (2011) argued that, though the process of involving multiple researchers in one study was beneficial, it was difficult to determine their roles. Hesse-Biber (2010) added that it was not known, for example, how much data was to be analysed by the principal investigators and how much by fieldworkers since data analysis starts in the field (Hesse-Biber and Johnson, 2013). The section below discusses theoretical triangulation.

2.8.3 Theoretical Triangulation

Some scholars explained that theoretical triangulation was one of the different forms of triangulation (Mertens, 2012; Rugg, 2010; Patton, 2002). For example, Johnson and Onwuegbuzie (2004) stated that researchers can use several theories when studying an event, a behaviour, phenomenon or a situation to increase the validity of the research findings (Wheeldon, 2010). Denzin (2012) explained that not only theories can be triangulated, but professional views, models and conceptual frameworks, which function as lenses in studies. Teddlie and Tashakkori (2009) stated that theoretical views that can be triangulated can be from within the discipline or across disciplines. Though there is an acknowledgement in IS research on the existence of theory triangulation as the practice of involving multiple theoretical plans in studying a phenomenon, there is a dearth of studies in IS research on the understanding and application of theoretical triangulation. The section below discusses analyst triangulation.

2.8.4 Analyst Triangulation

Cohen and Manion (1997) explained that several analysts or analysis techniques may be used in one study to increase validity of the research findings (Denzin, 2012). The literature on IS research is silent on analyst triangulation, although there is an acknowledgement by IS researchers such as Huysmans and Bryun (2013), Arnott (2006), Hevner et al. (2004) and Hirschheim and Klein (2003), that analyst triangulation happens when researchers use multiple analysts in one study.

Though the literature in IS research and in general shows that there are different types of triangulation, most of the studies conducted are on methodological triangulation (Mertens and Hesse-Biber, 2015; Mertens, 2012). As a result, there is a huge amount of information on the meaning and usage of methodological triangulation. However, there is no single study the researcher is aware of in the existing body of knowledge in the IS and the literature in general, conducted on the understanding and application of data source, investigator, theoretical, analyst, space, and time triangulation. Thus, triangulation remains an understudied area in general, and in IS research, in particular. As a result, very little is known about triangulation (data source, investigator, theoretical, analyst, space, and time triangulation) and how it is used in research. This is the main reason that prompted the researcher to study the interpretation and application of triangulation in the IS research, justifying why this study was conducted. The section below discusses ideas underlying the use of triangulation in research.

2.9 ASSUMPTIONS ON THE USE OF TRIANGULATION IN IS RESEARCH

The application of triangulation research in IS is plagued by a lack of awareness of the different ways triangulation can be used in research.

2.9.1 Convergence

Studies indicate that IS researchers use data source, investigator, theoretical, methodological, analyst, space, and time triangulation respectively because they believe that the bias that is inherent in one research technique can be offset by the use of another technique (Mertens and Hesse-Biber, 2015; Denzin, 2012). Triangulation also allows research results to be a convergence upon the truth about the research problem under study (Anfara and Mertz, 2006). Some IS scholars use triangulation to help eliminate bias, though several of the studies reviewed suggest that it is not possible to eliminate bias in a study (Fidel, 2008; Mingers, 2001). This remains an under-studied area, adding to the reasons for conducting this study. IS researchers such as Kolfschoten and De Vreede (2009) explained that triangulation uses different research techniques that neutralises weakness in research techniques (Corbin and Strauss, 2008). Denzin (2012) mentioned several benefits of using triangulation, including: validating, explaining and refuting research findings, and enriching research instruments (see also Patrick, 2009). Berg (2007) explained that triangulation might be used for internal and external validity. Thus, the literature seems to suggest that using different research techniques in one study enables studies to generate different understandings about a social phenomenon, but neither IS researchers nor Denzin, the advocate of triangulation, explained how, for example, different understandings of research problems generated from different research techniques can be reconciled in one study. This is one of the areas investigated in this study.

IS scholars, such as O'Neill and Wilson (2015); Orlikowski and Iacono (2001); Peffers, et al. (2007) argue that triangulation provides a rich and complex understanding of research problems but does not generate one perspective of the phenomenon under study. In agreement, Purao, Baldwin, Hevner, Storey, Pries-Heje, Smith and Zhu (2008); Siau and Rossi (2007), also from the discipline of IS, articulated that triangulation is good at generating evidence that can help researchers to have a good understanding of the research issue under study. However, Neuman (2011) found that triangulation does not bring about a single valid position or proposition about a research problem.

2.9.2 Inconsistency

The literature in this study shows that triangulation as a research strategy sometimes generates inconsistent research results (Creswell, 2014; Gustavsson, 2007). Several studies show that when different research techniques are used, different findings with a different range of perspectives on the research problem are generated (Denzin, 2012; Machin and Mayr, 2012). Sometimes the different research findings do not confirm a single view about the phenomenon under study (Clandinin, 2013; Babbie, 2007). Gustavsson (2007) said that when there are ambiguous and inconsistent results in the same study, it is difficult to ascertain the meaning of the research findings, which is a challenge of using triangulation.

2.9.3 Contradictions

Scholars argue that when conducting research using triangulation, it is possible to generate research findings that are contradictory (Hesse-Biber, and Johnson, 2015; Machin and Mayr, 2012). Denzin (2012) found that when several methods are used in one study, researchers are often left with a data bank containing opposing views rather than agreeing views about the phenomenon under study. Leavy (2011) clarified that having contradictory and inconsistent findings is not something negative in a study because researchers can utilise these findings to arrive at a better understanding of a research problem. Denzin (2012) and Simonsen, Bærenholdt and Büscher (2010) found that the value of triangulation is not in providing a technological solution to studying research problems, but rather it is a strategy that allows researchers to have varied (inconsistent and contradictory) evidence to use to arrive at a better understanding of a social phenomenon. Thus, triangulation is valuable because it allows researchers to construct meaningful assumptions about a research problem using rich evidence (Patrick, 2009). While the literature seems to suggest that triangulation leads to generating varying research outcomes, researchers should not view this as a problem but rather an opportunity to construct meaning from the research findings using different perspectives (Denzin, 2012). Therefore, the value of triangulation lies in providing evidence, whether contradictory, inconsistent or convergent. This is because these research findings may be used to construct a plausible explanation of a phenomenon from the data generated in a study (Venables, Pries-Heje and Baskerville, 2012). In other words, research outcomes

need to be viewed from different angles, taking into account the immediate data, the context of the research project, and an understanding of the larger social world, to arrive at a better understanding of the research problem (Smith and Narayan, 2012). Deducing from the literature reviewed in general, and in IS research in particular, there is no general agreement regarding the nature and use of triangulation. Different scholars have different ways of using triangulation, and this is another aspect that inspired the researcher to conduct this study.

2.10 SUMMARY

This chapter presented a literature review on triangulation using a chronological order approach, taking into account the dates of publication of triangulation related scholarly materials and trends in the development of triangulation. The main reason for conducting the literature review was to have an understanding of triangulation, highlight the area for this research, show related works done on triangulation, and show the knowledge gaps that triggered the investigation. The literature review in this study assessed triangulation, beginning with the origin of triangulation and focusing mainly on the evolution of the phenomenon to date. The chronological order approach to literature review helped to place this study in historical perspective. It also helped to ascertain how much is known about triangulation and determine a possible way forward in the interpretation and application of triangulation. The chronological development of triangulation was effective in helping determine the development of triangulation over a period of time. The phenomenon of triangulation cannot be studied without first discussing the phenomenon of mixed methods, also known as methodological triangulation. Scholars argue that methodological triangulation is the most widely used and documented type of triangulation. Thus, the historical account of triangulation is divided into the formative, paradigm debate, procedural development, and advocacy stage of methodological triangulation. The chapter also explored triangulation and narrowed down the discussion to IS research. In addition, the chapter explored the usage of triangulation, highlighting challenges encountered in using triangulation. The weaknesses and gaps in the current understanding and interpretation of triangulation were revealed. The following chapter presents the theoretical frameworks underpinning the study.

CHAPTER THREE

CONCEPTUAL FRAMEWORKS UNDERPINNING THE STUDY

3.1 INTRODUCTION

The previous chapter presented an account of the existing and scholarly body of knowledge on triangulation. This study explored the understanding and use of triangulation in IS research at the four top-ranking universities in South Africa. This chapter discusses the conceptual frameworks underpinning the study. Scholars liken the process of developing a conceptual framework to the process of planning a good holiday. The reason people plan before they go for a holiday is to ensure that they have a good understanding of how they will get to their holiday and return from their holiday destination. In addition, planning before going for a holiday helps to know what one will be doing during that holiday. Part of the preholiday preparation may involve asking people who have been to the same holiday destination for more information, getting tour maps and the GPS driving route. For people to make the most of the holiday they can also make use of their experiences and any information gathered from others. In the same way, the conceptual framework of a study provides a system of concepts that are logically related and interrelated, which tries to explain the phenomenon under study and informs the study. The conceptual framework provides a roadmap for the study by suggesting specific issues to be studied. Some researchers call the conceptual framework a lens for the study (Creswell, 2014).

A conceptual framework can also be defined as a collection of concepts (Fletcher, Hanton and Mellalieu, 2012). A concept is an abstract or vague idea that explains something or a phenomenon or situation (Hall, Griffiths and McKenna, 2013). Therefore, a conceptual framework according to Shields and Rangarjan (2013) is a collection of concepts or a network of connected and interconnected ambiguous ideas that together provide some explanation of a phenomenon, a situation, an event or a behaviour. The concepts in the conceptual framework logically support each other and interact with each other to form a whole conceptual

framework. Individually, concepts explain particular issues and a collection of concepts forms a conceptual framework that explains a research problem. A conceptual framework contains ontological, epistemological, and methodological suppositions. This means that each concept within a conceptual framework plays an ontological, epistemological or methodological role. Concepts are ontological in the sense that each explains knowledge of the way things are, the nature of reality and the existence of things (Guba and Lincoln, 2009). The epistemological supposition of a concept relates to how researchers come to know things and what knowledge is, or what things really are in an assumed reality (Goddard, Raenker and Macdonald, 2013). The methodological supposition of a concept relates to the process of formulating the conceptual framework and appraising what the conceptual framework says about reality. In other words, pieces of the conceptual framework or concepts are borrowed from literature, experience or both, and from these, the researcher formulates the structure or framework. This means that a conceptual framework may be of the researcher's own making, an adaptation of models, theories or other conceptual frameworks used in previous studies, with specific modifications to suit the study. The researcher provides an explanation to the conceptual framework either graphically or through a narrative of the main ideas, concepts or variables to be investigated, including a convincing presumed relationship among the concepts. In practical methodological terms, a conceptual framework gives direction to the study. Apart from indicating the direction of the study, the conceptual framework shows the relationship of the different concepts to be investigated.

This study was underpinned by Denzin, Jick and Patton's (1990) concepts of triangulation complemented by those of Cohen and Manion (1997) to form the Data, Investigator, Theory, Methodological, Analyst, Space, and Time (DITMAST) triangulation conceptual framework used to study the interpretation of triangulation. However, the DITMAST framework is limited, in that it focuses mainly on understanding triangulation and does not address its usage or application, i.e. its purpose. Scholars including Denzin (2012) and Patrick (2009) saw the purpose of triangulation as Validating findings, Explaining findings, Enriching research instruments, and Refuting findings (VEER), hence he the researcher developed the VEER triangulation conceptual framework. Thus, for the purposes of this study, the DITMAST

triangulation conceptual framework was complemented by the VEER triangulation conceptual framework, to investigate the interpretation and application of triangulation, respectively, as explained below.

3.2 FORMULATION OF THE CONCEPTUAL FRAMEWORKS

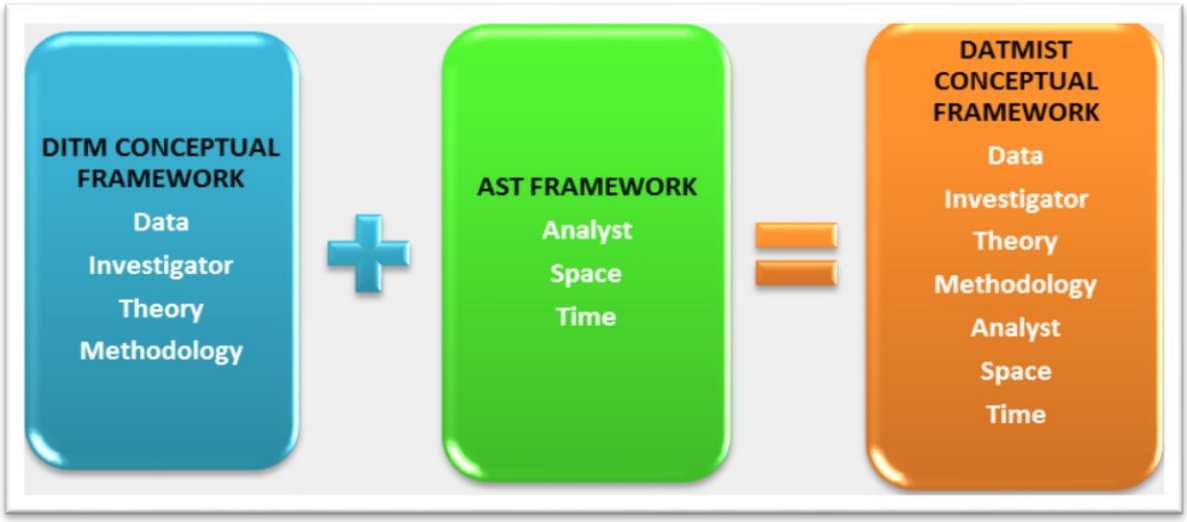
The DITMAST and VEER triangulation conceptual frameworks will now be discussed separately.

3.2.1 The DITMAST triangulation conceptual framework

Denzin, Jick and Patton (1990) explain that there are four types of triangulation: Data,

Investigator, Theoretical, and Methodological triangulation. Denzin, Jick and Patton's (1990) concepts of triangulation were criticised for not taking seriously the influence of the Analyst, Space and Time as separate forms of triangulation in a study. Therefore, the Analyst, Space and Time concepts of triangulation by Cohen and Manion (1997) were used to complement Denzin, Jick and Patton's (1990) concepts of triangulation to form the Data, Investigator, Theory, Methodological, Analyst, Space and Time (DITMAST) triangulation conceptual framework. Figure 3.1 below shows the DITMAST triangulation conceptual framework used to study the interpretation of triangulation among IS academics.

Figure 3.1: The DITMAST triangulation conceptual framework



Source: synthesised from Denzin, Jick and Patton (1990), and Cohen and Manion (1997)

The DITMAST triangulation conceptual framework postulates that an effective way of studying a phenomenon or situation is to use different research techniques, in this case, different data sources, investigators, theories, methodologies, analysts, spaces and times, to study the same phenomenon. This does not suggest that all of the different types should be used in a single study. Rather, various permutations of the types could be selected as appropriate to the research problem. When these different options are used, the findings should be assessed to determine the validity of research findings, explanation of the findings, and enrich research instruments, and refute findings. If the findings remain the same when studied using different data sources, investigators, theories, methodologies, analysts, spaces and times, then the research findings are sound. Thus, scholars claimed that triangulation, in research, allows researchers to use multiple research techniques in a study to generate trustworthy answers to research problems (Hammersley, 2008). The concepts of the DITMAST triangulation conceptual framework underpinning the study are explained below.

3.2.1.1 Data Source Triangulation

Denzin, Jick and Patton (1990) explained that data source triangulation is used to collect data from multiple data sources, for example, using data from in-depth interviews, focus group discussions, questionnaires and observation to study the same research problem. Leech, Dellinger, and Brannagan, Tanaka (2010) stated that findings from different data sources should be assessed together to increase the quality of research being conducted (see also Torrance, 2012).

3.2.1.2 Investigator Triangulation

Scholars regard investigator triangulation as a method whereby different investigators study the same research problem, for example, using two or more interviewers or observers with diverse research training backgrounds to examine the same phenomenon (Hemmings et al.,

2013; O'Cathain, Murphy and Nicholl, 2008; Onwuegbuzie, 2012). The results from the different investigators should then be combined (Wheeldon, 2010).

3.2.1.3 Theoretical Triangulation

Theoretical triangulation is a method that uses multiple theories, models or professional views when examining the same situation, phenomenon or behaviour (Morse and Niehaus, 2009; Bergman, 2008; Bryman, 2007). The method requires researchers to look at a situation or research problem from different perspectives, through different lenses, with different questions to interrogate (Denzin, 2012). Denzin and Lincoln (2008) explained that different theories in a study do not have to be similar or compatible. In fact, the more divergent the theories are, the more likely they are to identify different issues or concerns (Smith, Barratt and Trevena, 2012).

3.2.1.4 Methodological Triangulation

Some studies explain methodological triangulation as a method of using two or more research methods in a single study (Greene, 2007; Morgan, 2007). Data collected using different

methods should then be evaluated. LoBindo-Wood and Haber (1998) identified two different types of methodological triangulation: 'within-method' triangulation, which is used when a phenomenon is being studied using methods from the same research methodological tradition; and 'across-method' or 'between-method' triangulation, which involves combining research strategies or methods from two or more research traditions in the same study (AlHamdan and Anthony, 2010).

3.2.1.5 Analyst Triangulation

Cohen and Manion (1997) defined analyst triangulation as a method that uses two or more analysts to analyse the same data set and evaluate the results from two perspectives. Bazeley (2009) defined analyst triangulation as a method of effectively inspecting selective perceptions using different analysts or analysis techniques (see also Bergman, 2008). According to Bryman (2006), analyst triangulation sheds light on gaps in the presentation and interpretation of research findings.

3.2.1.6 Space Triangulation

Several scholars interpret space triangulation as a technique that uses different settings and locations to conduct a study, and then assesses the results collected from different spaces (Lunde, Heggen and Strand, 2013; Halcomb and Andrew, 2005). Denscombe (2008) added that space triangulation does not only consider settings and locations for the study, but should also take into account both external and internal environmental factors that can influence the data collected during the study (Youngs and Piggot-Irvine, 2012).

3.2.1.7 Time Triangulation

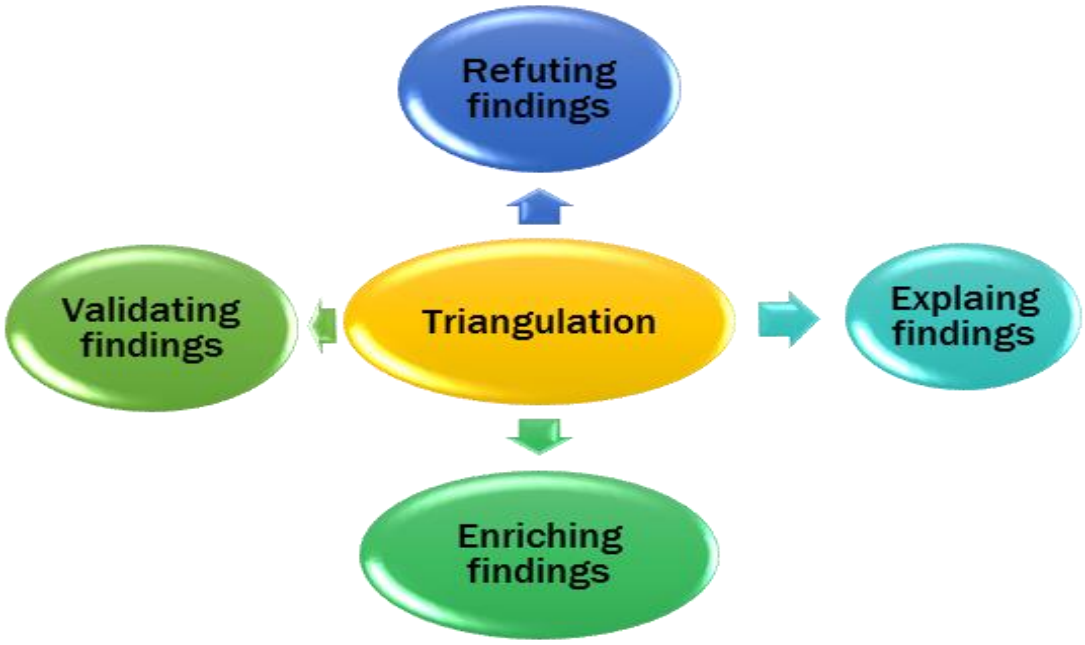
The literature shows that time factors such as the hour, day or season researchers conduct studies can influence the outcome of the study (Flick, Garms-Homolva, Herrmann, Kuck and Rohnsch, 2012; Greene, 2007). Hesse-Biber (2010) said that it is important for a researcher to conduct a study on the same research problem at different times, and, according to

Hemmings et al. (2013), the researcher should also identify time factors that can influence data collected during the research process (Hemmings et al., 2013).

3.2.2 The VEER Triangulation Conceptual Framework

As discussed earlier, while the DITMAST triangulation conceptual framework is useful in interpreting triangulation, it does not provide a lens to understand the usage or application of triangulation in a study. For this reason, the VEER conceptual framework to examine the usage of triangulation complemented the DITMAST triangulation conceptual framework. Patrick (2009) loosely explained that Denzin identified four main uses of triangulation, namely to: Validate research results, Explain unanticipated research results, Enrich research instruments, and Refute research results (VEER) as formulated by the researcher This is diagrammatically presented in figure 3.2, and explained below.

Figure 3.2: The VEER triangulation conceptual framework



Source: synthesised from Patrick (2009)

3.2.2.1 Validating Research Findings

Denzin (2012) explained that the purpose of triangulation in a study is to validate research findings (see also Patrick, 2009). Validation is done by using one set of perspectives to validate research findings generated using another set of options (Hesse-Biber, 2010).

3.2.2.2 Enriching Research Instruments

This concept elucidates that different types of triangulation are used to enrich research instruments in a study (Dellinger and Leech, 2007; Johnson, Onwuegbuzie and Turner, 2007). In this concept, research instruments are expected to enhance each other and add value to the findings (Grant and Booth, 2009).

3.2.2.3 Explaining Unanticipated Research Findings

This concept holds that triangulation in a study is intended to explain unanticipated research findings (Denzin, 2012). This is achieved by employing one set of options to shed light on unforeseen research findings generated using another set of options. This is supported by Patrick (2009), who argued that triangulation enables a researcher to generate research findings that are specific in explaining different facets of a phenomenon to arrive at comprehensive findings (see also Patrick, 2009; Onwuegbuzie and Johnson, 2006; Teddlie and Tashakkori, 2009).

3.2.2.4 Refuting Findings

Johnstone (2007) and Onwuegbuzie (2012) explained that triangulation should be used to refute findings by employing one set of options to specifically challenge research findings realised from using another set of options. In agreement, Patrick (2009) stated that triangulation is effective in proving the falsity or erroneousness, or the accuracy or truthfulness of research findings (see also Heyvaert, Hannes, Maes and Onghena, 2013).

The section below explains how the DITMAST triangulation conceptual framework and the VEER triangulation conceptual framework were used to inform this study. The DITMAST conceptual framework was used because it is the most comprehensive and current framework that explains triangulation. Therefore, the DITMAST conceptual framework focuses on the interpretation of triangulation making it suitable for the study but does not explain the usage of triangulation. For this reason, the DITMAST conceptual framework was complemented by the VEER conceptual framework that comprehensibly explains the use of triangulation.

3.3 APPLICATION OF THE CONCEPTUAL FRAMEWORKS TO THE STUDY

This section presents the DITMAST and VEER conceptual frameworks used to underpin the study.

The DITMAST triangulation conceptual framework was used to investigate the interpretation of triangulation in IS research, as presented below. The concepts in the framework were used to construct the interview guide and questionnaire.

- **Investigator Triangulation:** This idea was used to study the interpretation of investigator triangulation in triangulation in IS research.

- **Data Source Triangulation:** The researcher used this construct to investigate the interpretation of data triangulation in IS research.

- **Theoretical Triangulation:** The researcher used this concept to assess the interpretation theoretical triangulation in IS research.

- **Methodological Triangulation:** This construct was used to investigate the interpretation of methodological triangulation in IS research.

- **Analysis Triangulation:** The researcher used this concept to investigate the interpretation of analysis triangulation in IS research.

- **Space Triangulation:** This construct was used to examine the interpretation of space triangulation in IS research.

- **Time Triangulation:** The researcher used this concept to explore the interpretation of time triangulation in IS research.

The **VEER Triangulation Conceptual Framework** was used to investigate the application of triangulation in IS research, as presented below. The concepts in the framework were used to construct the interview guide and questionnaire.

- **Validating Findings:** The researcher used this construct to investigate triangulation in IS research is used to validate findings.
- **Enriching Research Instrument:** The researcher used this idea to investigate how triangulation in IS research is used to enrich research instruments.

- **Explaining Research Findings:** The researcher used this construct to investigate how triangulation in IS research is used to explain research findings.

- **Refuting Findings:** The researcher used this concept to investigate how triangulation in IS research is used to refute research findings.

3.4 SUMMARY

This chapter presented the conceptual frameworks used to investigate the interpretation and application of triangulation in IS research. The interpretation of triangulation was investigated using the DITMAST triangulation conceptual framework that explains triangulation as a research method that combines different research techniques to study one research issue. Triangulation techniques used in studies include data sources, investigator, theoretical, methodological, analyst, space, and time respectively. Using the DITMAST triangulation conceptual framework that has seven concepts, this study investigated the interpretation of triangulation in IS research. The DITMAST triangulation conceptual framework was complemented by the VEER triangulation conceptual framework to investigate the application of triangulation among IS academics. This is because the DITMAST triangulation conceptual framework only deals with the understanding of triangulation, not the usage, as this falls under the domain of the VEER triangulation conceptual framework. The VEER triangulation conceptual framework explains that triangulation is used to: validate findings, enrich research instruments, explain unanticipated research findings, and refute findings. The overall purpose of triangulation is to deepen the understanding of a research problem. Denzin (2012) described triangulation as a research effort that tries to explain more fully or map out the richness and complexity of research problems by investigating them from more than one perspective. The DITMAST triangulation conceptual framework and the VEER triangulation conceptual framework were key parts of the research design as they provided the system of concepts that supported and informed the study. The DITMAST and the VEER triangulation conceptual frameworks were very effective in helping the researcher to investigate the interpretation and application of triangulation in IS research. The following chapter presents the research methodology underpinning the study.

CHAPTER FOUR

RESEARCH METHODOLOGY

4.1 INTRODUCTION

This study examined the interpretation and application of triangulation within IS research at the four top-ranking universities in South Africa. This chapter presents the research methodology used to underpin the study. Research is understood as a logical and systematic process for 'looking again' for new and useful information on a specific topic or phenomenon or situation or event. Methodology is a process of pursuing how something is done. Thus, research methodology is a systematic, critical and managed process of studying how research is scientifically done with the purpose of ensuring that the study meets the highest possible standards of rigour (Creswell, 2014).

Essentially, this chapter presents the procedures by which the researcher went about his work of studying the interpretation and application of triangulation in IS research. It covers the following topics: the research design, methods, the study site, population, target population, and sampling strategies. The chapter also presents research techniques used to collect and analyse data.

4.2 RESEARCH DESIGN

Creswell (2014) defines a research design as a research tool box with all the research tools used in a study determined by the nature of the research problem not the other way around. A research design is used to structure the research methods and to show how all the major parts of the research project work together to address the central research questions in the study (Creswell, 2014). This study combined the exploratory and descriptive research approaches to realise the objectives of this study. An exploratory research approach was used to

investigate the interpretation and application of triangulation in IS research. Denzin and Lincoln (2009) and Yin (2009) state that exploratory research investigates a phenomenon or situation that has not been studied before. The objectives of an exploratory study are aimed at generating new insights, knowledge and understandings, and investigating factors associated with the research problem (McNiff and Whitehead, 2002). The research design for this study was exploratory in the sense that it was intended to study the whole phenomenon of the interpretation and application of triangulation in IS research, which had not been studied before. Leedy and Ornmond (2005) and Fink (2005) explained that exploratory studies investigate important factors related to a phenomenon in an in-depth manner to reach a reliable explanation of the existing phenomenon. Thus, an exploratory approach was chosen as it was appropriate to this study, enabling the researcher to gain a better grasp of the interpretation and application of triangulation in IS research. This approach was complemented by a descriptive research approach because the latter is effective in describing the behaviour of the phenomenon under study, a quality that is lacking in exploratory research (Babbie, 2010).

The descriptive research approach was incorporated because of its effectiveness in underpinning sequential methodology research and ability to generate accurate narratives of the features of a person or population in practical situations (Merriam, 2009). This approach is sometimes used to make judgements, rationalise existing behaviour, generate theory, and ascertain problems with existing practices (Booth, 2008), which were among the purposes of this study. The intention of employing a descriptive research approach was to generate the perceptions of the study sample on the research problem under study. In addition, descriptive research was used to describe what exists with regard to the understanding and usage of triangulation and to help unearth new facts and meanings about triangulation. This approach was suitable to this study because the study was aimed at identifying and describing the interpretation and application of triangulation.

4.3 RESEARCH METHODOLOGY

Scholars have defined research methodology as the science of how research is conducted (Creswell, 2014; Denzin and Lincoln, 2008). Therefore, this section presents the procedures whereby the researcher went about his research work of exploring and describing triangulation. The study used a mixed methods approach which became active in the 1980s (Fink, 2005). Even before that, researchers had long been using several research methods but these were never actually called the approach 'mixed methods' (Creswell, 2009:23). Mixed methods has been defined as a research procedure used to collect and analyse findings (Hennink, Hunter and Bailey, 2011; Bloor and Wood, 2006). Thus, the approach mixes or integrates methods within one study. The purpose of using mixed methods is to have a better understanding of the research problem, as quantitative and qualitative research methods are each inadequate to enable a researcher to capture the details and trends of the phenomenon under study (Jaccard and Becker, 2010). Mixed methods thus enables the researcher to make a robust analysis of the research problem by taking advantage of the strengths of both qualitative and quantitative research methodologies. Tashakkori and Teddlie (2003) mention that there are more than forty mixed methods research designs, including mixed sequential methodology which is used in this study (see also Jonson and Christensen, 2012; Merriam, 2009).

4.3.1 Sequential Methodology

Sequential methodology is a research methodology with two separate stages: quantitative followed by qualitative methodology (Maxwell, 2012; Dixon, 2009). The aim of sequential methodology is to employ qualitative research findings to help to elucidate and understand the research findings garnered using quantitative methodology. The researcher first collects and analyses quantitative data. Then, qualitative data are collected and analysed. The methodology helps to elaborate on the quantitative findings collected in the first phase of the study. Thus the qualitative method is used to build on the first, quantitative methodology (Mitchell and Jolley, 2010). The quantitative and qualitative phases come together in the in-between phase of the study. In this study the use of quantitative methodology generates a general understanding of the interpretation and application of triangulation in IS research,

while qualitative methodology helps to refine and elaborate statistical results by bringing out academics' views on the interpretation and application of triangulation in a detailed manner. This means that sequential methodology is used to validate and explain results, enrich research instruments, and refute results. Patten (2007) argued that mixed sequential research methodology allows a study to use the strengths of one approach to overcome the weaknesses of the other (see also Saunders, 2010).

Mixed sequential methodology was also employed to increase the generalisability of results (Rubin, 2008). In addition, the researcher wanted to provide stronger evidence to produce a strong conclusion through corroboration and convergence of findings. This was because the study aimed to develop conceptual frameworks on the interpretation and application of triangulation.

In short, sequential methodology offered advantages as the study investigated complex research questions (Stringer, 2007). The quantitative method provided detailed assessment of patterns and responses, while the qualitative method provided more depth to the understanding of survey responses as findings were discussed and analysed together (Yin, 2009). This allowed the researcher to produce a more thorough study.

4.4 GEOGRAPHICAL SITE

A study site is a place where a study is conducted (Bazeley, 2009). For a study site to be chosen, it must meet criteria set forth by the researcher informed by the processes of research methodology. The population in the study site should have the characteristics a researcher is interested in. The study was conducted at department level in the four of the top-ranking South African universities; the University of KwaZulu-Natal (KwaZulu-Natal Province), the University of the Witwatersrand (Gauteng Province), the University of Cape Town and Stellenbosch University (Western Cape Province). The four universities are among South African universities that have the strongest production of research, international outlook, industrial outcomes, citations, and teaching reputation (Mohamedbhai, 2012).

4.4.1 Target Population

A target population is defined as the entire group with specific parameters or characteristics a researcher is interested in (Crooks et al., 2011). In other words, the target population is a group from which the researcher selects a sample and about which the researcher draws conclusions (Creswell, 2014). The target population for this study were academic staff in the IS disciplines at the University of KwaZulu-Natal, the University of the Witwatersrand, the University of Cape Town, and Stellenbosch University.

4.4.2 Accessible Population

The accessible population is a subgroup of the target population that reflects particular characteristics the researcher is interested in (Howell and Savin-Baden, 2010). Eligibility conditions suggest that for a person to be included in a sample s/he should have specific characteristics that will help achieve the objectives of the study (Seidman, 2006). In this study, the accessible population were all academics in IS disciplines at the respective universities.

4.5 SAMPLING METHODS

A sampling method is a technique used to select participants or respondents for the study (Denscombe, 2008). Sampling methods are categorised as either probability or nonprobability. When using probability sampling methods, each member or unit of the target population has a known chance and equal probability or chance of being selected to be part of the sample (Farmer et al., 2006). Probability methods include: simple random sampling, stratified sampling, cluster sampling and many others informed by the principle of random selection. This means that units or people are selected by ‘chance’ or ‘probability’. The principle of random selection requires that a researcher begins by establishing the sampling frame, whereby all people in the population have an equal chance of inclusion. Therefore, people know in advance the opportunity of inclusion in the sample and this sampling method is used when conducting quantitative research (Flick et al., 2012).

In non-probability sampling, also called judgment, non-random or qualitative sampling, units or people are selected based on the judgement of the researcher (Sprague, 2005), however the researcher's judgement is not chaotic, nor are researchers able to defile research processes. The researcher's judgement concerning who to include in the study is informed by theory: tested knowledge on how to sample a population, and academic information, rules and concepts on how to select a sample (Grant and Booth, 2009). Other factors that inform the judgement are the practice, skills and experience of the researcher, as well as the evolutionary nature of research (Mertens, 2005). In other words, selection is by choice not chance. Nonprobability sampling methods include: snowball sampling, quota, convenience, purposive and self-selection.

4.5.1 Census Sampling

This study used the census sampling method which is both a probability and a non-probability sampling method (Grant and Booth, 2009). Census sampling allows a study to cover the total accessible population as a sample for the study (Denscombe, 2008). The census sampling technique was used to generate a study sample for quantitative research. Therefore all academic staff in IS disciplines at the universities under study were conscripted for the study.

4.5.2 Purposive Sampling

For the qualitative part, the purposive sampling method was used. Purposive sampling is a non-probability sampling method where participants are selected based on the researcher's knowledge of a population and the purpose of the study (Creswell, 2013). In other words, inclusion in the sample depends on the judgment of the researcher. In this sampling method, the researcher selects people with a 'purpose' in mind, which is to understand the phenomenon under study. By examining the characteristics of the people available, the researcher makes a judgement on which people to include in the sample (Halcomb and Andrew, 2005). People with relevant characteristics are selected to answer the research questions to help achieve the purpose of the study. The academics selected purposively in this study were IS lecturers who teach research methodology modules.

4.6 SAMPLE SIZE

Several researchers define a sample size as the total number of units or people selected to participate in the study (Bogdan and Biklen, 2007; Onwuegbuzie and Collins, 2007). The sample size for this study is fifty-eight (58). For the quantitative study, a sample size of fifty (50) academic staff was drawn from the four strata in the discipline of IS: University of KwaZulu-Natal (15), the University of the Witwatersrand (10), the University of Cape Town (18) and Stellenbosch University (7). For the qualitative part, a total of eight (8) participants; 2 lecturers for research methodology modules (2 from each strata) were drawn, respectively.

Table 4.1: Sample Size

University	Number	Per cent
WITS	10	20
University of Cape Town	18	36
University of KwaZulu-Natal	15	30
SUN	7	14
Total	**50**	**100**

4.7 DATA COLLECTION

Three research techniques were used to collect data: document collection, questionnaires, and in-depth interviews.

4.7.1 Phase One: Document Collection

Documents collection included research methodology text books, pamphlets, course outlines, and other research methodology teaching material used in the IS disciplines at the four universities. This process helped to inform the formulation of the questionnaire and in-depth interviews.

4.7.2 Phase Two: Structured Questionnaires

A total of sixty (60) structured questionnaires were used to collect data. A structured questionnaire is a quantitative data collection instrument that has a set of standardised questions and a fixed plan for data collection (Dellinger and Leech, 2007). The questions have specific wording and order aimed at helping to achieve the research objectives underpinning the study. The questionnaires were designed in such a way that they collected the data related to the patterns among academics on the interpretation and application of triangulation. The questionnaire was divided into several sections, including: demographics, data source, investigator, theoretical, methodological, analyst, space, and time triangulation. Each of the seven types of triangulation was divided into four sections: knowledge, usage, usability, and frequency of the usage of triangulation. A five-Likert or a 1-to-5 response scale with an even-point was used, where the middle option of neutral was available as shown below: 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree, and 5=Strongly Agree. The researcher used electronically administered questionnaires by e-mailing to the Head of IS Disciplines. Bloor and Wood (2006) considered e-mailed questionnaires to be a useful way of getting hold of dispersed populations. Creswell (2007) explained that the technique is beneficial as it may be used to contact people who may not be comfortable being questioned face-to-face. Data collection using the questionnaire was followed up by data collection using in-depth interviews to corroborate, confirm and cross-validate findings.

4.7.3 Phase Three: Semi-Structured In-Depth Interviews

Eight (8) semi-structured in-depth interviews were conducted with lecturers teaching research methodology. Semi-structured in-depth interviews are also called ‘conversational interviews’

as they allow interviewees and interviewers to engage in a purposive conversation (Creswell, 2007:20). Semi-structured in-depth interviews fall between structured and unstructured interviews (Hennink, Hutter and Bailey, 2011). The researcher used semi-structured in-depth interviews because they allow the researcher and participant to be equal partners in the research process (Howell Major and Savin-Baden, 2010). Though the researcher knows the specific areas to be covered in the study, participants are given freedom to meander, generating different views on the research problem under study (Onwuegbuzie, 2012).

The researcher, however, brings participants back to the themes being discussed using prompt questions. Johnson and Christensen (2012) explain that successful in-depth interviews are those that consist of a two-way dialogue between the researcher and participants. Maxwell (2012) cautions that researchers should be flexible, but, at the same time, in control of the research process. Open-ended questions were mainly used with a few closed questions. As allowed by semi-structured, in-depth interviews, probes and prompts were employed to help participants to elaborate on aspects of their account (Merriam, 2009) to complete the story on the interpretation and application of triangulation.

In brief, semi-structured, in-depth interviews were used to gather more in-depth insights on participants' attitudes, thoughts and actions with regard to the interpretation and application of triangulation, as well as to generate confirmatory results from the questionnaires (Mitchell and Jolley, 2010). Thus data collection methods were used to overcome the weaknesses of one method with the strengths of another (Simons, 2009).

4.8 RELIABILITY AND VALIDITY

Reliability and validity are critical issues when it comes to research. Failure to assure the reliability and validity of the findings may cause the research to be questioned, or even worse, rejected as null and void.

Reliability refers to consistency or repeatability of the measurement (Babbie, 2010). For example, in this study, consistency can be related to the questionnaires and moderators' interview guide being clear and well defined to avoid confusing the respondents or participants. Repeatability means that if researchers have findings from a group they should be able to repeat the survey and get the same results (Bloor and Wood, 2007).

To ensure reliability the researcher carried out a pre-test of the questionnaire on eight academic staff selected randomly across four universities, namely, the University of KwaZulu-Natal (2), the University of the Witwatersrand (2), the University of Cape Town (2), and Stellenbosch University (2). The moderators' interview guide was tested on four academic staff selected randomly, one from each university. This assisted in testing the reliability of both the questionnaire and the moderators' interview guide before fieldwork commenced.

Validity refers to the degree to which the measurement procedure actually measures the concept that it is intended to measure (Denzin and Lincoln, 2011). To ensure validity in the research, content validity was conducted. Subject-matter experts and a statistician were provided with access to both the questionnaire and the moderator's interview guide and asked to provide feedback on how well each question measured and interrogated the construct in question. Their feedback was then analysed and used to inform decisions made about the effectiveness of each question. The statistician validated the questionnaire.

Reliability was also computed by taking several measurements on the same subjects. A reliability coefficient of 0.70 or higher is considered as "acceptable". The Cronbach's alpha score high for all the items that constituted the questionnaire. The reliability scores for all sections exceeded the recommended Cronbach's alpha. This indicated a degree of acceptable, consistent scoring for these sections of the research.

4.9 QUALITATIVE DATA CONTROL MEASURES

In order "for a study to generate qualitative findings that are reliable, data quality control measures should be put in place. This study employed the following data control" measures:

4.9.1 Credibility

The study used this data control measure by ensuring that methods used in this study are those that have been used by other researchers and have been found to be reliable in operating generating credible research results (Denzin and Lincoln, 2013. In addition, only participants who are willing to be part of the study were included in the study.

4.9.2 Transferability

This data quality control measure was used to succinctly and adequately highlight the context of this study and the findings to help researchers find it easy to ascertain transferability of the research findings.

4.9.3 Dependability

The researcher ensured that the methodology used in particular data collection instruments were scientific to allow interested researchers to use the methodology to conduct research and realise the similar results.

4.9.4 Confirmability

The study ensured that results generated in this study are confirmed by literature review and participants if results presented reflected their views.

4.10 DEVELOPMENT OF THE RESEARCH INSTRUMENTS

The questionnaire was constructed with several sections. Section One explored demographic information; Section Two - knowledge of triangulation; Section Three - usage, frequency and usability of triangulation constructed using variables from the VEER conceptual framework; and Section Four to Section Ten - Data, Investigator, Theoretical, Methodological, Analyst, Space, and Time triangulation each divided into three section focusing on usage, frequency, and usability constructed using variables from the DITMAST conceptual framework.

Questionnaires were emailed to all respondents in the IS departments selected for the study. The questionnaires had information on the purpose, main objectives and duration of the study. Respondents were informed of their rights to participate and withdraw from the study anytime of their choice without consequences. The researcher worked around respondents' time. All this was done to make respondents feel free to participate in the study.

Respondents were emailed to find out if they needed help to complete the questionnaire. The researcher asked the respondents to email back the completed questionnaire after two weeks at the time convenient to respondents. Two weeks was enough for all respondents to complete the questionnaires.

The same approach was followed to develop the interview guide which had several sections. Section One explored demographic information; Section Two; knowledge of triangulation; Section Three; usage, and usability of triangulation constructed using variables from the VEER conceptual framework; and Section Four to Section Ten; Data, Investigator, Theoretical, Methodological, Analyst, Space, and Time triangulation each divided into two section focusing on usage and usability of triangulation constructed using variables from the DITMAST conceptual framework.

4.11 PILOT STUDY

A pilot study was conducted before the actual study. To pilot the questionnaire, the pilot study was conducted on small scale with eight academics and to pilot the interview guide four academics were selected to help eliminate problem in the research protocol and instruments. Pilot studies were conducted to reduce errors, prevent waste in terms of time, money, and effort. The pilot study also helped to test the research protocol and ascertain the feasibility of the questionnaire, interview guide and research process. The pilot study helped to eliminate misleading and confusing research questions. This was effective in maximizing research

objectivity, refining the research questionnaires, interview guide and making it easy to answer and record findings.

4.12 DATA ANALYSIS

Data analysis is a process of systematically applying logical techniques to describe and illustrate, condense and summarise, and evaluate data (Simons, 2009). Shamoo and Resnik (2009) state that various data analytic procedures offer a way of drawing inferences from data to understand the phenomenon under study.

4.12.1 Quantitative Data Analysis

In this study, quantitative data were analysed using descriptive statistics including mean and standard deviations, where applicable. Frequencies are represented in tables or graphs.

- **Chi-square Goodness-of-Fit-Test:** in particular a univariate test was used on a categorical variable to test whether any of the response options were selected significantly more/less often than the others. Under the null hypothesis it is assumed that all responses are equally selected (Stringer, 2007).

- **One Sample T-Test:** was used to test whether the average value was significantly different from a value of 3 (the central score). This was applied to Likert scale questions.

4.12.2 Qualitative Data Analysis

Data collected using in-depth interviews were analysed using the thematic analysis technique. This involves a process of identifying themes within data (Greene, 2007; Tashakkori and Teddlie, 2010). Thematic analysis then analyses the identified themes and records patterns or themes identified from the data collected. Thematic analysis was suitable to analyse the data collected because the technique organises data and then describes the data sets in detail

(Jaccard and Becker, 2010). Scholars such as Greene (2007), Tashakkori and Teddlie (2010) and Braun and Clarke (2006) claimed that thematic analysis is effective in identifying, analysing and reporting patterns within data, which was the intention of the qualitative study. Besides, thematic analysis was used because the technique is a widely used method of analysis in qualitative research. The study also used thematic analysis because it is simple to use which lends itself to use in mixed methods such as this one with more complex dimensions. Thematic analysis allows flexibility in the study's choice of theoretical framework. Scholars (Greene, 2007; Tashakkori and Teddlie, 2010) agree that other methods of qualitative data analysis are closely tied to specific theories, but thematic analysis can be used with any theory the study chooses. Through this flexibility, thematic analysis allows for rich, detailed and complex description of data making it as mentioned above suitable for this study.

The researcher adapted Braun and Clarke (2006)'s thematic analysis that uses the following steps to analyse the qualitative data because of the advantages explained above:

- **Familiarising With Data:** In this stage, the researcher immersed himself in the data on the interpretation and application of triangulation to familiarise himself with it. The Voice recordings of in-depth interviews were transcribed. The researcher had to read and reread the transcriptions searching for meanings and patterns (Babbie, 2010).

- **Generating Initial Codes:** After familiarising himself with the data, the researcher generated the initial codes for his data (Braun and Clarke, 2006). All the data were systematically coded manually, using highlighters. The researcher coded for as many potential codes and themes as possible. After coding, all the data were collated according to code.

- **Searching for Themes:** After generating a fairly long list of different codes, the researcher sorted them into potential themes (Braun and Clarke, 2006). This was done with the help of visuals, such as mind maps, flash cards and tables to sort out the codes.

Themes and subsets of codes were identified. Some codes were discarded, while others were kept as outliers. This stage provided the researcher with themes and sub-themes. The main themes included data source, investigator, theoretical, methodological, analyst, space and time triangulation, knowledge, usage, and usability of triangulation.

- **Reviewing Themes:** During this stage, the researcher refined his themes (Braun and Clarke, 2006; Greene, 2007; Morgan, 2007). Some themes were combined while others were broken down into smaller components. This stage was carried out systematically by assessing the level of the coded data, re-reading extensively all data extracts that fitted into each theme to ensure that all the data on the types of triangulation, knowledge, usage, and usability of triangulation, formed a coherent pattern. After reviewing the data at the level of each theme in relation to the data bank, a thematic map was created to help visualise the relationships between themes in order to ensure that they reflected the meaning of the data as a whole. This stage provided a satisfactory thematic map of the data.

- **Defining and Naming Themes:** This step was used to capture the essence of what each theme was about and what aspect of the data it captured. Here the researcher created an overall narrative with all of his data. Each theme and its individual narrative was analysed to ensure that each theme fitted into the overall narrative. It was at this stage that the researcher named his themes. The names of the themes were concise and punchy to give readers a sense of what the theme is about. This phase enabled the researcher to identify his themes clearly.

- **Matching of Themes with Quantitative Data:** After revising the themes several times, the researcher produced a thematic chart that guided the merging of the quantitative and qualitative data. During this stage, the research compared the results from the quantitative and qualitative research. The qualitative and qualitative data that covered the same theme or sub-theme were grouped together by two independent researchers to ensure credibility in the piling and matching up of data according to themes across

methods. Then, the qualitative data was used to help explain, validate, enforce and refute the quantitative findings.

- **Producing the Report:** The researcher then analysed and wrote up a research report. The report provided sufficient evidence of each theme using clear examples from the qualitative data to support the quantitative findings. This step helped in writing the final thesis.

4.13 DATA PRESENTATION TECHNIQUE

Creswell (2013) argues that an effective way of presenting and analysing data is to employ an approach where data presentation, discussion and interpretation are presented together. Patton (2009) claimed that data presentation, discussion and interpretation especially qualitative data should include verbatim quotations as the matter of evidence, demonstration, elucidation, a way of giving participants a voice, to deepen understanding, and to increase readability.

Nelson (2011) argues that when a study is underpinned by the mixed methods approach such as in-depth interviews and questionnaires, data from interviews and questionnaires should be presented at the same time to facilitate validation of the data through cross verification. Gregor and Baskerville (2012) explained that presenting qualitative and qualitative data at the same time or simultaneously helps to confirm and corroborate research findings. In short, a concurrent mixed method data presentation, discussion and interpretation strategy was used in this study to triangulate quantitative data presentation with qualitative data (Creswell and Plano Clark, 2007). The analysis of embedded qualitative responses helped to augment, explain complex, agreeing, and contradictory quantitative responses. This is in agreement with Mertens (2010)'s finding that qualitative data can be used to complement, validate, and clarify quantitative data by assisting the research process to identify common themes. Dellinger and Leech (2007) argued that synchronised mixed method data presentation, discussion and interpretation is complex, time consuming, and exhausting as it requires that a researcher pairs quantitative and qualitative data. Qualitative data helped in understanding

the interpretation and application of triangulation. The data presentation, discussion and interpretation techniques mentioned above were adopted in this study.

4.14 ETHICAL CONSIDERATIONS

Ethical processes were followed during this research in line with the universities under study. The gatekeepers' letters were provided by university under study (see appendix 3) and ethical clearance was obtained from all four universities (see appendix 4). Participants were adequately informed about the nature and purpose of the study. Hence, their participation in the study was based on having ample knowledge of the study. Participants' privacy was upheld by informing them of their right to keep certain information from the public. Confidentiality was upheld by limiting access to participants' private information, and anonymity was upheld by not using names in the study.

4.15 SUMMARY

This chapter presented the research methodology underpinning the study. Research methodology is an approach involving studying a phenomenon in a systematic, critical and controlled manner. Thus this chapter presented the main steps used to study the interpretation and application of triangulation in IS research. More specifically, the exploratory and descriptive research design, methods, study site and population were described. In addition, the sample selection methods were described, as well as the procedure used in designing the research instruments and collecting the data. The thematic and statistical procedures used to analyse the data were explained, as well as the ethical issues that were taken into consideration. The following chapter presents the data collected in this study.

CHAPTER FIVE

DATA PRESENTATION

5.1 INTRODUCTION

This study investigated the interpretation and application of triangulation in Information Systems (IS) research. The previous chapter presented the research methodology underpinning the study. This chapter presents findings on the interpretation and application of triangulation. The chapter starts by recapitulating on the research objectives the study set out to achieve followed by a section on characteristics of the target population. Characteristics presented include age, gender, place of work, department, level of study, ethnicity, education level, and years of work experience. Subsequently, the chapter presents quantitative and qualitative data separately on the understanding, usage, usability, and frequency of use of data source, investigator, theoretical, methodological, analyst, space, and time triangulation. This is followed by simultaneous discussion, analysis, and interpretation of quantitative and qualitative data. The chapter closes with a summary on the main findings generated in this study.

5.2 SUMMARY OF THE RESEARCH PROCESS FOLLOWED IN THE STUDY

Ethical measures were put in place before commencing the data collection process. The gatekeepers' letters (see appendix A) and ethical clearance (see appendix B) were sought from relevant authorities at the University of KwaZulu-Natal (UKZN), Stellenbosch University (SUN), University of Cape Town (UCT) and the University of the Witwatersrand (WITS), respectively. In adhering to research ethics, consent was sought from participants before collecting data and the response was positive. The issues of confidentiality, anonymity, and privacy were explained to the participants.

The target population for this study were academic staff in the IS disciplines at four universities under study. In this study, the accessible population were all academics in IS disciplines at UKZN, WITS, SUN and UCT. Census sampling method where a study covers the total accessible population was used to generate a sample for the quantitative study. Therefore, all academic staff in IS disciplines at UKZN, WITS, UCT, and SUN were asked to participate in the study. For the qualitative

study eight (8) participants; 2 lecturers for research methodology modules (2 from each of the four strata) were drawn. Purposive sampling method was used to select participants based on the researcher's knowledge of the population and the purpose of the study. Thus, eight (8) research methodology lecturers participated in the qualitative study.

To start data collection, the researcher introduced himself to the Information Systems (IS) Head of Departments (HODs) at UKZN, WITS, UCT, and SUN through phone calls and explained the main purpose of the study. The HODs were asked to introduce the researcher and his study to their respective academic staff. The HODs then emailed the consent letters and questionnaires to their academic staff respectively to complete. All completed questionnaires were sent to the researcher through the HODs. Fifty-eight (58) questionnaires were distributed and 50 were completed (see appendix 6 or the questionnaire). Therefore, the researcher automatically worked with the 95.0 per cent confidence level and a 5.0 per cent margin of error determined by the questionnaires returned since census sampling was used. The population distribution for the quantitative study was as follows; UKZN (30.0 per cent), WITS (20.0 per cent), UCT (36.0 per cent), and SU (14.0 per cent) while for the qualitative study was UKZN (25.0 per cent), WITS (25.0 per cent), UCT (25.0 per cent), and SU (25.0 per cent).

Three research techniques were used to collect data; document collection, questionnaires, and in-depth interviews. Data collected using in-depth interviews (see appendix 7) were analysed manually using thematic analysis. Documents were analysed using content analysis, and questionnaires were analysed using descriptive and inferential statistics.

Data presentation, discussion and interpretation is a logical and methodological research process of putting across information collected in a study in a clear and succinct manner to show findings and the meaning of findings in the study (Dellinger and Leech, 2007). Data presentation, discussion and interpretation in this chapter includes the description of the dataset with the main variables covered, the classifications and breakdowns with an aim of telling a story about the interpretation and application of triangulation in IS research.

5.3 RESEARCH OBJECTIVES

The following are the seven research objectives the study set out to achieve.

- To understand the interpretation and application of data triangulation in IS research at four of the top ranking universities in South Africa.

- To ascertain the interpretation and application of investigator triangulation in IS research at four of the top ranking universities in South Africa.

- To ascertain the interpretation and use of theory triangulation in IS research at four of the top ranking universities in South Africa.

- To understand the interpretation and application of methodological triangulation in IS research at four of the top ranking universities in South Africa.

- To determine the interpretation and application of analyst triangulation in IS research at four of the top ranking universities in South Africa.

- To understand the interpretation and application of time triangulation in IS research at four of the top ranking universities in South Africa.

- To understand the interpretation and application of space triangulation in IS research at four of the top ranking universities in South Africa.

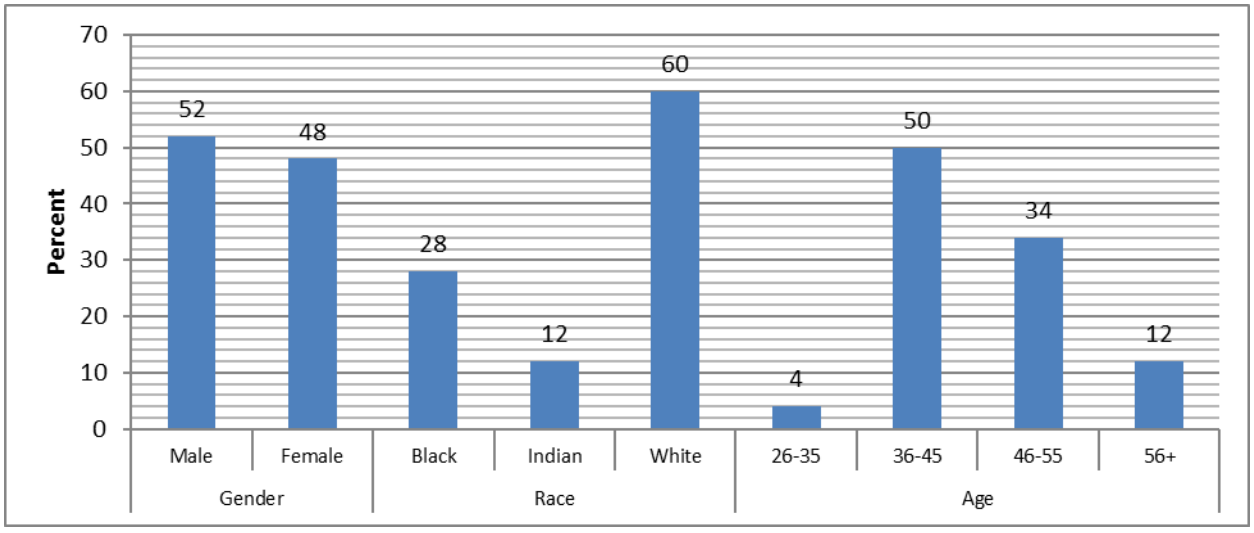
Data presentation, discussion and interpretation on themes generated in this study is done in this chapter while the contribution to the body of knowledge is presented in the next chapter.

Generally, the research process though strenuous unfolded as planned. Data presentation starts with a summary of the demographic information pertaining to the participants as presented in the following section.

5.4 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

The quantitative findings show that there was almost an equal distribution of respondents by gender; 52.0 per cent were males and 48.0 per cent were females as presented in figure 5.1 below.

Figure 5.1: Distribution of respondents by gender, race and age



These findings above are in agreement with the Council on Higher Education (CHE) report (2016) that shows that there were 3.0 per cent more male academics than females.

The analysis shows that over half of the respondents were Whites (60.0 per cent) while 28.0 per cent were Blacks and 12.0 per cent were Indians. This finding is in agreement with the national trend on academic staff employment status in South Africa by race showing that White academics make up

53.0 per cent followed by Black academics 32.0 per cent of the academic staffing sector with fewer Indians (8.0 per cent) and Coloureds (5.0 per cent) staff members (CHE, 2016).

The findings also show that half (50.0 per cent) of the respondents were aged between 36 to 45 years, 34.0 per cent were aged between 46 and 55 years, 12.0 per cent were above 55.0 per cent and only 4.0 per cent were aged between 26 and 35 years old. The highest number of academics is under 55 years old. This is in agreement with the CHE report (2016) showing that the highest number of academics is under 56 years old. For the qualitative study, there were eight (8) participants; three (3) were female and five (5) were male. Majority of academics interviewed were aged between 36 and 45 years. Table 5.2 below shows the demographic characteristics of the academic staff who participated in the qualitative study.

Table 5.1: Demographic characteristics of the interviewees

University	Number
UKZN	2
WITS	2
UCT	2
SUN	2
Total	**8**

The findings show that majority of participants were lecturers (60.0 per cent). Besides, majority of the participants were White (70.0 per cent), and majority had permanent employment (60.0 per cent).

5.5 THE DISTRIBUTION OF RESPONDENTS BY UNIVERSITY, POSITION AND QUALIFICATION

The quantitative findings show that the majority (36.0 per cent) of respondents were from UCT followed by UKZN (30.0 per cent). WITS accounted for 20.0 per cent of the respondents while SUN

accounted for 14.0 per cent. The findings also show that the majority of respondents were lecturers (54.0 per cent) followed by professors at 22.0 per cent. Senior lecturers accounted for 20.0 per cent while researchers and heads of divisions accounted for 2.0 per cent each. The findings suggest that data was collected from knowledgeable and experienced academic staff enhancing the trustworthiness of the findings. All respondents (100 per cent) were permanent employees.

When asked about the highest academic qualification they held, most of the respondents reported having a Masters degree (56.0 per cent). Those with doctorates accounted for 38.0 per cent and in total 62.0 per cent (masters 56.0 per cent and masters in commerce 6.0 per cent). The findings indicate that data was collected from people who by study had mastery of their disciplines. For the qualitative part, four participants were PhD holders (50.0 per cent) and the other four were Masters degree holder (50.0 per cent).

5.6 KNOWLEDGE OF TRIANGULATION

The objective of the study was to ascertain IS academics' knowledge of triangulation. When asked about whether they knew what triangulation is, more than half of the respondents in each qualification agreed as shown in table5.3 below.

Table 5.2: Knowledge and Source of Knowledge of Triangulation

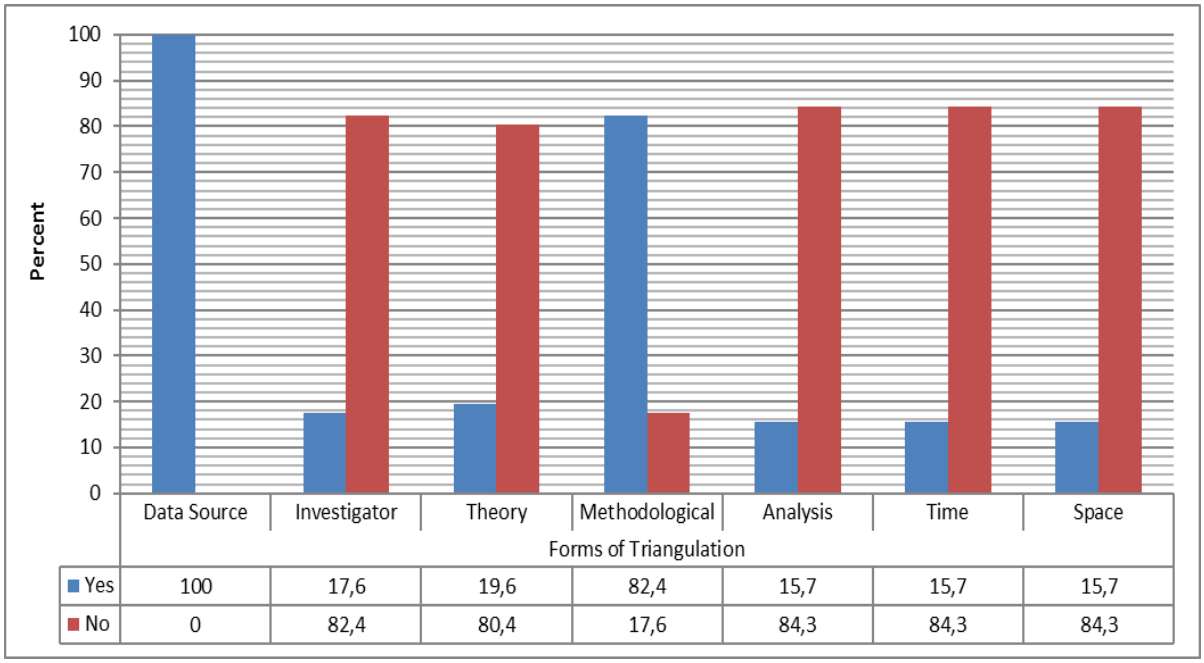
	PhD		**MCom**		**Masters**		**All**		**Chi-Square**
	%	**N**	**%**	**N**	**%**	**N**	**%**	**N**	
Ever heard about triangulation	100	18	100	3	100	29	100	50	-
Source of knowledge on triangulation									
Colleagues	0.0	0	33.3	1	10.3	3	7.84	4	0.252
Seminar	10.5	2	0.0	0	24.1	7	17.65	8	
Conference	5.3	1	0.0	0	13.8	4	9.80	5	

Supervisor	5.3	1	0.0	0	0.0	0	1.96	1
Readings	78.9	15	66.7	2	51.7	15	62.75	32

Table 5.3 above shows that all respondents were aware of triangulation. The finding suggests that all IS academic staff in this study were in a condition of knowing triangulation with familiarity possibly gained either through experience or association. Table 2 further shows that most respondents reported reading as their source of knowledge on triangulation. Reading as source of triangulation was more pronounced among PhD holders (78.9 per cent) as compared to Masters holders (51.7 per cent). It appears that most participants (PhD and Masters holders) obtained knowledge of triangulation through readings while very few academics were exposed to triangulation methods via their supervisors (1.96 per cent) or conferences (9.80 per cent). The chi-squared test was p=0.252 suggesting that there is no significant difference between the expected frequencies and the observed frequencies in all categories in the table above.

When respondents were asked whether they understood what triangulation is, more than half of the respondents in each qualification agreed. Twenty-six per cent of the PhD holders strongly agreed whereas only about 14 per cent of the Masters holders strongly agreed. Respondents were asked if they understand the different types of triangulation. The findings in figure 5.2 below show that all (100 per cent) respondents reported that they knew data source triangulation and 82.4 per cent reported that they knew about methodological triangulation. Furthermore, 20.0 per cent knew theory triangulation while 18.0 per cent knew investigator triangulation and only 16.0 per cent knew analyst, time and space triangulation.

Figure 5.2: Knowledge of Different Types of Triangulation



The study in appendix 5 also found that PhD holders (78.9 per cent) agreed more than Masters holders (69.0 per cent) to the statement that they understood the different types of triangulation.

5.7 THEORETICAL TRIANGULATION

The aim of this section is to present, discuss and interpret the interpretation and application of theoretical triangulation. The research objective was to ascertain the interpretation and application of theoretical triangulation.

5.7.1 The Usage of Theoretical Triangulation

Respondents were asked whether they use different theories in the same study, the majority (33.3 per cent) of the respondents agreed whereas 30.0 per cent disagreed. Furthermore, 10.0 per cent of the respondents were neutral while 20.0 per cent strongly agreed and 8.0 per cent strongly disagreed.

Table 5.4 below shows that the chi-square yielded a statistically significant finding (p-value of 0.010) for three categories. The finding implies there is difference between the means therefore a significant difference does not exist.

Table 5.3: Usage of Theoretical Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	N	%	n	%	n	%	p-value
I use different theories in the same study	4	7.8	15	29.4	5	9.8	17	33.3	10	19.6	0.000
I use different theories outside my discipline when conducting a study	6	11.8	24	47.1	3	5.9	13	25.5	5	9.8	0.000
I use different theories within my discipline in research	4	7.8	17	33.3	1	2.0	21	41.2	8	15.7	0.000

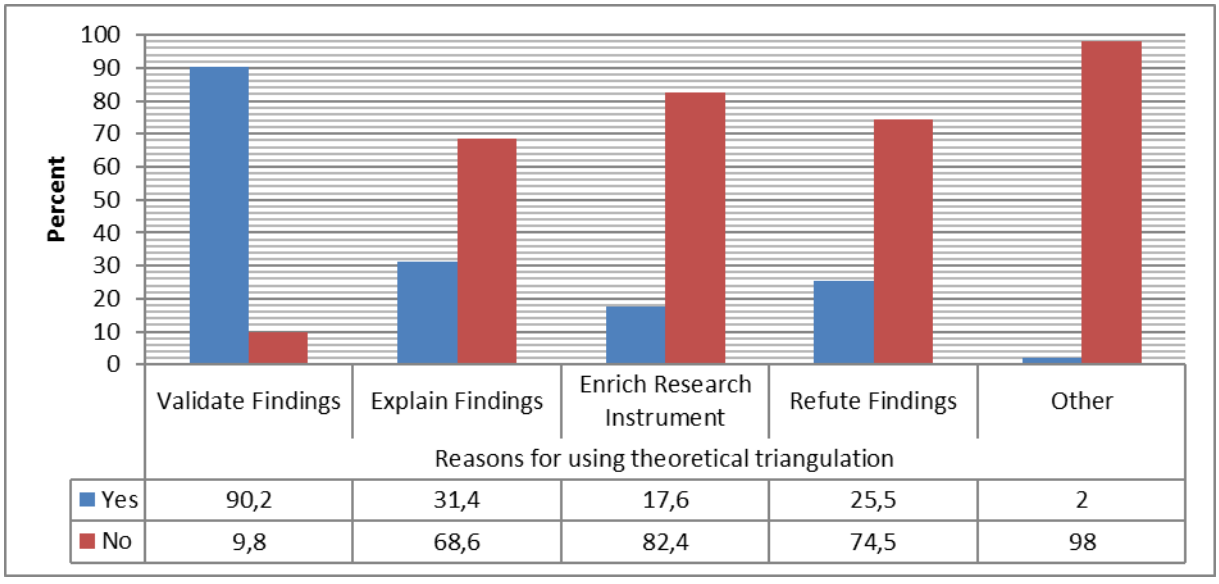
Respondents were also asked about whether they use different theories outside their disciplines when conducting a study. Table 3 above shows that the majority disagreed (47.1 per cent) while a quarter agreed (25.5 per cent) and about 6.0 per cent were neutral. Additionally, about 10.0 per cent strongly agreed, 12 per cent strongly disagreed, and the chi-square test of significance yielded a p-value of 0.000.

Concerning the usage of different theories within academics' discipline, the majority of respondents (41.2 per cent) agreed that they use different theories within their disciplines while about 33 per cent disagreed and two per cent were neutral. Furthermore, about 16 per cent strongly agreed while about eight per cent strongly disagreed.

5.7.2 The Reasons of Using Theoretical Triangulation

Respondents were asked about their various reasons for using theoretical triangulation, and most of the respondents (90.2 per cent) in the sample indicated that they use theoretical triangulation to validate findings while 31 per cent to explain findings and 26 per cent to refute findings. Figure 5.3 below further shows that about 18 per cent use theoretical triangulation to enrich research instruments while two per cent use theoretical triangulation for other unspecified reasons.

Figure 5.3: Reasons for Using Theoretical Triangulation



5.7.3 The Frequency of Using Theoretical Triangulation

The study investigated how often respondents use different theories in a study, and table 5.5 below shows that the majority (43.1 per cent) occasionally use theoretical triangulation.

Table 5.4: Frequency of Using Theoretical Triangulation

	Never		**Rarely**		**Occasionally**		**Frequently**		**Very Frequently**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value
How often do you use different theories in a study?	3	5.9	18	35.3	22	43.1	7	13.7	1	2.0	0.000
How often do you use different theories from your discipline in a study?	4	7.8	16	31.4	17	33.3	12	23.5	2	3.9	0.001
How often do you use different theories from other disciplines in a study?	8	15.7	25	49.0	14	27.5	4	7.8	0	0.0	0.000

The proportion of those who rarely use theoretical triangulation was about 35.0 per cent while those who frequently use was about 14 per cent. Furthermore, only two per cent of the respondents reported that they frequently use and six per cent reported that they never use theoretical triangulation. The chi-square test of significance on the same yielded a p-value of 0.000. In table 4 above, the study shows that the majority (33.3 per cent) of respondents occasionally use different theories from their discipline in a study. Furthermore, 31 per cent rarely use while 23.5 per cent frequently use theoretical triangulation. Those who frequently use accounted for four per cent whereas those who never accounted for eight per cent. The chi-square test of significance was 0.001. When asked about

how often they use different theories from other disciplines in a study, almost half (49 per cent) of the respondents reported that they rarely do. Those who reported that they occasionally use were slightly above a quarter (27.5 per cent) while those that reported that they frequently use were eight per cent whereas those who indicated that they never use were about 16 per cent. Table 4 above shows a p-value of 0.000 for the chi-square test of significance.

5.7.4. Usability of Theoretical Triangulation

In order to assess the usability of theoretical triangulation, respondents were asked whether it is easy to use different theories, whether there are problems and whether they were confident in using different theories in a study. The table 5.6 below shows that 52.9 per cent of the respondents disagreed with the statement that it is easy to use different theories in a study.

Table 5.5: Usability of Theoretical Triangulation

	Strongly disagree		**Disagree**		**Neutral**	**Agree**		**Strongly agree**			**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value
It is easy to use different theories in a study	10	19.6	27	52.9	7	13.7	6	11.8	1	2.0	0.000
There are problems in using different theories in a study	0	0.0	3	5.9	5	9.8	25	49.0	18	35.3	0.000
I am not very confident in using different theories in a study	5	9.8	32	62.7	9	17.6	5	9.8	0	0.0	0.000

The study indicates that only 12 per cent agreed that it is easy to use different theories in a study and those who strongly agreed accounted for two per cent. Twenty per cent reported that they strongly disagreed and 14 per cent were neutral. The chi-square test of significance yielded a p-value of 0.000.

Respondents were further asked to rate their competence in using theoretical triangulation. Findings were not statistically significant; fifty-eight per cent of respondents with PhD qualifications rated their competence as good and 38 per cent for those with Masters qualifications (p-value: 0.792). However, 63.0 per cent of the respondents disagreed with the statement that they were not confident in using different theories in a study and 10.0 per cent strongly disagreed. Only 10 per cent agreed and 18.0 per cent were neutral. The p-value for the chi-square test was 0.000.

5.8. METHODOLOGICAL TRIANGULATION

This section is a presentation, discussion and interpretation of findings on the interpretation and application of methodological triangulation. The research objective was to understand the interpretation and application of methodological triangulation.

5.8.1 Usage of Methodological Triangulation

The study investigated whether respondents use different methods in a study, and the majority agreed (90.2 per cent) whereas 10 per cent disagreed. Respondents were further asked about whether they use qualitative methods when conducting research and table 5.7 below shows that the majority agreed (86.3 per cent) while 14 per cent disagreed.

Table 5.6: Usage of Methodological Triangulation

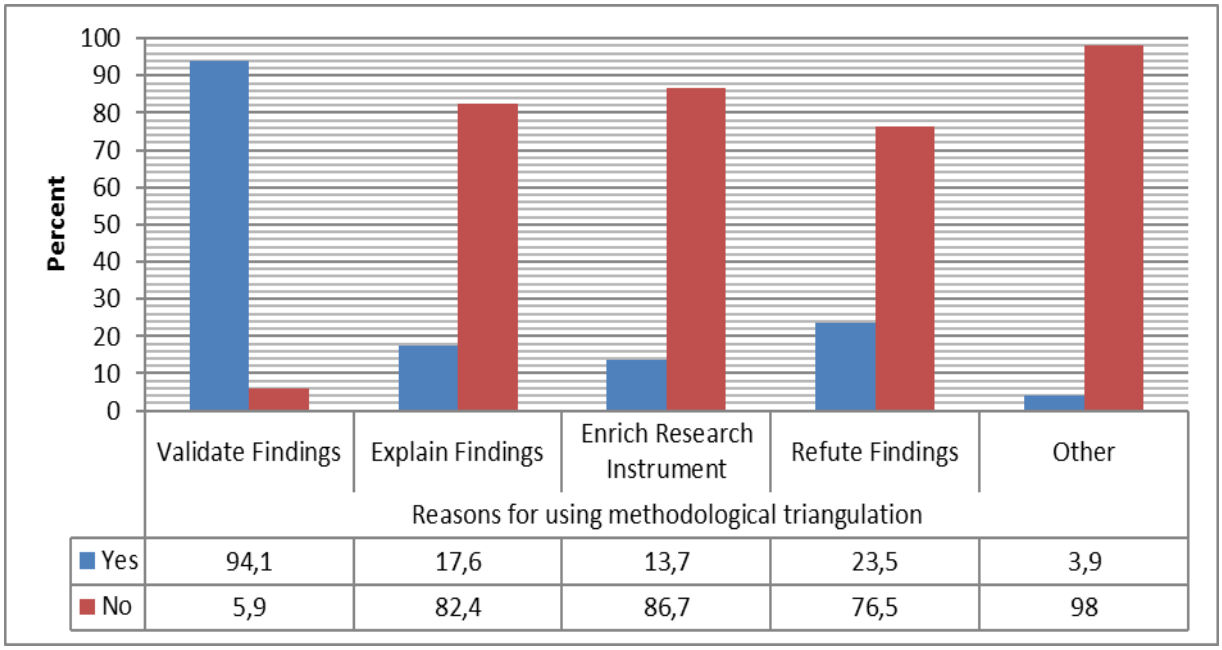
	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	N	%	n	%	n	%	P value
I use different methods in a study	0	0.0	5	9.8	0	0.0	26	51.0	20	39.2	0.001
I use qualitative methods when conducting research	0	0.0	7	13.7	0	0.0	28	54.9	16	31.4	0.001
I use quantitative methods when conducting research	1	2.0	4	7.8	0	0.0	19	37.3	27	52.9	0.000

Still on usage, respondents were asked about whether they use quantitative methods when conducting research and about 90.0 per cent agreed as compared to 10 per cent that disagreed. Chi-square tests yielded p-values of less than 0.05 for all the three variables.

5.8.2 The Reasons of Using Methodological Triangulation

The study explored the various reasons academics use methodological triangulation, and 94.1 per cent of those who use methodological triangulation indicated that they use it to validate findings while 24.0 per cent indicated that they use it to refute findings and 18.0 per cent indicated that they use it to explain findings. Figure 5.4 below further shows that 14.0 per cent indicated that they use methodological triangulation to enrich research instruments while four per cent use it for unspecified reasons.

Figure 5.4: Reasons for Using Methodological Triangulation



5.8.3. The Frequency of Using Methodological Triangulation

Respondents were asked about how often they use different methods in a study and table 7 in the appendix shows that the majority (60.8 per cent) only use methodological triangulation occasionally. The proportion of those who rarely use was 16 per cent while those who frequently use was 14.0 per cent. Furthermore, only two per cent of the respondents reported that they frequently use and eight per cent reported that they never use methodological triangulation.

The study found that 47.1 per cent of the respondents use the qualitative method alone in a study occasionally while 29.4 per cent rarely use and 12 per cent never use qualitative method. Those who reported frequent use were 12 per cent and four per cent of them indicated very frequent use.

Respondents were further asked about how often they use quantitative methods alone in a study. Table 7 in the appendix shows that 82.4 per cent of the respondents frequently use quantitative

methods alone. Ten per cent indicated that they rarely use while about eight per cent occasionally use quantitative methods alone in a study. The chi-square tests for all the three variables yielded p-values of less than 0.001.

5.8.4. Usability of Methodological Triangulation

In order to assess the usability of methodological triangulation, respondents were asked whether it is easy to use different methods in a study, whether there are problems in using different methods in one study and whether they were confident in using different methods in one study. Table 8 in the appendix indicates that 52.9 per cent of the respondents disagreed with the statement that it is easy to use different methods in a study with four per cent strongly disagreeing. Only 37 per cent agreed, and six per cent were neutral. Table 8 in the appendix further shows that 88 per cent (60.8 per cent agreed and 27.5 per cent strongly agreed) agreed that there are problems in using different methods in a study and eight per cent disagreed while four per cent were neutral. When asked about whether they were not very confident in using different methods in one study, 78.4 per cent disagreed (23.5 per cent strongly disagreed and 54.9 per cent disagreed), 20 per cent were neutral and only two per cent agreed. The p-values for the chi-square tests were all 0.000.

When asked to rate their competence in using different methods in one study, 59 per cent of those with PhD qualifications rated themselves being good, while those who reported being good for Masters qualifications were 47 per cent. Overall, table 8 in the appendix shows that those with PhD qualifications were more competent in using methodological triangulation.

5.9 INVESTIGATOR TRIANGULATION

This section presents, discusses and interprets data on the interpretation and application of investigator triangulation. The research objective was to determine the interpretation and application of investigator triangulation.

5.9.1 Usage of Investigator Triangulation

The study explored whether respondents collaborate with different researchers in one study, 67 per cent agreed (49 per cent agreed and 17.6 per cent strongly agreed). Thirty-three per cent disagreed (21.6 per cent disagreed and 11.8 strongly disagreed).

Respondents were also asked about whether they collaborate with researchers from different disciplines in one study, table 5.8 below shows that 55 per cent agreed (31.4 per cent agreed and 23.5 per cent strongly agreed) while 45 per cent disagreed (37.3 per cent agreed and 7.8 per cent strongly agreed).

Table 5.7: Usage of Investigator Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	N	%	n	%	n	%	p-value
I collaborate with different researchers in one study	6	11.8	11	21.6	0	0.0	25	49.0	9	17.6	0.001
I collaborate with researchers from different disciplines in one study	4	7.8	19	37.3	0	0.0	16	31.4	12	23.5	0.019
I collaborate with researchers from my discipline in one study	16	31.4	30	58.8	2	3.9	3	5.9	0	0.0	0.000

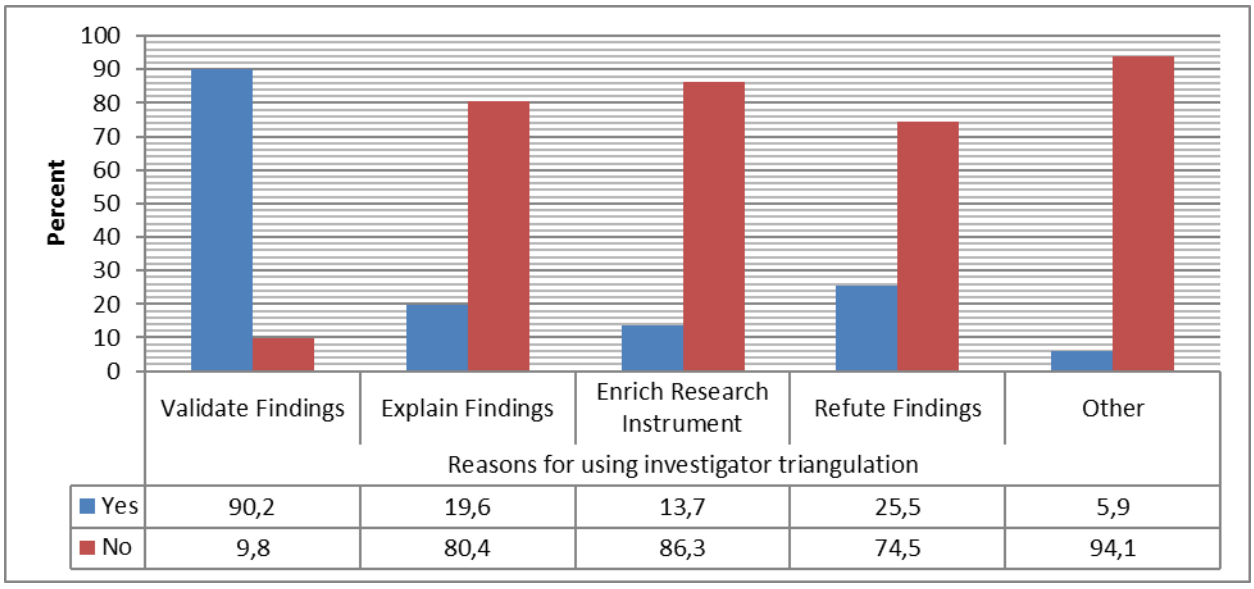
The study also investigated whether respondents collaborate with other researchers from their disciplines in one study and table 9 above shows that 90.0 per cent disagreed (58.8 per cent disagreed

and 31.4 per cent strongly disagreed) and six per cent agreed while four per cent were neutral. The chi-square tests all yielded p-values of less than 0.05.

5.9.2 The Reasons for Using Investigator Triangulation

Respondents were asked to indicate their reasons for using investigator triangulation. Figure 5.5 below shows that the majority of respondents use investigator triangulation to validate findings (90.2 per cent).

Figure 5.5: Reasons for Using Investigator Triangulation



A quarter (25.5 per cent) of the respondents reported using investigator triangulation to refute findings, 20 per cent to explain findings and 14 per cent to enrich research instruments while six per cent used intradisciplinary investigator triangulation for other reasons.

5.9.3. The Frequency of Using Investigator Triangulation

Respondents were asked how often they collaborate with different researchers in a study and table 10 in the appendix shows that the majority (54.9 per cent) occasionally do. The proportion of those who rarely use was eight per cent while those who frequently use was 29 per cent. Furthermore, only four per cent of the respondents reported that they frequently use and four per cent reported that they never use. The chi-square test of significance on the same yielded a p-value of 0.000.

Table 10 in the appendix further shows that the majority (47.1 per cent) of respondents only occasionally collaborate with researchers within their discipline in a study, 29.0 per cent indicated that they frequently do while eight per cent indicated that they rarely do. Also, four per cent indicated that they never did whereas four per cent also indicated that they frequently do. The chi-square test of significance was 0.000.

When asked about how often respondents collaborate with different researchers from other disciplines in a study, 37 per cent of the respondents reported that they occasionally do. Those who reported that they rarely do were also 37 per cent while those that reported that they frequently use were eight per cent. Furthermore, those who indicated that they never use were 12 per cent while those who reported very frequent collaboration were six per cent. The chi-square test of significance was 0.000.

5.9.4. Usability of Investigator Triangulation

Table 11 in the appendix shows that the majority of respondents disagreed (56.8 per cent: 39.2 per cent agreed and 17.6 per cent strongly disagreed) while 35 per cent agreed (25.5 per cent agreed and 9.8 per cent strongly agreed) and eight per cent were neutral to the statement that it is easy to use investigator triangulation. The chi-square test of significance yielded a p-value of 0.002. Table 11 in the appendix further shows that 80 per cent of the respondents agreed that there are problems in collaborating with different researchers in a study (43.1 per cent agree and 37.3 per cent strongly agreed), 12.0 per cent disagreed and eight per cent were neutral. When asked whether they were not very confident in collaborating with different researchers in a study, 62.0 per cent of the respondents reported that they disagreed (35.3 disagreed and 27.5 per cent strongly disagreed) while 18 per cent agreed (13.0 per cent agree and 3.9 per cent strongly agree) and 20.0 per cent were neutral.

Respondents were asked to rate their competence in using investigator triangulation. Most of those with PhDs (63.2 per cent) rated their competence level as fair while the majority of those with Masters (48.3 per cent) rated their competence as good. This is contrary to previous findings where the PhDs rated themselves higher.

5.10 DATA SOURCE TRIANGULATION

This section presents, discusses and interprets findings on interpretation and application of data source triangulation. The research objective was to ascertain the interpretation and application of data source triangulation.

5.10.1 Usage of Data Source Triangulation

The study explored whether respondents use different data sources in a study, 100 per cent agreed (68.4 per cent agreed and 31.6 per cent strongly agreed). Table 5.9 below shows that the chi-square test of significance yielded a p-value of 0.001.

Table 5.8: Usage of Data Source Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	N	%	n	%	n	%	p-value
It is easy to use different data sources in a study	6	11.8	11	21.6	0	0.0	25	49.0	9	17.6	0.001
There are problems in using different data sources in a study	4	7.8	19	37.3	0	0.0	16	31.4	12	23.5	0.019
I am not very confident in using different data sources in a study	16	31.4	30	58.8	2	3.9	3	5.9	0	0.0	0.000

Respondents were also asked if there are problems in using different data sources in a study. The table 12 above shows that slightly above half agreed (54.9 per cent: 31.4 agreed and 23.5 strongly agreed) while 45.0 per cent disagreed (37.3 per cent and 7.8 per cent) and the chi-square test of significance yielded a p-value of 0.019.

About not being very confident in using different data sources in a study, the majority of respondents disagreed (58.8 per cent disagree and 31.4 per cent strongly disagree). Only six per cent agreed while four per cent were neutral and the chi-square test of significance yielded a p-value of 0.000.

5.10.2 The Reasons for Using Data Source Triangulation

Respondents were asked on their various reasons for using data source triangulation, most of the respondents (96.1 per cent) indicated that they use it to validate findings while 37 per cent to explain findings, 31 per cent to refute findings and 10 per cent to enrich research findings (see figure 15 in the appendix).

5.10.3. The Frequency of Using Data Source Triangulation

The study investigated how frequently respondents used different data sources when conducting a study. The table 5.10 below shows that 80 per cent of the respondents (56.9 frequently and 23.5 per cent very frequently) whereas 4.0 per cent rarely use, 2.0 per cent never do and 14.0 per cent occasionally do. The chi-square test of significance was 0.000.

Table 5.9: Frequency of Using Data Source Triangulation

	Never		**Rarely**		**Occasionally**		**Frequently**		**Very Frequently**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	pvalue
How often do you use different spaces in a study?	0	0.0	16	31.4	23	45.1	10	19.6	2	3.9	0.000

How often do you use different spaces within your workplace when conducting a study	1	2.0	2	3.9	7	13.7	29	56.9	12	23.5	0.000
How often do you use difference spaces from outside your workplace when conducting a study	3	5.9	30	58.8	15	29.4	3	5.9	0	0.0	0.000

When respondents were asked how often they use different data sources from outside their disciplines when conducting a study, 58.8 per cent indicated that rarely do and six per cent reported that never do. Only six per cent reported that they frequently use and 29.0 per cent occasionally do. When asked about how often they use different data sources from within their disciplines when conducting a study, 78.8 per cent indicated frequently. Table 5.10 above shows a p-value of 0.000 for the chi-square test of significance.

5.10.4. Usability of Data Source Triangulation

The study found that 49.0 per cent of the respondents agreed that it is easy to use different data sources in study and 18 per cent strongly agreed whereas about 22.0 per cent disagreed and 12.0 per cent strongly disagreed as presented in table 14 in the appendix. The chi-square test of significance yielded a p-value of 0.001.

Table 14 in the appendix shows that slightly over half (54.9 per cent: 31.4 per cent agree and 23.5 per cent strongly agree) of the respondents agreed with the statement that there are problems in using different data sources in a study while 37 per cent disagreed and 8 per cent strongly disagreed. The chi-square test of significance yielded a p-value of 0.019.

Findings also show that the majority of respondents were confident in using different data sources as only 6.0 per cent agreed that they were not confident in using different data sources in a study and four per cent were neutral. The p-value for the chi-square test was 0.000.

Among those with PhD qualifications, 37 per cent of them indicated that they were good with using data source triangulation, while 47 per cent reported that they were very good and only 11 per cent were excellent in using data source triangulation. For Masters, slightly above half (58.6 per cent) of the respondents reported that they were good and 17 per cent reported that they were very good.

5.11 ANALYST TRIANGULATION

This section presents, discusses and interprets findings on the interpretation and application of analyst triangulation. The research objective was to understand the interpretation and application of analyst triangulation.

5.11.1 Usage of Analyst Triangulation

When respondents were asked if they use different analysts in the same study, 52.9 per cent disagreed and 22 per cent strongly disagreed. However, 14 per cent agreed and 12 per cent we neutral. Table 15 in the appendix shows that the chi-square test of significance yielded a p-value of 0.000.

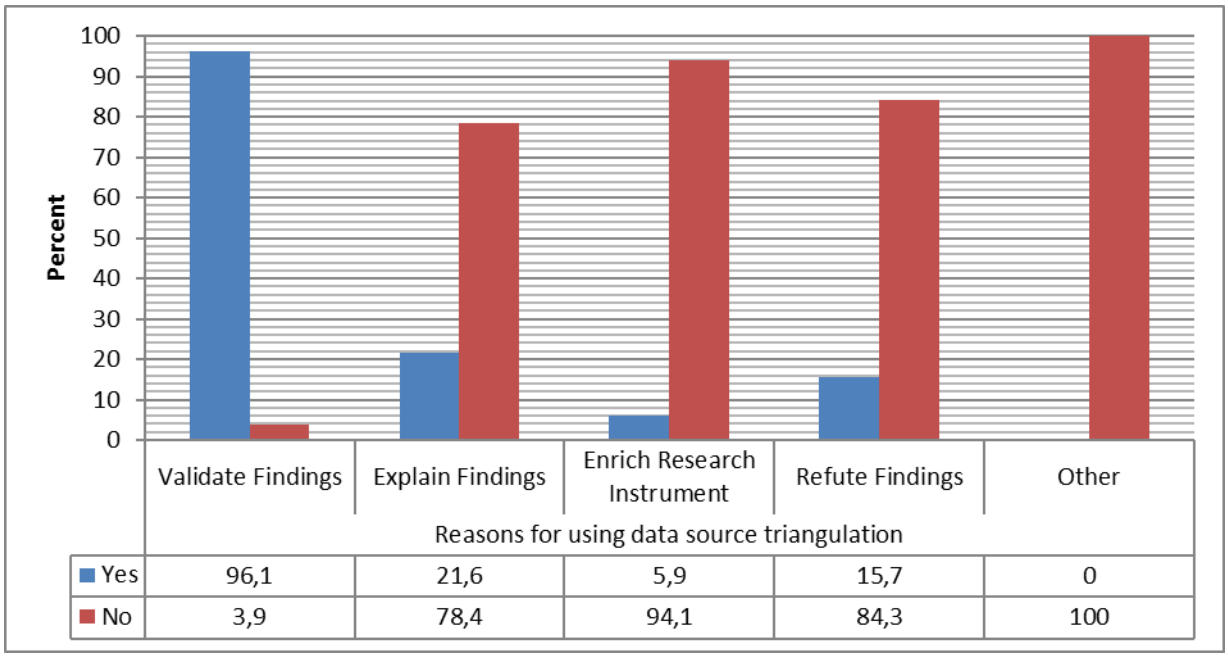
Respondents were also asked whether they use different analysts outside their disciplines in a study. Table 15 in the appendix shows that 56.9 per cent disagreed and 18 per cent strongly disagreed whereas only six per cent agreed and 20 were neutral. The chi-square test of significance yielded a p-value of 0.000.

On whether respondents use different analysts within their disciplines in a study, 71 per cent disagreed with four per cent strongly disagreed, only 10.0 per cent agreed and 16 per cent were neutral. The chi-square test of significance yielded a p-value of 0.000.

5.11.2 The Reasons for Using Analysis Triangulation

The study investigated the various reasons academics use analyst triangulation, and most of the respondents (96.1 per cent) indicated that they use it to validate findings while 22 per cent indicated that they use it to explain findings, 16.0 per cent reported that they use it to refute findings and six per cent use it to enrich research instruments as presented in figure 5.6 below.

Figure 5.6: Reasons for Using Analysis Triangulation



5.11.3. The Frequency of Using Analyst Triangulation

Respondents were asked how often they use different analysts in a study and Table 16 in the appendix shows that 49 per cent never while 35 per cent rarely, 14 per cent occasionally and only two per cent frequently use analyst triangulation. The same was observed when respondents were asked how often they use different analysts within and outside their discipline in a study. The chi-square test of significance on the yielded a p-value of 0.000.

5.11.4. Usability of Analyst Triangulation

The findings in table 5.11 below show that 57.0 per cent of the respondents disagreed with the statement that it is easy to use different analysts in a study. Only eight per cent agreed and 10.0 per cent were neutral. The chi-square test of significance yielded a p-value of 0.000 as presented in table 17 below.

Table 5.10: Usability of Analyst Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	N	%	n	%	n	%	n	%	p-value
It is easy to use different analysts in a study	10	19.6	29	56.9	8	15.7	4	7.8	0	0.0	0.000
There are problems in using different analysts in a study	0	0.0	4	7.8	8	15.7	24	47.1	15	29.4	0.000
I am not very confident in using different data analysts in a study	7	13.7	23	45.1	14	27.5	5	9.8	2	3.9	0.000

Table 18 above also shows that 47.0 per cent of the respondents agreed that there are problems in using different analysts in a study and 29 per cent strongly agreed. Those who disagreed accounted for eight per cent and 16 per cent were neutral. The chi-square test of significance yielded a p-value of 0.000.

When asked about whether they were confident about using different data analysts in a study, 45.0 per cent disagreed and 14.0 per cent strongly disagreed. Only 10 per cent agreed and four per cent strong agreed while 28.0 per cent were neutral. The p-value for the chi-square test was 0.000.

Respondents were asked to rate their competence in using analyst triangulation. Most of those PhD holders (63.2 per cent) rated their competence level as fair while the majority of those with Masters (48.3 per cent) rated their competence as good as indicated in table 18 above.

5.12 SPACE TRIANGULATION

This section presents, discusses and interprets findings on the interpretation and application of space triangulation. The research objective was to determine the interpretation and application of space triangulation.

5.12.1 Usage of Space Triangulation

The study set out to explore whether academics use different spaces when conducting a study, and 39.0 per cent disagreed and 22.0 per cent strongly disagreed. Twenty-eight per cent however agreed and two per cent strongly agreed while 10 per cent were neutral. A p value of 0.000 was yielded from the chi-square test as presented in table 18 in the appendix.

Respondents were further asked about whether they use different spaces within their disciplines when conducting a study. The majority (58.8 per cent) agreed and 31.0 per cent strongly agreed. Only four per cent disagreed (2 per cent disagree and 2.0 per cent strongly disagree) and 6.0 per cent were neutral. Similar findings were reported concerning using spaces outside their disciplines. The chi-square test of significance yielded a p-value of 0.000 as presented in table 18 in the appendix.

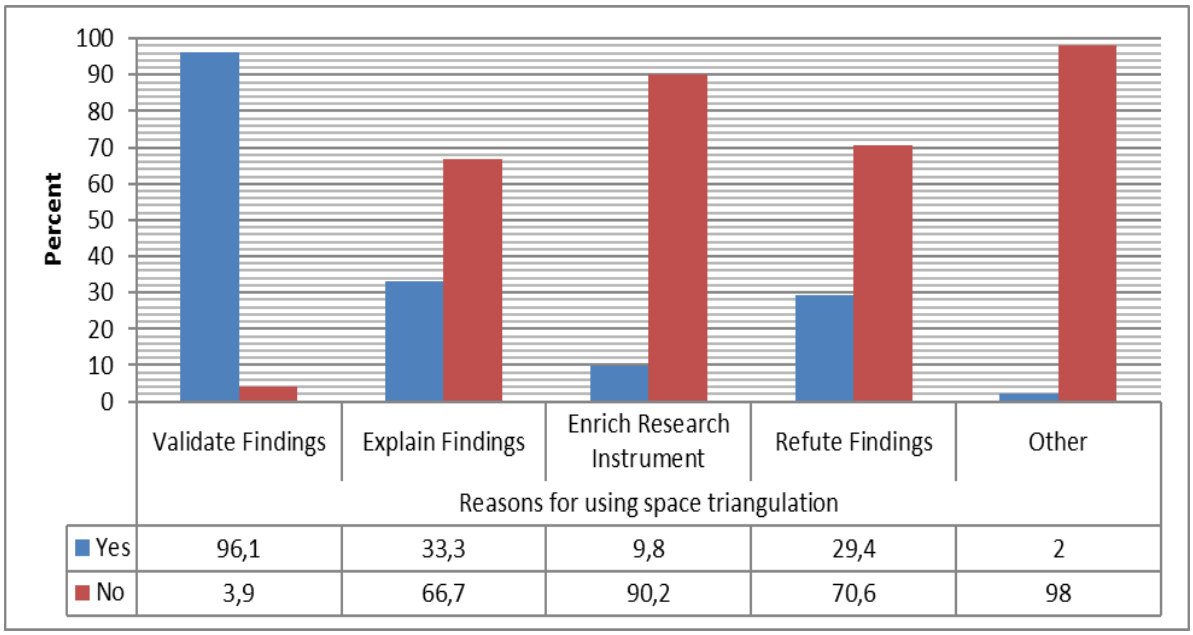
Respondents were also asked about whether they take into account different cultures when conducting research, almost all respondents agreed (94.0 per cent), only about six per cent were

neutral. The chi-square test of significance yielded a p-value of 0.000 as demonstrated in table 18 in the appendix.

5.12.2 The Reasons for Using Space Triangulation

Respondents were asked to give reasons for using space triangulation, 96.1 per cent of those that use the approach indicated that they use it to validate findings while 33 per cent indicated that they use it to explain findings and 29 per cent to refute findings. Figure 5.6 below shows that 10 per cent indicated that they use it for enriching research instruments while two per cent indicated that they use it for other unspecified reasons.

Figure 5.7: Reasons for Using Space Triangulation



The findings indicate that space triangulation is mainly used for validation purposes. There is, therefore, a need to bridge the practice gap.

5.12.3. The Frequency of Using Space Triangulation

Respondents were asked about how often they use different spaces in a study and table 19 in the appendix shows that the 45.1 per cent occasionally use different spaces in a study. The proportion of those who rarely use was 31 per cent while those who frequently use was 20 per cent and those who frequently use was four per cent. The chi-square test of significance on the same yielded a p-value of 0.000.

The majority (56.9 per cent) of respondents frequently use different spaces within their workplace when conducting a study, 24 per cent reported very frequent use and 14 per cent indicated that they occasionally use. Table 19 in the appendix also shows that only four per cent rarely used and two per cent never used. The chi-square test of significance had p-value of 0.000.

When asked about how often they use different spaces from outside their workplace when conducting a study, 59 per cent reported that they rarely, and six per cent never use. Table 19 in the appendix shows a p-value of 0.000 for the chi-square test of significance.

5.12.4. Usability of Space Triangulation

The findings in the table 5.12 below shows that 56.9 per cent of the respondents agreed with the statement that it is easy to use different spaces when conducting a study and 14 per cent strongly agreed. Twenty-four per cent disagreed and six per cent were neutral.

Table 5.11: Usability of Space Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	N	%	n	%	n	%	pvalue

It is easy to use different spaces when conducting a study	7	13.7	29	56.9	3	5.9	6	11.8	6	11.8	0.000
There are problems in using different spaces when conducting a study	0	0.0	0	0.0	4	7.8	30	58.8	17	33.3	0.000
I am not very confident in using different spaces when conducting a study	9	17.6	28	54.9	13	25.5	1	2.0	0	0.0	0.000

The chi-square test of significance yielded a p-value of 0.000. Table 20 above further shows that 92 per cent (58.8 per cent disagree and 33.3 per cent strongly disagree) of the respondents disagreed that there are problems in using different spaces when conducting a study. Eight per cent were neutral. The chi-square test of significance yielded a p-value of 0.000.

Furthermore, the majority of the respondents disagreed with the statement that they were not very confident in using different spaces when conducting a study. Fifty-five (55.0) percent of the respondents disagreed and 18.0 per cent strongly disagreed. Only two per cent agreed and 26 per cent were neutral. The p-value for the chi-square test was 0.000.

Almost all respondents were either good or very good with regard to using space triangulation for all qualifications. Respondents with PhD qualifications had the highest proportion of those who said they were very good (47.4 per cent) followed by those with Masters qualifications at 38 per cent.

5.13 Time Triangulation

This section presents, discusses and interprets the findings on the interpretation and application of time triangulation. The research objective was to ascertain the interpretation and application of time triangulation.

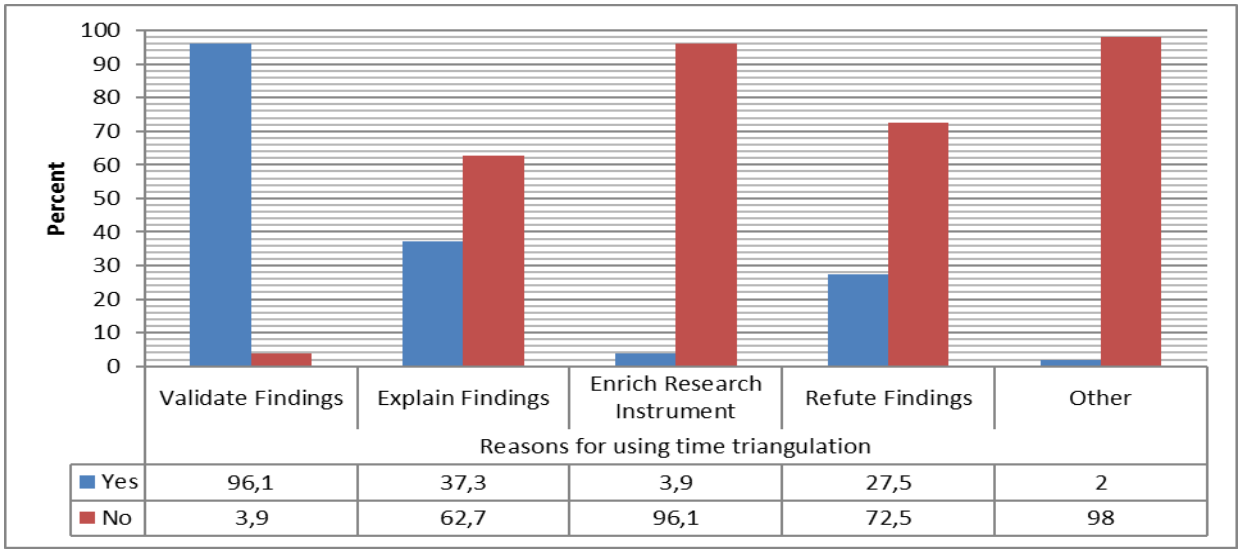
5.13.1 Usage of Time Triangulation

The study investigated whether academics use different times to conduct the same study, and 45.0 per cent disagreed and four per cent strongly disagreed. Thirty-three per cent agreed and 8.0 per cent strongly agreed while 9.0 per cent were neutral as presented in table 21 in the appendix. The chi-square test of significance yielded a p-value of 0.000.

5.13.2 The Reasons for Using Time Triangulation

When asked about their various reasons for using time triangulation, 96.1 per cent of the respondents who use time triangulation use it to validate findings while 37.0 per cent to explain findings, 28 per cent to refute findings and only four per cent to enrich research instruments as presented in figure 5.7 below.

Figure 5.8: Reasons for Using Time Triangulation



5.12.3. The Frequency of Using Time Triangulation

The study explored how often academics use different times in a study, and majority (45.1 per cent) occasionally use time triangulation. Thirty-one (31.0) per cent rarely use different times while 20 per cent frequently and four per cent very frequently use different times. The chi-square test of significance on the same yielded a p-value of 0.000 as presented in table 22 in the appendix.

The study found that 56.9 per cent of respondents frequently use different times within their workplace when conducting a study, 24.0 per cent very frequent and 14.0 per cent occasionally use different times within their workplace. Only four per cent rarely used and two per cent never used. The chi-square test of significance had p-value of 0.000

When asked about how often they use different times outside their workplace when conducting a study, 59.0 per cent reported that they rarely use, and six per cent reported that they never use. Twenty-nine per cent occasionally while only six per cent reported that they frequently use different times outside their workplace. The findings show a p-value of 0.000 for the chi-square test of significance (see table 23 in the appendix).

5.13.4. Usability of Time Triangulation

Forty-four per cent of the respondents disagreed with the statement that it is easy to use different times in a study and 14 per cent strongly disagreed. The chi-square test of significance yielded a p-value of 0.001.

The table 5.13 below shows that 92.2 per cent (54.9 per cent agree and 37.3 per cent strongly agree) of the respondents agreed that there are problems in using different times in a study. Only four per cent disagreed and four per cent were neutral. The chi-square test of significance yielded a p-value of 0.000. Furthermore, the majority of the respondents disagreed (51 per cent) with the statement that they were not very confident in using different times in as study and 28 per cent of them strongly

disagreed. Only four per cent agreed and 18 per cent were neutral. The p-value for the chi-square test was 0.000.

Table 5.12: Usability of Time Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	N	%	N	%	n	%	n	%	p-value
It is easy to use different times in a study	7	13.7%	22	43.1 %	4	7.8 %	11	21.6 %	7	13.7 %	0.001
There are problems in using different times in a study	0	0.0%	2	3.9 %	2	3.9 %	28	54.9 %	19	37.3 %	0.000
I am not very confident in using different times in a study	14	27.5%	26	51.0 %	9	17.6 %	2	3.9 %	0	0.0 %	0.000

5.14 COMPARISON OF THE DIFFERENT TYPES OF TRIANGULATION

The results on the type of triangulation participants use show that more use data source triangulation (74.0%), p=0.001, and methodological triangulation (74.0%), p=0.000 as presented in table 5.14 below.

Table 5.13: Use of triangulation by participants

Statements	**Response categories**					**Statistics**
	SD	*D*	*A*	*SA*	*N*	*p-values*
Use of triangulation	*N (%)*	N (%)	N (%)	N (%)	N (%)	
				Yes	*No*	
I use data source triangulation				37(74.0)	13(26.0)	0.001
I use investigator triangulation				26(52.0)	24(48.0)	0.888
I use theory triangulation				15(30.0)	35(70.0)	0.007
I use methodological triangulation				37(74.0)	13(26.0)	0.001
I use analyst triangulation				16(32.0)	34(68.0)	0.015
I use space triangulation				10(20.0)	40(80.0)	< 0.001
I use time triangulation				13(26.0)	37(74.0)	0.001

The findings in table 5.14 show that the majority of the respondents were less likely to have used theoretical triangulation (70.0%), $p<0.001$; analysis triangulation (68.0%), $p<0.05$; space triangulation (80.0%), $p<0.001$, and time triangulation (70.0%), $p=0.001$.

The Binomial test was applied to determine whether a significant proportion responded Yes or No the use of the different types of triangulation.

Table 5.14: Use of triangulation by type

		Category	N	Observed Prop.	Test Prop.	Asymp. Sig. (2-tailed)
2.6.1 I use data source triangulation	Group 1	Yes	37	.74	.50	.001[a]
	Group 2	No	13	.26		
	Total		50	1.00		
2.6.2 I use investigator triangulation	Group 1	Yes	26	.52	.50	.888[a]
	Group 2	No	24	.48		
	Total		50	1.00		
2.6.3 I use theory triangulation	Group 1	No	35	.70	.50	.007[a]
	Group 2	Yes	15	.30		
	Total		50	1.00		
2.6.4 I use methodological triangulation	Group 1	Yes	37	.74	.50	.001[a]
	Group 2	No	13	.26		
	Total		50	1.00		
2.6.5 I use analysis triangulation	Group 1	No	34	.68	.50	.015[a]
	Group 2	Yes	16	.32		
	Total		50	1.00		
2.6.6 I use space triangulation	Group 1	No	40	.80	.50	.000[a]
	Group 2	Yes	10	.20		
	Total		50	1.00		
2.6.7 I use time triangulation	Group 1	No	37	.74	.50	.001[a]
	Group 2	Yes	13	.26		

	Total		50	1.00		
a. Based on Z Approximation.						

The able presents an overview of the different types of triangulation used by the respondents. From the data in this table, it can be seen that a significant proportion responded Yes to using data triangulation (p=0.001) and methodological triangulation (p=0.001).

Table 5.15: Reasons of using different types triangulation

The Binomial test was applied to determine whether a significant proportion responded Yes or No the reasons of using data, investigator, theoretical, methodological, analyst, space, and time triangulation in research.

		Theoretical triangulation		**Methodological triangulation**		**Investigator triangulation**		**data source triangulation**		**space triangulation**		**Analysts triangulation**		**time triangulation**	
		Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %	Count	Column N %
To validate findings	Yes	46	90.2	48	94.1	46	90.2	49	96.1	49	96.1	49	96.1	49	96.1
	No	5	9.8	3	5.9	5	9.8	2	3.9	2	3.9	2	3.9	2	3.9
	p-value	0.000		0.008		0.000		0.000		0.000		0.000		0.000	
To explain findings	Yes	16	31.4	9	17.6	10	19.6	19	37.3	17	33.3	11	21.6	19	37.3
	No	35	68.6	42	82.4	41	80.4	32	62.7	34	66.7	40	78.4	32	62.7
	p-value	0.000		0.000		0.000		0.000		0.000		0.000		0.000	
To enrich research instruments	Yes	9	17.6	7	13.7	7	13.7	5	9.8	5	9.8	3	5.9	2	3.9
	No	42	82.4	44	86.3	44	86.3	46	90.2	46	90.2	48	94.1	49	96.1
	p-value	0.065		0.064		0.066		0.000		0.008		0.067		0.069	

To refute findings	Yes	13	25.5	12	23.5	13	25.5	16	31.4	15	29.4	8	15.7	14	27.5
	No	38	74.5	39	76.5	38	74.5	35	68.6	36	70.6	43	84.3	37	72.5
	p-value	0.017		0.063		0.062		0.066		0.065		0.061		0.000	
Other	Yes	1	2.0	2	3.9	3	5.9	1	2.0	1	2.0	0	0.0	1	2.0
	No	50	98.0	49	96.1	48	94.1	50	98.0	50	98.0	51	100.0	50	98.0
	p-value	0.066		0.000		0.062		0.069		0.001		-		0.061	

Data presented in the table shows that a significant proportion responded YES to using theoretical (p=0.00), methodological (p=0.00), investigator (p=0.00), data source (p=0.00), space (p=0.00), analysis (p=0.00) and time triangulation (p=0.00) to validate and explain findings respectively.

Table 5.16: Usability of the different types of triangulation

Chi-square test was performed to determine the usability of data, investigator, theoretical, methodological, analyst, space and time triangulation in research.

			Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
			Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
SECTION 3	Theoretical triangulation	It is easy to use different theories in a study	10	19.6%	27	52.9%	7	13.7%	6	11.8%	1	2.0%	0.167
		There are problems in using different theories in a study	0	0.0%	3	5.9%	5	9.8%	25	49.0%	18	35.3%	0.100
		I am not very confident in using different theories in a study	5	9.8%	32	62.7%	9	17.6%	5	9.8%	0	0.0%	0.151
SECTION 4	Methodological	It is easy to use different methods in a study	2	3.9%	27	52.9%	3	5.9%	15	29.4%	4	7.8%	0.000
		There are problems in using different methods in one study	0	0.0%	4	7.8%	2	3.9%	31	60.8%	14	27.5%	0.000

		I am not very confident in using different methods in one study	12	23.5%	28	54.9%	10	19.6%	1	2.0%	0	0.0%	0.000
SECTION 5	Investigator triangulation	It is easy to collaborate with different researchers in a study	9	17.6%	20	39.2%	4	7.8%	13	25.5%	5	9.8%	0.161
		There are problems in collaborating with different researchers in a study	0	0.0%	6	11.8%	4	7.8%	22	43.1%	19	37.3%	0.162
		I am not very confident in collaborating with different researchers in a study	14	27.5%	18	35.3%	10	19.6%	7	13.7%	2	3.9%	0.168
SECTION 6	Data source triangulation	It is easy to use different data sources in a study	6	11.8%	11	21.6%	0	0.0%	25	49.0%	9	17.6%	0.163
		There are problems in using different data sources in a study	4	7.8%	19	37.3%	0	0.0%	16	31.4%	12	23.5%	0.000
		I am not very confident in using different data sources in a study	16	31.4%	30	58.8%	2	3.9%	3	5.9%	0	0.0%	0.000
SECTION 7	Space triangulation	It is easy to use different spaces when conducting a study	7	13.7%	29	56.9%	3	5.9%	6	11.8%	6	11.8%	0.166
		There are problems in using different spaces when conducting a study	0	0.0%	0	0.0%	4	7.8%	30	58.8%	17	33.3%	0.107
		I am not very confident in using different spaces when conducting a study	9	17.6%	28	54.9%	13	25.5%	1	2.0%	0	0.0%	0.183
SECTION 8	Analysts triangulation	It is easy to use different analysts in a study	10	19.6%	29	56.9%	8	15.7%	4	7.8%	0	0.0%	0.164
		There are problems in using different analysts in a study	0	0.0%	4	7.8%	8	15.7%	24	47.1%	15	29.4%	0.162
		I am not very confident in using different data analysts in a study	7	13.7%	23	45.1%	14	27.5%	5	9.8%	2	3.9%	0.161
SECTION 9	Time triangulation	It is easy to use different times in a study	7	13.7%	22	43.1%	4	7.8%	11	21.6%	7	13.7%	0.166
		There are problems in using different times in a study	0	0.0%	2	3.9%	2	3.9%	28	54.9%	19	37.3%	0.177

		I am not very confident in using different times in a study	14	27.5%	26	51.0%	9	17.6%	2	3.9%	0	0.0%	0.189

Data shows that a significant proportion of the respondent reported that they find methodological (p=0.00) and data source (p=0.00) usable.

Table 5.17: Frequency of using different types of triangulation

A Chi-square test was performed to determine whether there was a statistically significant relationship between the frequency of academics in using data, investigator, theoretical, methodological, analyst, space and time triangulation focusing on rows versus columns.

			Never		**Rarely**		**Occasionally**		**Frequently**		**Very Frequently**		**Chi Square**
			Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
Section 3	Theoretical triangulation	How often do you use different theories in a study?	3	5.9%	18	35.3%	22	43.1%	7	13.7%	1	2.0%	0.178
		How often do you use different theories from your discipline in a study?	4	7.8%	16	31.4%	17	33.3%	12	23.5%	2	3.9%	0.178
		How often do you use different theories from other disciplines in a study?	8	15.7%	25	49.0%	14	27.5%	4	7.8%	0	0.0%	0.178
Section 4	Methodological triangulation	How often do you use different methods in a study?	4	7.8%	8	15.7%	31	60.8%	7	13.7%	1	2.0%	0.000
		How often do you use qualitative method alone in a study?	6	11.8%	15	29.4%	24	47.1%	4	7.8%	2	3.9%	0.000
		How often do you use quantitative method alone in a study?	0	0.0%	5	9.8%	4	7.8%	26	51.0%	16	31.4%	0.000

Section 5	Investigator triangulation	How often do you collaborate with different researchers in a study?	2	3.9 %	4	7.8 %	28	54.9 %	15	29.4 %	2	3.9 %	0.178
		How often do you collaborate with researchers within your discipline in a study?	2	3.9 %	3	5.9 %	24	47.1 %	16	31.4 %	6	11.8 %	0.155
		How often do you collaborate with different researchers from other disciplines in a study?	6	11.8 %	19	37.3 %	19	37.3 %	4	7.8 %	3	5.9 %	0.145
Section 6	Data source triangulation	How often do you use data from different sources in one study?	1	2.0 %	2	3.9 %	16	31.4 %	23	45.1 %	9	17.6 %	0.000
		How often do you use questionnaires as a data source in a study?	0	0.0 %	0	0.0 %	2	3.9 %	27	52.9 %	22	43.1 %	0.000
		How often do you use focus group discussions as data sources in a study?	9	17.6 %	31	60.8 %	9	17.6 %	2	3.9 %	0	0.0 %	0.000
		How often do you use in-depth interviews as data sources in a study?	1	2.0 %	11	21.6 %	32	62.7 %	5	9.8 %	2	3.9 %	0.000
		How often do you use books as a data source in a study?	0	0.0 %	4	7.8 %	38	74.5 %	7	13.7 %	2	3.9 %	0.000
		How often do you use journals articles as a data source in a study?	0	0.0 %	0	0.0 %	1	2.0 %	20	39.2 %	30	58.8 %	0.000
		How often do you use internet pages as a data source in a study?	9	17.6 %	22	43.1 %	10	19.6 %	6	11.8 %	4	7.8 %	0.001
Section 7	Space triangulation	How often do you use different spaces in a study?	0	0.0 %	16	31.4 %	23	45.1 %	10	19.6 %	2	3.9 %	0.188
		How often do you use different spaces within your workplace when conducting a study	1	2.0 %	2	3.9 %	7	13.7 %	29	56.9 %	12	23.5 %	0.166
		How often do you use difference spaces from outside your workplace	3	5.9 %	30	58.8 %	15	29.4 %	3	5.9 %	0	0.0 %	0.177

		when conducting a study											
Section 8	Analysts triangulation	How often do you use different analysts in a study?	25	49.0%	18	35.3%	7	13.7%	1	2.0%	0	0.0%	0.164
		How often do you use different analysts within your discipline in a study?	25	49.0%	18	35.3%	7	13.7%	1	2.0%	0	0.0%	0.177
		How often do you use analysts from other disciplines when conducting a study?	27	52.9%	17	33.3%	6	11.8%	1	2.0%	0	0.0%	0.168
Section 9	Time triangulation	I collect data at different times in a study	2	3.9%	23	45.1%	19	37.3%	5	9.8%	2	3.9%	0.167
		I use different times to ask the same research questions in the study	3	5.9%	34	66.7%	7	13.7%	7	13.7%	0	0.0%	0.111
		I conduct research at the beginning of the year	1	2.0%	10	19.6%	34	66.7%	4	7.8%	2	3.9%	0.177
		I conduct research at the end of the year	0	0.0%	5	9.8%	39	76.5%	6	11.8%	1	2.0%	0.188

Data indicates that a significant proportion of the respondent reported that they frequently use methodological (p=0.00) and data source (p=0.00) in this order.

5.15 QUALITATIVE DATA PRESENTATION

This section presents qualitative data collected in this study.

5.15.1 KNOWLEDGE OF TRIANGULATION

The objective of the study was to ascertain IS academics' knowledge of triangulation. When asked about whether they knew what triangulation is, majority of the respondents said that they knew triangulation. The finding is reflected in the response of a participant reflecting views of the majority of participants:

> *I am not sure of the types of research triangulation that are there. But I know there is triangulation of using different research methods where you combine quantitative and qualitative methodology, and triangulation of using different data sources where a researcher mixes different avenues of data sources* (in-depth interview (1), 2017).

In agreement, another participant said:

> I would say I have full knowledge but know triangulation because I have used it before. I have several times combined for example different using different data sources in one study (in-depth interview (1), 2017).

The finding shows that participants had ideas about triangulation.

5. 15.2 THEORETICAL TRIANGULATION

The aim of this section is to present, discuss and interpret the interpretation and application of theoretical triangulation. The research objective was to ascertain the interpretation and application of theoretical triangulation.

5.15.1 The Usage of Theoretical Triangulation

When participants were asked whether they use different theories in the same study, majority of the participants agreed. Reflecting views of other a participant said that:

> *I cannot remember when I started using theory triangulation, but I think it was when I was working on my research project funded by the University Teaching and Learning Office* (in-depth interview (3), 2017).

This view is in contrast to another participant's response:

> *I have not taken time and interest to read about theoretical triangulation, therefore I cannot say much because I do not use it* (in-depth interview (8), 2017).

The findings suggest that more participants use theoretical triangulation.

Participants were also asked about whether they use different theories outside their disciplines when conducting a study. This finding show that majority of participants disagreed:

> *I have never used theories from other disciplines. I would need help from someone who is experienced in theory triangulation for me to use theories from other disciplines* (in-depth interview (8), 2017).

In relation to the usage of different theories within academics' discipline, majority of the participants said that they use different theories within their disciplines. This finding is supported by a response reflecting other participants' views:

> *I use theories in my discipline. I am yet to use theories from other disciplines. I find theories in my discipline adequate* (in-depth interview (3), 2017).

The finding suggests that participants use of different theories within their disciplines.

5.15.2 The Reasons of Using Theoretical Triangulation

The study investigated the reasons participants use theoretical triangulation. The finding show that majority of the participants use theoretical triangulation mainly to validate findings, as well as to explain findings. This finding resonates well with what two participants said:

> *I use theoretical triangulation to validate findings as this centres my research findings on the research problem under study. Theoretical triangulation enables me to confirm my research findings that unpack the research problem* (in-depth interview (6), 2017).

In the same vein, another participant said:

> *When conducting research, I choose good theories to help me explain the research problem for better understanding. I use different ideas, concepts, or constructs together to explain my research findings* (in-depth interview (7), 2017.

The finding suggest that theoretical triangulation is mainly used to validate findings.

5.15.3 The Frequency of Using Theoretical Triangulation

Participants were asked how often they use different theories in a study. The study found that majority of the participants sometimes use theoretical triangulation. Here is what one participant said reflecting what others said:

> *It is not all times that I use different theories in my studies. However, I find some research results of studies that use theoretical triangulation generally rigorous and produce rewarding findings and conclusions* (in-depth interview
>
> (1), 2017).

This finding makes sense when viewed together with another response from a participant:

> *It is not in all my studies that I use theory triangulation to analyse and compare two or more theoretical positions relating to the research problem I am studying. I rarely use theoretical triangulation to inform my research plans. If I happen to use theoretical triangulation, it helps me make sense of data that sometimes do not seem to corroborate or relate to any individual theory* (in-depth interview (4), 2017).

This finding above agrees with the view of one participant reflecting other participants view:

> *Once in a while, I use theoretical triangulation within my discipline to inform my studies. The different theories I use are not all the times similar, and I have realised that the more divergent theories are, the more likely they are to help me identify different research issues* (in-depth interview (2), 2017).

Participants were also asked how often they use different theories from other disciplines in a study. Majority of the participants said that they hardly use different theories from other disciplines in a study. What one participant said reflecting views of other participants supports this finding:

> *I once in a blue moon use theories from other disciplines to be part of my studies. Nevertheless, I know that it is possible to use theories outside my disciplines to inform my studies* (in-depth interview (1), 2017).

The finding suggest that participants barely use different theories from other disciplines in a study.

5.15.4. Usability of Theoretical Triangulation

Participants were asked whether it is easy to use different theories, there are challenges and whether they were confident in using different theories in a study. Findings show that majority of the participants said that it is not easy to use different theories in a study. One participant reflecting views of majority of the participants said:

> *I would need help from someone who is experienced in theory triangulation for me to use different theories in one study. I have never conducted a study employing two or more theories. I am not sure about using different theories in the same study* (in-depth interview (8), 2017).

To the question whether they were competent in using theoretical triangulation, findings show that participants were not competent. The findings however show that More participants with PhD qualifications appeared to be competent in using theoretical triangulation than participants with Masters qualifications.

The findings suggest that IS academics have challenges in using theoretical triangulation. However, findings show that participants said that they were confident in using different theories in a study. In support of the finding reflecting majority of the participants one participant had this to say:

> *I would say I am reasonably capable of using theoretical triangulation* (smiles and continues). *Multiple perspectives guide my studies. I try to use theories or professional views outside or within my discipline. Theories and professional views bring different perspectives that is good for my studies* (in-depth interview (5), 2017).

The study suggests that participants were confident in using different theories in a study.

5.16 METHODOLOGICAL TRIANGULATION

This section presents, discusses and interprets findings on the interpretation and application of methodological triangulation. The research objective was to understand the interpretation and application of methodological triangulation.

5.16.1 Usage of Methodological Triangulation

Participants were asked if they use different methods in a study. Findings show that majority said that they use different methods in a study. Majority of the participants also said that they use qualitative methods when conducting research.

When asked whether they use quantitative methods when conducting research almost all the participants said that they used use quantitative methods. This view is supported by responses from two participants:

> *I use methodological triangulation by employing different research methods for example combining quantitative and qualitative methods in one study to increase certainty in my research results* (in-depth interview (1), 2017).

This is in agreement with what another participant said:

> *I use methodological triangulation. I mix two or more methods to study the same phenomenon. A blended quantitative and qualitative approach in a study works for me though I am more a quantitative researcher than qualitative* (in-depth interview (3), 2017).

The finding suggest that academics use methodological triangulation in their studies.

5.16.2 The Reasons of Using Methodological Triangulation

Participants were asked why they use methodological triangulation. Majority of the participants said that they use methodological triangulation to validate findings and a few said that they use

methodological triangulation to refute findings, explain findings, and to enrich research instruments. The findings are reflected well in what a participant said:

> *I use the mixed methods approach by integrating quantitative and qualitative research in the same study to validate my research findings* (in-depth interview (8), 2017).

Another participant said that:

> *Qualitative and quantitative methods provide me a better process to refute findings* (in-depth interview (8), 2017).

The findings imply that participants mainly use methodological triangulation to validate findings and a few to refute findings and other uses.

5.16.3. The Frequency of Using Methodological Triangulation

Participants were asked about their frequency of using different methods in a study. Majority of the participants said that they rarely use methodological triangulation. This finding is in contrast to what a participant said:

> *Yes, I have heard about multiple methodology and I use this method regularly. The method offers researchers the best of interpretivist and positivist worlds. That a researcher is able to get the detailed, contextualised, and natural insights of qualitative research combined with the more-efficient however less rich predictive power of quantitative research* (in-depth interview (5), 2017).

The response above is in contrast to what another participant said:

> *I use methodological triangulation but once in a while. I am not a mixed research methods freak* (in-depth interview (5), 2017).

Participants also reported that they sometimes employ the qualitative method alone in a study. This is echoed in a participant's response:

> *… I have never used qualitative research methodology alone. It may be because I do not conduct research that collects data on culturally specific information about the feelings, values, attitudes, opinions, behaviours, and socio-environmental contexts of given populations* (in-depth interview (4), 2017).

Participants were further asked about how often they use quantitative methods alone in a study. All participants reported that they frequently use quantitative methods alone. This finding is reflected well in a participant's words reflecting all participants; views:

> *Quantitative research methodology enables me to ask people about their perceptions and opinions in a structured way such that I am able to produce hard facts and statistics. So to get reliable statistical results, I regularly use quantitative research methodology in my research projects* (in-depth interview (3), 2017).

The study suggests that participants use quantitative methods alone in a study.

5.16.4. Usability of Methodological Triangulation

Participants were asked whether it is easy to use different methods in a study, whether there are problems in using different methods in one study and whether they were confident in using different methods in one study. Majority of the participants said that it is not easy to use different methods. Below are words of a participant that resonates with the findings above:

> *It is not easy to employ both quantitative and qualitative research methods to conduct one study. I find it difficult to use mixed methods, especially how to integrate the two methods and use them to collect and analyse data* (in-depth interview (1), 2017).

When asked about their competence in using different methods in one study, majority of the participants with PhD and a some with Masters qualifications said that they were good. Findings therefore show that those with PhD qualifications reported themselves to be competent in using methodological triangulation.

5.17 INVESTIGATOR TRIANGULATION

This section presents, discusses and interprets data on the interpretation and application of investigator triangulation. The research objective was to determine the interpretation and application of investigator triangulation.

5.17.1 Usage of Investigator Triangulation

Participants were asked whether they collaborate with different researchers in one study. Majority of the participants said that they work with different researchers in one study. This finding is reinforced by a participant's response:

> *I conduct research together with other researchers in the same study. Research collaboration is a good strategy of achieving the common goal of generating knowledge* (in-depth interview (2), 2017).

When asked about whether they collaborate with researchers from different disciplines in one study, majority said that they do. Two participants with contradicting responses support the findings:

> *Yes, I conduct research with researchers outside my discipline. I believe in big research group working on one research problem. I like collaboration. I believe that basic research is a global activity where researchers from different disciplines can work together to advance the frontiers of scientific knowledge* (in-depth interview (2), 2017).

The finding above is contrary to the finding below from another participant reflecting views of other participants:

> *Well, I conduct research but I have never collaborated with researchers from outside my discipline. I guess there is time for everything, and I have not reached that stage where I can be comfortable to work with other researchers in one study* (in-depth interview (7), 2017).

The study also investigated whether participants collaborate with other researchers from their disciplines in one study. Majority of the participants said that they do not work with other researchers from their disciplines in one study. This view is echoed in the responses given by two participants:

> *I understand what you are referring to. This is a method of bringing together on board different researchers to conduct a study on the same research problem in the same discipline. It is all about collaboration with others in your discipline but I do not use this method* (in-depth interview (1), 2017).

The find suggest that intradisciplinary investigator triangulation is rarely applied.

5.17.2 The Reasons for Using Investigator Triangulation

The study investigated the reasons for using investigator triangulation. Findings show that majority of the participants use investigator triangulation to validate findings and a few to refute findings. The response below reflects the findings above:

> *I use research triangulation mainly to validate findings as this enables me to have findings that I can confidently present* (in-depth interview (8), 2017).

Another participant said:

> *This is an unfamiliar territory to me. However, I use investigator triangulation sometimes to refute and explain findings* (in-depth interview (2), 2017).

Findings show a limited use of investigator triangulation.

5.17.3. The Frequency of Using Investigator Triangulation

The study investigated how often participants collaborate with different researchers in a study. The finding revealed that majority of the participants occasionally used investigator triangulation. In in-depth interviews, this finding is supported as a follows:

> *Yes, I sometimes use investigator triangulation. Some of my research projects have been accomplished by working together with other researchers to achieve shared research goals* (in-depth interview (2), 2017).

Another participant who had this to say supports this finding:

> *I rarely use intradisciplinary investigator triangulation. This method requires that I take up leadership research roles although most of the times the form of leadership can be social within a decentralised situation* (in-depth interview (3), 2017).

When participants were asked about how regularly they collaborate with different researchers from other disciplines in a study, findings suggest that they seldom do. The finding ties in well with the response below from a participant who seldom uses investigator triangulation with researchers from other disciplines:

> *I cannot remember when I last engaged in interdisciplinary investigator triangulation with researchers from other disciplines, community-based organisations, and policy makers to conduct research. But I feel it is good as a team to frame together research problems to be tackled and the research questions to be posed in a study as this would enable us to come up with good research projects. I do not know, I am just thinking* (in-depth interview (4), 2017).

The response above is in agreement with what another participant who said:

> *I will be honest with you, I have never collaborated with other researchers in a study whether within and outside the discipline* (in-depth interview (4), 2017).

The finding show that participants rarely apply investigator triangulation.

5.17.4. Usability of Investigator Triangulation

The study found that majority of the participants find it is easy to use investigator triangulation. The following response from a participant resonates well with the findings above:

> *It is not that I do not believe in investigator triangulation research. Nevertheless, the thing is, there are a lot of problems involved in collaboration such that I would need quality support from experienced colleagues.*

The response above is contrary to what another participant said:

> *I have confidence in my collaboration knowledge and skills to conduct scientific research with others and write up papers. However, research collaboration complicates the research process and it is time consuming* (in-depth interview (3), 2017).

When asked about their competence in using investigator triangulation, majority of the participants said that they are competent. More participants with Masters than those with PhDs reported to be competent.

5.18 DATA SOURCE TRIANGULATION

This section presents, discusses and interprets findings on interpretation and application of data source triangulation. The research objective was to ascertain the interpretation and application of data source triangulation.

5.18.1 Usage of Data Source Triangulation

The study found that majority of the participants said that they use different data sources in a study. The finding is supported by a participant's views reflecting majority of participants' views:

> *I use evidence from different types of data sources. My data sources are both primary and secondary research. Using different data sources in a study takes my research and findings to another level in terms of credibility* (in-depth interview (1), 2017).

In agreement to the findings above, a participant put it this way:

> *As a researcher, I find myself using different types of data sources to help me to understand the research problem I am pursuing. Countless times, I have used data from the same sample collected using questionnaires, in-depth interviews, focus group discussions and observations for a richer study than when one is using one data source* (in-depth interview (7), 2017).

The responses above are in contrast to what another participant shared:

> *No, let me tell you something, I have never used multiple data sources in one study. When I learn to complement different data sources then maybe I will use data source triangulation. I guess soon after completing my doctorate I will be able to take that first baby step to data source triangulation, and knowing that we have people like you to guide us through every step of research, I will one day use data source triangulation* (in-depth interview (8), 2017).

Participants were also asked if there are problems in using different data sources in a study. Majority of the participants said that there are problems in using different data sources in a study.

The study found majority of the participants said that they were not confident in using different data sources in a study. The findings above are reflected in the following views:

> *I use data source triangulation. I find it easy-going to employ different data sources in one study and I have a strong edge of using data source triangulation* (in-depth interview (7), 2017).

In support of participants who said that they are very confident in using different data sources, a participant said:

> *I have cultivated a belief and feeling that I can use data source triangulation successfully. I have built the confidence needed to use the technique* (in-depth interview (5), 2017).

The finding show that participants have challenges but confident in using different data sources in a study.

5.18.2 The Reasons for Using Data Source Triangulation

The study investigated the reasons participants use data source triangulation. Majority use data source triangulation to validate findings followed by to explain findings, to refute findings and to enrich research findings. These findings are supported by responses from participants:

> *I use this method to employ several sources of data when investigating a research issue in order to validate my findings* (in-depth interview (6), 2017).

Another participant supported this view:

> *I use for example, questionnaires, focus group discussions, and other data sources to study a research problem ... It does not matter whether the data source is from the qualitative or quantitative domain all I want is to help me explain my findings* (in-depth interview (2), 2017).

Findings show that there are several reasons participants use data source triangulation with validate findings being the main reason.

5.18.3. The Frequency of Using Data Source Triangulation

The study found that participant frequently use different data sources when conducting a study. The findings reported above are reflected in what a participant said:

> *I apply data source triangulation in my studies on a consistent basis. I am a mixed methods researcher; hence, I regularly use data from different methods* (in-depth interview (4), 2017).

Another participant had the same view to share:

> *On a regular basis engage in research using different data sources. I find the experience of using data gathered from different sources very useful because one is able to target variables in a proven systematic manner from different angles to answer research questions and assess research results in a credible fashion* (in-depth interview (7), 2016).

There is a regular use of data source triangulation among participants.

5.18.4. Usability of Data Source Triangulation

The study found majority of the participants feel that it is easy to use different data sources in study. The findings above are reflected in the following view:

> *I use data source triangulation. I find it easy-going to employ different data sources in one study* (in-depth interview (5), 2017).

The findings above are contrary to the following response:

> *As for me, I find it hard to use data source triangulation because I do not have an edge to do so* (in-depth interview (7), 2017).

The study found that majority of the participants said that they have problems in using different data sources in a study. Further, findings show that majority of participants were confident in using different data sources. In support of participants who said that they are confident in using different data sources, a participant said:

> *I can use data source triangulation successfully. I have built the confidence needed to use the technique then I will do so* (in-depth interview (5), 2017).

Participants with PhD qualifications said that they were very good than those with Masters qualifications.

5.19 ANALYST TRIANGULATION

This section presents, discusses and interprets findings on the interpretation and application of analyst triangulation. The research objective was to understand the interpretation and application of analyst triangulation.

5.19.1 Usage of Analyst Triangulation

The study shows that there were a few participants using different analysts in the same study. The following response corroborates the finding above:

> *I do not use this method in my studies. I am not sure what analyst triangulation is about. Of course, from the word 'analyst' I can tell that it has to do with multiple analysts. That is all I can say* (in-depth interview (4), 2017).

When asked whether they use different analysts outside their disciplines in a study, majority of the participants reported that they do not use different analysts in a study. This finding resonates with other participants' responses:

> *I have never used analysts from other disciplines to review my findings or any parts of research processes* (in-depth interview (6), 2017).

When asked whether they use different analysts within their disciplines in a study, majority of the participants reported that they do not use different analysts within their disciplines in a study. This finding is in agreement with a participant's view:

> *I think I understand what you are talking about. However, the thing is that I have never used multiple analysts within or outside my discipline to analyse my findings. I know some researchers use multiple analysts as a method of verifying research findings. Though having two or more persons independently analyse the same data and compare their findings is good I have never used this method* (in-depth interview (6), 2017).

Findings show that that participants do not use different analysts in a study.

5.19.2 The Reasons for Using Analysis Triangulation

The study investigated the various reasons academics use analyst triangulation. Findings show that they use analyst triangulation to validate findings, and a few to explain findings, to refute findings and to enrich research instruments. This findings are supported by what participant said:

> *Mostly I use one analyst to review findings and I am able to check on selective perceptions and then illuminate blind spots in my research analysis. The reason I do this is not to make it quick and easy to arrive at findings using one analyst most of the times myself. Therefore, to answer*

> *your question, I do use analyst triangulation for validation purposes* (in-depth interview (5), 2017).

Another participant shared a contrary perspective in the following response:

> *I have little thoughtful views on what you are talking about. I read about analyst triangulation once in a journal article some time back, and that was all* (in-depth interview (1), 2017).

The study found that some participants use while other participants do not use analyst triangulation.

5.19.3 The Frequency of Using Analyst Triangulation

The study found that participants rarely use different analysts in a study. This finding coincides with what a participant said:

> *I use analyst triangulation but I should state that I do it sporadically. For example, sometimes I conduct research where I bring on board two researchers to analyse the same qualitative data because I am not good at qualitative research. I allow analysts to analyse interview transcripts and discuss themes emerging from the data collected separately* (in-depth interview (1), 2017).

The finding above is in agreement with what another participant said, whose view reflects those of participants who do not use analyst triangulation:

> *I am not into analyst triangulation. There is no time I conducted a study and allowed other researchers to analyse my data* (in-depth interview (4), 2017).

This finding is in agreement with a participant's view:

> *I think I understand what you are talking about. However, the thing is that I have never used multiple analysts to analyse my findings. I know some researchers use multiple analysts as a method of verifying research findings. Though having two or more persons independently analyse the*

> *same data and compare their findings is good I have never used this method* (in-depth interview (6), 2017).

This finding resonates with what another participant said:

> *I use analyst triangulation but I have never used analysts from other disciplines to review my findings or any parts of research processes* (in-depth interview (2), 2017).

Therefore there is a dearth use of analyst triangulation.

5.19.4 Usability of Analyst Triangulation

The study found that majority of the participants said that it is not easy to use different analysts in a study. This finding is in agreement with what a participant said in the qualitative study:

> *It is quite a cumbersome technique to employ especially that a researcher has to use multiple analysts to review findings of the same study, meaning that all researchers in the team should be involved in independently reviewing data collected from the study and data has to be constantly compared. I feel I can only be comfortable with analyst triangulation if I was to have research seminars or workshops on analyst triangulation* (in-depth interview (2), 2017).

The response above is in agreement with the following response:

> *Analysis triangulation is a controversial method and does not work well for me. I would need support from researchers with research experience in analyst triangulation to use it* (in-depth interview (6), 2017).

Majority of the participants said that there are problems in using different analysts in a study. Further, when asked about whether they were confident about using different data analysts in a study, majority said that they were not confident.

The study also found that PhD and Masters holders said that they were competent in analyst triangulation in a study.

5.20 SPACE TRIANGULATION

This section presents, discusses and interprets findings on the interpretation and application of space triangulation. The research objective was to determine the interpretation and application of space triangulation.

5.20.1 Usage of Space Triangulation

The study found that majority of academics do not use different spaces when conducting a study. The finding on those who disagreed is in agreement with what a participant said:

> *I have never considered this method* (meaning space triangulation). *Thinking about the place, location, or site where I will conduct my research, no! It is not an issue I ponder on. I find time consuming and cumbersome* (in-depth interview (1), 2017).

This response is contrary to the following view:

> *I use space triangulation. To me, it is important to take into account different factors related to the environment in which one's study is conducted* (in-depth interview (6), 2017).

The study further found that majority of the participants use different spaces within their disciplines when conducting a study. A similar response was reported concerning using spaces outside their disciplines. This finding is supported by what a participant said:

> *I use several locations within my discipline to collect data to contribute to the body of knowledge and the research problem under study. Sometimes I compare data collected from different locations to validate my findings. When my data collected from the different locations helps me to generate the same conclusion then I know my findings are valid* (in-depth interview (2), 2017).

When asked about whether they take into consideration different cultures when conducting research, majority reported that they take into account different cultures when conducting research. Below are the words of a participant agreeing to the findings above:

> *I regularly use space triangulation in my research projects to identify environmental or cultural influences that may affect the data collected during my research. Changing of environmental factors helps me to see if the findings are the same across settings. When I see that findings remain the same under different space conditions to me that is an indication that validity has been established* (in-depth interview (2), 2017).

The above statement is in agreement with what another participant said:

> *Space factors really matter to me. I do seriously and consciously think about this as a critical issue to be addressed because culture and the environment are able to influence research outcomes* (in-depth interview (3), 2017).

The findings suggest that participants take into space factors when conducting research.

5.20.2 The Reasons for Using Space Triangulation

The study shows that majority of participants use space triangulation mainly to validate findings in this order. A participant put it this way:

> *I use space triangulation. I apply mainly for validation purposes* (in-depth interview (3), 2017).

The findings indicate that space triangulation is mainly used to authenticate findings.

5.20.3. The Frequency of Using Space Triangulation

Participants were asked about how often they use different spaces in a study. The study found that majority said that they occasionally use space triangulation. However, majority of the participant said that they frequently use different spaces within their workplace when conducting a study but rarely use different spaces from outside their workplace.

5.20.4. Usability of Space Triangulation

Majority of the participants said it is easy to use different spaces when conducting a study. A participant expresses the findings as follows:

> *Space triangulation to some extent works for me. But I cannot say that there are no problems in using space triangulation. There are challenges related to ensuring that space factors capable of influencing the research process are dealt with. To me this is what makes the whole process of space triangulation cumbersome. There are just so many space issues that need to be taken into consideration, for example, there are many administration procedures to be met* (in-depth interview (6), 2017).

Further, majority of the participants said that there are few problems, were very confident, and were good at using space triangulation in a study. PhD qualifications were more positive in responding to the questions than those with Masters qualifications.

5.21 Time Triangulation

This section presents, discusses and interprets the findings on the interpretation and application of time triangulation. The research objective was to ascertain the interpretation and application of time triangulation.

5.21.1 Usage of Time Triangulation

The study investigated whether academics use different times to conduct the same study. Some participants said that they use while some said that they do not use different times to conduct the same study. This view is reflected in a response given by a participant reflecting the views of the majority of participants who agreed:

> *I use time triangulation. I first heard about triangulation in a journal article several years ago and started using the method. Based on my experience, I can say I use this method* (in-depth interview (1), 2017).

A participant reflecting the views of participants who disagreed said that:

> *No no no! I do not use time triangulation. I understand that it is a research approach that allows a researcher to collect data at different times on the same research problem* (in-depth interview (5), 2017).

This finding is in agreement with what a participant said:

> *I do not use time triangulation. My experience shows that using different times to conduct research helps to generate diverse data for the study. Something different comes from using different times in a study, or it is just my view or a common experience* (in-depth interview (3), 2017).

Findings show that while time triangulation is not widely used.

5.21.2 The Reasons for Using Time Triangulation

Participants said that they use time triangulation to mainly validate findings. The finding above are underscored in what a participant said:

> *In my research projects, I use time triangulation. I collect data about a research problem or phenomenon or situation whatever you want to call it at various points in time. I use this method as it allows me to collect data on the same phenomenon at different times. Usually interval between data collection points may be weeks or months, and I compare the results* (in-depth interview (4), 2017).

The findings show that the application of time triangulation is limited.

5.21.3 The Frequency of Using Time Triangulation

When asked how often academics use different times in a study, the study found that majority of the academics sometimes use time triangulation.

The study shows that academics normally use different times and rarely use different times outside their workplace when conducting a study.

5.21.4 Usability of Time Triangulation

Majority of participants reported that it is easy to use different times in a study but not without challenges:

> *Quite well I use different times in a study but I would be frank to you that I have challenges but not bad* (in-depth interview (6), 2017).

The view above shows that participants use time triangulation but have challenges.

The study found that participants use more data source triangulation followed by methodological triangulation. A participant said shared this view that captures majority of participants' perspectives:

> *I have used data source triangulation to conduct research. Using research evidence from different data sources including primary and secondary research such as questionnaires, observations, interviews, and photographs and documents respectively makes part of my research processes. Besides, I use methodological triangulation as it allows me to combine different research instruments* (in-depth interview (1), 2016).

The view above is supported by another response reflecting other participants' views puts this finding in perspective:

> *There are few times that I use other forms of triangulation such as what you call space triangulation, or it is because I do not fully understand what space triangulation attempts to overcome or achieve in a study. The same with the phenomenon of drawing upon alternative theories in preference to utilising one viewpoint only. I only use triangulation methods that I understand to avoid complicating my research. Besides, I do not have enough time in my research projects to use all forms of triangulation* (in-depth interview (3), 2016).

The response above show that data source and methodological triangulation are the most used types of triangulation.

5.23 DICUSSION, ANALYSIS AND INERPRETATION

This section presents the discussion, analysis and interpretation of the findings of this study.

5.23.1 Knowledge of triangulation

The objective of the study was to ascertain IS academics' knowledge of triangulation. More than half of the academics with PhD and Masters qualifications knew what triangulation is. The finding suggests that all IS academic staff in this study were in a condition of knowing triangulation with familiarity possibly gained either through association or experience. Reading (78.9 per cent) is the main source of knowledge on triangulation. Reading as source of triangulation was more pronounced among PhD holders (78.9 per cent) as compared to Masters holders (51.7 per cent). It appears that most participants (PhD and Masters holders) obtained knowledge of triangulation through readings while very few academics were exposed to triangulation methods via their supervisors (1.96 per cent) or conferences (9.80 per cent). The study shows that reading was the most common source of knowledge on triangulation among respondents. This finding is not a surprise because academics find reading to be unavoidable in their work. It is through reading books, journal articles, and even Internet materials that they find material they use for their academic work and discover new knowledge they use or build on. Besides, universities require academics to have the ability to read critically. Since academics especially PhD holders tend to engage in rigorous reading, they are likely to educate themselves in the area of research especially triangulation. In addition, academics are encouraged to conduct research and publish therefore are more likely to read about the best practices of conducting research such as triangulation. This could also imply that not much emphasis is placed on the different triangulation methods by supervisors or conference presentations (Tashakkori and Teddlie (2010). However the chi-squared test was $p=0.252$ suggesting that there is no significant difference between the expected frequencies and the observed frequencies in all categories. Therefore, knowledge and source of knowledge of triangulation had no influence on IS academics.

The study found that twenty-six per cent of the PhD holders and only about 14 per cent of the Masters holders understood what triangulation is. The findings can imply that PhD holders have some sort of grasp or knowledge of the underlying causal structures that give rise to triangulation. The finding suggests that there is a difference between knowledge and understanding. The study

found that all academics have knowledge of triangulation but not all understand triangulation. Having knowledge means that academics possess a collection of facts that they may have learnt through reading or studying. However, academics do not have understanding of triangulation meaning that they are not able to apply their knowledge of triangulation to conduct a study. Thus, PhD holders seem to not only have knowledge of triangulation but also some sort of deeper and direct experience of using triangulation. It is therefore logical to state having a PhD allows a person to have both knowledge and understanding of triangulation; which is information about triangulation and a direct experience of using triangulation respectively.

The study found that the most known type of triangulation is data source triangulation (100 per cent) followed by methodological triangulation (82.4 per cent). Analyst, time and space triangulation were the least known each with 15.7 per cent. Thus, both qualitative and quantitative findings show that academics were more aware of data source triangulation and methodological triangulation in this order than other types of triangulation. The findings are in agreement with previous studies on triangulation that interpret triangulation in various ways. For example, Denzin, Jick and Patton (1990) interpret triangulation as a method of using multiple data sources, investigators, and methods to investigate a phenomenon in the same study respectively and assessing the results from different options. Denzin, Jick and Patton's (1990) concept of triangulation was criticised for not including analyst triangulation; a method of using multiple analysts to review the findings and assess the results as another aspect of triangulation (Patton, 2009). Besides, theory, space, and time triangulation are also not taken into serious account by existing concepts of triangulation as types of triangulation.

The implication of the findings above is that there is a limited or fractional understanding of triangulation although IS academics have heard and have knowledge of the different types of triangulation. This finding supports the finding above that suggests that hearing or knowledge of triangulation cannot be equated to understanding what triangulation is. Therefore, triangulation should be understood as using different data sources, investigators, theories, methods, analysts, spaces, and times to study the same research problem respectively and assess the results from different options, which is one of the key contributions of this study to the body of knowledge.

There is therefore need in IS research to promote the comprehensive and credible understanding of triangulation.

PhD holders (78.9 per cent) than Masters holders (69.0 per cent) understood the different types of triangulation. The study implies that PhD holders understand more the different types of triangulation. The finding may be attributed to PhD holders' state of research knowledge that having conducted substantial theses and research projects they have been exposed to advanced research techniques such as triangulation largely than Masters degree holders.

5.24 THEORETICAL TRIANGULATION

The research objective was to ascertain the interpretation and application of theoretical triangulation.

5.24.1 The Usage of Theoretical Triangulation

The study found that IS academics use different theories in the same study (53.3 per cent). The p-value was 0.010. The findings indicate that slightly more respondents use theoretical triangulation than those who do not. This finding is supported by Rugg (2010) who argued that not all researchers make use of the primary strength of theoretical triangulation in looking deeper and broadly at research problems. He attributed this to the challenges that come with using several theories or perspectives or hypotheses when studying one research problem. Though it is challenging to use multiple theories in the same study, Denzin (2012) said that theoretical triangulation has the ability to reduce the number of alternative explanations for a phenomenon. In support of this finding, Yin (2009) stated that the research culture of using different theories in one study is not widespread because of lack of knowledge of theoretical triangulation. Therefore, if academics knew that using multiple or even rival theories, perspectives can challenge them to come up with sharper methods of investigating research problems and generate beyond obvious explanations of research problems, then many would want to use theoretical triangulation more in their studies than they do now.

Findings show that 59.1 per cent of the academics do not use different theories outside their disciplines when conducting a study. The p-value was 0.000. This finding is in agreement with the qualitative study that found that some academics were not using different theories outside their disciplines when conducting a study. The researcher is therefore justified to state that, in spite of the benefits of using interdisciplinary theoretical triangulation such as allowing studies to look at research problems from two or more different perspectives, the IS academics use theories from other disciplines but not often. The IS discipline should promote interdisciplinary, multidisciplinary and transdisciplinary theoretical construction to make use of the benefits of using theories from other disciplines. Morse and Niehaus (2009) maintained that interdisciplinary theoretical triangulation can help IS researchers to go beyond disciplines' conventional boundaries in their research activities. In agreement with these assertions, Castro et al (2010) suggested that interdisciplinary theoretical approaches should be embraced if IS research is to resolve real life and complex research problems.

In support of this finding, Bryman (2006) stated that using interdisciplinary theoretical triangulation could help researchers to draw on theories from different disciplines while staying within boundaries of their disciplines. He also believes that interdisciplinary theoretical triangulation can help researchers to analyse, synthesise and harmonise theory connections between disciplines into coordinated and logical whole theories (Bryman, 2006). Manning and Ravi (2013) stated that the regular use of different theories from other disciplines in the same study would result in the development of cross-disciplinary theories that would promote high quality IS research.

Rothbauer (2008) advised that there is need for researchers to be aware of barriers to achieving true interdisciplinary theoretical triangulation because this is a necessity for collaboration of theories. Interdisciplinary theoretical triangulation should be maximised to be aware of the challenges of its application by ensuring that theories from different disciplines are used together with the aim of serving a common purpose and helping researchers to make the connections between different disciplines and their theories. Salkind (2012) claimed that interdisciplinary

theoretical interaction could help to enhance the constructivist paradigm that allows for new theory construction and a deeper understanding of theories.

Findings show that 57.2 per cent of academics use different theories within their disciplines. This finding is supported by findings from the qualitative study that reported that IS academics conduct studies using theories within their discipline. Sarantakos (2012) stated that when researchers use theories within their discipline, they are free to use concepts, models and theoretical frameworks from sub-disciplines. In other words, researchers' theory study designs are not limited to any one sub-discipline but can use all theories in the parent discipline. However, Peng, Nunes and Annansingh (2011) said that researchers require skills and knowledge to effectively use theories from sub-disciplines throughout different stages of the research process such as research design, analysis, interpretation and reporting of results (McCullaugh, 2016:77). Pickard (2007) states that intradisciplinary theoretical triangulation should be promoted because it allows researchers to learn by making connections between theories, models, ideas and concepts within their disciplinary boundaries. Thus, intradisciplinary theoretical triangulation grounds researchers in their research area and discipline. One of the most important benefits of intradisciplinary theoretical triangulation is that it enables researchers to develop their own disciplinary pathways in an area they are comfortable with and meaningful to them.

5.24.2 The Reasons of Using Theoretical Triangulation

The study found that 90.2 per cent of the academics use theoretical triangulation to validate findings. This finding resonates with the qualitative study that found that theoretical triangulation is mainly used to validate findings followed by explaining findings. In support of these findings, Greene (2007) argues that theoretical triangulation is used to validate findings and to have a better understanding of the phenomenon under study. The findings, however, show that theoretical triangulation is rarely used to enrich the research instruments and to refute findings, which are core usages of theoretical triangulation (Patrick, 2009). This finding is in agreement with Imenda (2013) who argued that theoretical triangulation is used to guide different stages of research processes for a better understanding of a research problem. The study therefore shows that the application of theoretical triangulation is minimal in addition to being applied loosely by using

different ideas or concepts or constructs from literature in one study as revealed in the in-depth interviews. There is need to promote a wider range of reasons for using theoretical triangulation to empower academics with the ability to comprehensively apply theoretical triangulation. This is what Morse and Niehaus (2009) meant when they said that academics may be very knowledgeable, but that does not mean that they understand the structures of theoretical triangulation to comprehensively apply it in research. Therefore, there is a need to bridge the gap between academics' high knowledge levels reported above and the application of theoretical triangulation through ongoing research capacity-building programmes. In the same vein, the literature is not thorough on the usage of theoretical triangulation in IS research as there is lack of studies conducted to understand this phenomenon. Denzin (2009) pointed out that the usage of theoretical triangulation is both illusive and complex, and theoretical triangulation was not recognised as a type of triangulation until 1978. Therefore, there is a need to promote the appropriate usage of theoretical triangulation. If theoretical triangulation was used adequately in the different ways possible, studies conducted by IS academics would bring out deeper and wider understandings of research problems. Hopper and Hoque (2006), who argued that using different theoretical perspectives in tandem to study the same dimension of a research problem results in a profound understanding of the phenomenon, support this finding.

5.24.3 The Frequency of Using Theoretical Triangulation

Close to half (43.1 per cent) of academics occasionally use theoretical triangulation in a study. The finding ties up well with the qualitative study in which less than half of the academics reported they recurrently use theoretical triangulation in a study. The low rate of using theoretical triangulation may be attributed to lack of competence to apply theoretical triangulation. Tashakkori and Teddlie (2010) state that theoretical triangulation is complex and can perhaps be used for complex research problems or when single-theory studies do not yield useful results. For this reason, he would not encourage the use of theoretical triangulation. Denzin (2012) however recommends the use of theoretical triangulation regularly to help researchers surmount the intrinsic biases or weaknesses and glitches that emanate from single-theory studies. Therefore, there is a need to encourage the increase in the rate and comprehensive use of theoretical triangulation in IS research. This may help academics to map out the richness and complexity of research problems by investigating them from

different theoretical standpoints to extend their understanding of research problems. However, the frequent use of theoretical triangulation alone will not benefit IS research if theoretical triangulation is used partially or incorrectly.

The study found 49 per cent of the academics rarely use different theories from other disciplines in a study. The p-value was 0.000. The findings imply that the rate of using theoretical triangulation among IS academics is low. The finding is highlighted in the qualitative study that found that majority of the academics said that they hardly ever use different theories from other disciplines in a study. This finding may be linked to the limited understanding of theoretical triangulation making it difficult for IS academics to use the method frequently. This finding is supported by Tashakkori and Teddlie (2010) who explained that knowledge of or familiarity with a system or method or technology is one of the key determinants of the rate at which a system or method or technology is used over a particular period of time. This means that knowledge of theoretical triangulation, such as having correct facts, descriptions, information and skills acquired through education or experience have influence on the frequency of using theoretical triangulation. In addition, Shields and Rangarjan (2013) state that the theoretical or practical experience understanding of research methods plays an important role in the frequency of using a method that may be lacking among IS academics with regards to theoretical triangulation.

The study revealed that there is a limited application of both intradisciplinary (41.2 per cent) and interdisciplinary (25.5 per cent) theoretical triangulation. The findings suggest that academics do not only fully exploit theories outside their disciplines but also do not effectively integrate theories from different disciplines in their studies. The limited application of intradisciplinary and interdisciplinary theological triangulation may be linked to academics' limited awareness of the existence of theoretical triangulation. There is also a dearth of information and understanding of intradisciplinary and interdisciplinary theoretical triangulation that can be acquired by learning and experience. As a result, there is lack of a real synthesis of theories in research within or outside academics' disciplines. Syed, Sadiq and Indulska (2010) said that when there are no facts, information and experiences people have collected through education and life experience to use and apply a research method, it becomes difficult to use the method within the discipline

or outside the discipline. This finding implies that academics have limited rational representations about how to logically use theoretical triangulation in or outside their disciplines because there is a deficiency of empirical knowledge on theoretical triangulation.

It is therefore logical to state that when researchers fail to apply intradisciplinary and interdisciplinary theoretical triangulation in their research projects, they miss the opportunity of developing their critical theoretical thinking skills, developing more in-depth perspectives on research problems, developing creative research solutions and heightening communication on the application of intradisciplinary and interdisciplinary theoretical triangulation within and outside their disciplines.

5.24.4. Usability of Theoretical Triangulation

The study found that 72.9 per cent of the academics said that it is not easy to use different theories in a study. The p-value was 0.000. The findings suggest that IS academics have challenges in using theoretical triangulation. This may be attributed to lack of previous studies in IS research on how to use theoretical triangulation as ascertained in this study. In other words, this may mean that studies that use theoretical triangulation have not been published, or that very few studies have been conducted that employ theoretical triangulation or that theoretical triangulation is not widely used to warrant its easy application in research. For example, the literature review shows studies that use different constructs from different theories, and inappropriately identify the application of conceptual frameworks in a study as theoretical triangulation (Halcomb and Andrew, 2005; Patton, 2002). Thus, some researchers use the wrong name for theoretical triangulation.

Fifty-eight per cent of the academics with PhD and 38 per cent with Masters qualification rated their competence as good. One possible explanation for this finding is that academics with PhDs may have better research essential knowledge, attitudes, behaviour and skills to use theoretical triangulation. This is in agreement with Wao (2010)'s view that having a PhD gives academics the unique research ability to carry out the research correctly. As a result, PhD holders have an

advantage of competency that provides them a more structured guide to be able to identify, evaluate, use different theories, and even develop theories.

Sixty-three per cent of the academics believed that they were confident in using different theories in a study. The p-value was 0.000. In agreement, qualitative findings revealed that academics were reasonably capable of using theoretical triangulation. The finding means that most academics believe that they can use theoretical triangulation.

Confidence or the belief that one's actions will result in a positive outcome is an evolutionary advantage that should be seized to help IS academics use theoretical triangulation. The finding that some IS academics are confident suggests that they use theoretical triangulation in their studies though not adequately. Wheeldon (2010) said that confidence in research has positive impact on how researchers feel because it enables them to explore complex research techniques. Research capacity-building programmes are therefore needed to further augment IS academics' confidence in using theoretical triangulation.

5.25. METHODOLOGICAL TRIANGULATION

The research objective was to understand the interpretation and application of methodological triangulation.

5.25.1 Usage of Methodological Triangulation

The study shows that 90.2 per cent do not use different methods in a study. The p=value was 0.05. The finding may be attributed to the promotion of methodological triangulation in the IS discipline. Jokonya (2016) states that the realisation of the benefits of methodological triangulation has caused the IS discipline to promote methodological triangulation, especially since the IS discipline is already interdisciplinary in nature (Warfield, 2010). This is because the IS discipline works with different disciplines and paradigms, which makes the use of methodological triangulation indispensable. Tremblay, Hevner and Berndt (2010) explained that

the IS discipline is now embracing methodological triangulation because of an awareness that some components of research problems can only be effectively investigated using quantitative methodology, while other aspects, especially those associated with the humanities and social sciences, can only be effectively investigated using qualitative methodology (Warfield, 2016). Collins, Onwuegbuzie and Sutton (2006) pointed out that methodological triangulation, or mixed methods research, involving gathering, analysing and combining qualitative and quantitative research in a single study, has been common in IS research since the 1980s. Therefore, IS researchers have been able to build and enhance their competencies as individuals and as a discipline in the usage of methodological triangulation. Venables, Pries-Heje and Baskerville (2012) found that the IS discipline has made considerable efforts to promote methodological triangulation, not only by conducting studies using methodological triangulation, but also by creating a supportive and enabling atmosphere that has assisted in bringing about a greater understanding and ability to use methodological triangulation among IS academics.

The study found that more academics use quantitative (90.0 per cent) than qualitative (86.3 per cent) research methodology in a study. The p=value for both variables was 0.05. This did not come as a surprise because this study was conducted in the IS discipline that has a strong positivist background. The IS discipline is a home of natural scientists who believe in working with observable social phenomena to generate unambiguous and accurate knowledge by employing scientific empiricist method such as questionnaires, surveys, polls, and others. The aim of positivism is to generate pure data that are not influenced by human interpretations or biases. This means that positivism relies on quantifiable observations that result in statistical analysis. This is one explanation as to why there were more academics using quantitative than qualitative research methodology. In agreement with this finding, Williams and Gunter (2006) states that the IS discipline is predominantly driven by the quantitative philosophy as most of the studies employ objective measurements and mathematical analysis of data. Findings show that the application of qualitative research methodology is a good indication that the IS discipline is moving towards the pragmatic paradigm that encourages the mixing of research techniques at different stages in a research process.

5.25.2 The Reasons of Using Methodological Triangulation

Academics mainly use methodological triangulation to validate (94.1 per cent) and refute (14.6 per cent) findings. The qualitative study complements the quantitative findings because it found that academics were integrating quantitative and qualitative research in the same study to validate their research findings. The study therefore established that out of the four usages of methodological triangulation, academics use methodological triangulation mainly to validate and refute findings. In agreement with this finding, Creswell (2014) explains that methodological triangulation is mainly used to validate findings, as it is effective in offsetting weaknesses inherent in using qualitative and quantitative methods separately. Wolf (2010) added his voice by saying that methodological triangulation is overused by researchers to identify weaknesses in research findings and above all to present research findings with higher levels of confidence. Agerfalk (2013) said that using methodological triangulation for validation purposes entails that academics have to collect and analyse data to assess the accuracy of the data. Sale, Lohfeld and Brazil (2002) argued that there are other reasons of using methodological triangulation apart from validating or complementing research findings. Methodological triangulation can be used for developmental purposes to allow different research results to inform each other; for initiation purposes so that different research results interrogate other research results and for expansion purposes to broaden the breadth and range of the investigation (see also Denzin, 2012).

Jokonya (2016) in support of Sale, Lohfeld and Brazil (2002) stated that methodological triangulation should be used to explain findings. He said that, if well-applied, methodological triangulation is effective in providing a comprehensive understanding of a research problem, which cannot be provided by one research methodology. Therefore, methodological triangulation can be used to generate a wider and deeper understanding of research problems.

The findings indicate that the application of methodological triangulation is limited because the technique is mainly applied to validate and explain findings. There is need to promote the comprehensive usage of methodological triangulation to include refuting findings and enriching research instruments that are marginally applied by IS academics. In short, the application of

methodological triangulation is incomplete if not used to refute and to enrich research instruments that add value to the research findings.

5.25.3. The Frequency of Using Methodological Triangulation

The study revealed that academics use different methods in a study occasionally (60.8 per cent). The finding is in contrast with the qualitative findings that revealed that academics use methodological triangulation on a regular basis because the technique enabled them to get the detailed, contextualised, and natural insights of qualitative research combined with the more-efficient however less rich predictive power of quantitative research. The study however show that the frequency of the use of methodological triangulation is low in spite of efforts to promote pragmatism, a deconstructive paradigm that advocates the use of methodological triangulation by sidestepping the controversial matters of truth and reality (Feilzer, 2010. Pragmatism deals instead with what works as the truth in relation to the research problem under study (Tashakkori and Teddlie, 2003). The low frequency of use shows that methodological triangulation is not very popular in IS research though there are academics who use the method as revealed in the both quantitative and qualitative research findings. There is a need for the IS discipline to continue promoting pragmatism, a paradigm that rejects the choice associated with the paradigm wars between positivism and interpretivism and quantitative and qualitative approaches.

Only 12 per cent of the academics very frequent use the qualitative method alone in a study while 82.4 per cent frequently use quantitative methods alone. The p-values were less than 0.001. This finding is supported by the qualitative study that found that academics were not keen to use qualitative methodology in a study but keen to use quantitative research methodology because it enables them to ask people about their perceptions and opinions in a structured way and produce hard facts and statistics. Therefore, qualitative findings reinforces the quantitative findings that quantitative methodology that emphasises objective generation, measurements and mathematical analysis of data collected through surveys, questionnaires and polls as the most used in IS research. This is because the IS discipline is generally informed by the positivist philosophical system that is rooted in mathematics and science. Therefore, the IS discipline holds a view that a

phenomenon that exists can be verified using observation, experiments and mathematical proof (Anderson and Braud, 2011).

5.25.4. Usability of Methodological Triangulation

The study found that 52.9 per cent of the academics find it not easy and 88 per cent have problems in using different methods in a study. The p-values were all 0.000. The qualitative findings support the quantitative findings because the study found that it was not easy for academics to employ both quantitative and qualitative research methods to conduct one study. Some IS researchers argue that the challenges found in the application of methodological triangulation may be due to misunderstandings among researchers in the field of IS regarding the actual meaning of methodological triangulation (Mingers, 2003). Fidel (2008) states that IS researchers find it hard to make a decision as to which methodological triangulation approach is fitting for different research problems. Bogdan and Biklen (2011) argued that the difficulties in the application of methodological triangulation in the IS discipline are caused by challenges concerning how to integrate and make sense of the facets of methodological triangulation across the different stages of the entire research process (see also Peffers et al., 2007). It is therefore reasonable to infer that the usage of methodological triangulation is affected by academics' prior knowledge and skills regarding methodological triangulation.

The study found that 78.4 per of the academics were confident in using different methods in a study. The p-values were 0.000. The finding is an opportunity that should be explored to promote the application of methodological triangulation in IS research. Audrey (2013) said that the best time to encourage people to adopt or adapt a method or technology is when they show strong belief in their ability to use the method or technology.

Academics with PhD qualifications (59 per cent) were more competent than those with Masters qualifications (47 per cent). The p-values were 0.000. The finding implies that academics with PhD qualifications rated themselves confident than Masters degree holders. This may be attributed to the finding that a PhD degree involves years of independent research hence empowers academics with

knowledge and skills on how to use different methods including methodological triangulation. In support of the findings, Archibald (2015) said that a PhD is the de facto entrance qualification for a career in research and academics in general therefore making it easy for PhD holders to use methodological triangulation.

5.26. INVESTIGATOR TRIANGULATION

The research objective was to determine the interpretation and application of investigator triangulation.

5.26.1 Usage of Investigator Triangulation

The study found that 67 per cent of the academics collaborate with different researchers in one study. This finding is reinforced by qualitative findings that revealed that academics conduct research together with other researchers in the same study and believe that research collaboration is a good strategy of achieving the common goal of generating knowledge. The study found that 55 per cent of the academics collaborate with researchers from different disciplines in one study. This finding is not in agreement with the qualitative findings that revealed that some academics have never collaborated with researchers from outside their discipline. The findings therefore show that IS academics apply research collaboration at interdisciplinary level. The considerable high level of collaboration at interdisciplinary level may be attributed to views reported in in-depth interviews by academics that there are benefits of using interdisciplinary investigator triangulation. Originally, Denzin (1970) argued that the use of investigators from other discipline in a single study has the potential to empower researchers with the ability to deal with multilevel problems found in triangulation. This has influenced IS research to become open to interdisciplinary research collaboration, while fostering an interdisciplinary triangulation way of thinking. Greene (2007) found that different disciplines, including IS, find research collaboration outside the discipline particularly appropriate for a number of reasons, including its ability to grow in acceptance and complexity, and its potential to foster opportunities to tackle difficult research problems from novel and synergistic perspectives (Hesse-Biber, 2010; Youngs and Piggot-Irvine, 2012). Bergman (2008), Bryman (2007) and Morse and Niehaus (2009) stated that

interdisciplinary investigator triangulation promotes pluralistic inclinations to research processes and deals with enduring challenges in the discipline of triangulation, including issues related to legitimation and mixing of research techniques. Purao et al. (2008) suggested that interdisciplinary collaboration in IS research is becoming popular because researchers have realised that investigator triangulation helps to lessen complete dependence on individual researchers and disciplines that may not have all the necessary research expertise across research paradigms. However, there is no need to be complacent because a considerable number of IS academics do not engage in interdisciplinary research collaboration. Archibald (2015) said that this may be caused by lack of formal knowledge on the benefits of interdisciplinary investigator triangulation and a dearth of courses offered on interdisciplinary investigator triangulation. This is supported by Caruth (2013) who said that some IS academics do not apply interdisciplinary investigator triangulation because of lack of skills or the ability acquired through training on research methodology, or practice by conducting research. There is also lack of clarification on how several investigators can be brought on board and their roles to form a viable research team (Mertens, 2012). David and Jennifer (2014) argues that investigator triangulation's contributions differ in levels from the very extensive to the almost negligible making it hard to use the technique. In addition, Siau and Rossi (2007) argued that the strong IS positivist paradigm makes it difficult for IS researchers to collaborate with researchers from other disciplines that have a strong interpretivist paradigm. However, the emergence of triangulation in IS research makes it easier to encourage academics to use investigator triangulation at different levels of research. Thus, there is more that needs to be done to promote interdisciplinary investigator triangulation.

The study also shows that academics do not collaborate with other researchers from their disciplines in one study (90.0 per cent). The p-value was less than 0.05. This view is echoed by qualitative findings that revealed that some academics do not collaborate with researchers from other disciplines. The high levels of non-application of intradisciplinary investigator triangulation may be linked to a number of factors. For example, though the concept of investigator triangulation is old, it is not well understood. For instance, IS academics stated in the in-depth interviews that investigator triangulation could be used in different ways in a research process, whether in the entire research process or on certain research processes. Archibald (2016) concurred that the term investigator triangulation holds different meanings for different

researchers in the same disciplines. Creswell and Plano Clark (2011) explained that investigator triangulation is a complex phenomenon, as it involves issues such as the access to and use of the data generated in the study, ownership of intellectual property and expectations as to what the nature of the research relationship should be, including the rights and responsibilities of each researcher, thus making it difficult to use interdisciplinary investigator triangulation.

O'Cathain, Murphy and Nicholl (2008) and Onwuegbuzie (2012) explained that, while a wide range of factors that contribute to lack of discipline investigator triangulation activity are known, there are few specific explanations as to how and why intradisciplinary investigator triangulation takes place. Besides, the findings show that intradisciplinary investigator triangulation can take different forms ranging from offering broad insight and advice, to active participation in a research process.

5.26.2 The Reasons for Using Investigator Triangulation

Academics use investigator triangulation to validate findings (90.2 per cent). The quantitative finding is supported by qualitative findings that indicated that academics use research triangulation to validate findings as this enables me to have findings that academics can confidently present. The study indicates that IS academics mainly use investigator triangulation to facilitate the cross verification of findings. Dillinger and Leech (2007) said that using investigator triangulation for validation purposes is the initial way of using the method. In other words, investigator triangulation has evolved that the method is not only used to ascertain if findings truly represent the phenomenon under study. The study therefore shows that IS academics have limited ways of using investigator triangulation. Thus, there is need to promote other usages of investigator triangulation such as to refute findings, enrich research instruments, and explain research findings.

5.26.3. The Frequency of Using Investigator Triangulation

The study shows that academics (54.9 per cent) occasionally use investigator triangulation. The p-value is 0.000. The study further shows that academics (47.1 per cent) occasionally collaborate with researchers within their discipline in a study, and 37 per cent occasionally collaborate with

different researchers from other disciplines in a study. The p=value for all variables was 0.000. The finding ties up well with the qualitative research that revealed that majority of academics were not using investigator triangulation to conduct research within or outside their disciplines. In other words, the findings show significant differences in the responses suggesting that IS academics do not use both intradisciplinary and interdisciplinary investigator triangulation frequently. This means that the IS discipline is missing an opportunity to combine knowledge, skills, data, methodologies, views and notions from different disciplines to gain a better understanding of research problems. Feilzer (2010) in agreement argues that people's habits and behaviour to use research techniques frequently is determined by their interest in the research techniques and the influence of the research technique in enhancing their research productivity. This suggests that interest in using research techniques and perceived benefits influence the frequency in the application of investigator triangulation. There is need in the IS discipline to put in place strategies that would highlight the benefits of frequently using investigator triangulation.

5.26.4. Usability of Investigator Triangulation

The study found that 80 per cent of the academics have problems in collaborating with different researchers in a study, and 62.0 per cent were not confident to collaborate with other researchers. In general, the findings indicate that academics have challenges in using investigator triangulation. This may be attributed to the fact that there is a lack of intradisciplinary and interdisciplinary guidelines regarding how to use investigator triangulation, thus hindering academics from engaging in effective intradisciplinary and interdisciplinary investigator triangulation. Therefore, the IS discipline should develop guidelines to be employed as benchmarks and resources to enhance awareness and capabilities in applying investigator triangulation. In agreement, Fielding (2012) said that when researchers have guidelines they can use to determine a course of action, they find it easy to use a method because guidelines streamline particular processes according to a sound practice or set research routine. However, it is important to ensure that guidelines are not mandatory, binding and enforced but put in place to give relevant and systematic evidence to assist researchers in making decisions about using investigator triangulation. The findings also show that academics are confident in using investigator triangulation.

This is an indication that academics believe that they can use investigator triangulation. It seems academics' beliefs are validated by the signals coming from their behaviour of having used investigator triangulation. If this belief is exploited, academics will continue to feel more confident and effectively use investigator triangulation.

The study found that most of academics with PhD qualifications (63.2 per cent) rate themselves competent than those with Masters (48.3 per cent). This is contrary to previous findings where the PhDs rated themselves higher. This may be attributed to the finding that PhDs find it easy to work on their own because of rich research experience compared to those with masters degrees who would still need the research input of others than those with PhDs.

5.27 DATA SOURCE TRIANGULATION

The research objective was to ascertain the interpretation and application of data source triangulation.

5.27.1 Usage of Data Source Triangulation

The study found that 100 per cent of academics use data source triangulation. The p-value was 0.001. The finding is supported by qualitative study that found that some academics use different types of data sources while others have never.

The finding that academics use data source triangulation fits well with the trend in the IS literature showing studies that are using different data sources (see Venables, Pries-Heje and Baskerville, 2012 and Jokonya, 2016). In support of this finding, Warfield (2010) stated that the IS discipline is shifting from a rigid mono-method that is weightily positivist in approach, to a pragmatist discipline that is opening up to using evidence from different types of data sources such as interviews, surveys, polls, focus group discussions and observations. In addition, Peng, Nunes and Annansingh (2011) underscored the finding by stating that the IS discipline is making

progress towards embracing a paradigm that advocates the use of different data sources in research. However, the finding that some IS academics are not using different data sources to study the same research problems illustrates the challenge the IS discipline is facing with regard to integrating the use of multiple research techniques from different methodological paradigms and embracing research methodology innovations. Until the IS discipline stays away from the contentious issues of truth and reality with regard to data sources to focus on data sources that work in a study, the IS discipline will continue to have a pocket of academics who do not use data source triangulation due to a lack of knowledge and the skills to effectively use data source triangulation (Frels, Frels and Onwuegbuzie, 2011).

Besides the study found that 54.9 per cent of academics said that they have problem in applying data source triangulation and the p-value is 0.019. Both the quantitative and qualitative findings show that IS academics have challenges in using different data sources to study the same research problem. This finding is reinforced by the academics who said that they are able to use in-depth interviews, focus group discussions, observations and questionnaires to study the same research problem but not without problems. Tremblay, Hevner and Berndt (2010) found that challenges encountered in using data source triangulation partially emanate from combining data from written documents, interviews, observations and questionnaires in the same study, which is the most used data sources in IS research.

Findings show that 58.8 per cent of academics were confident to use data source triangulation in a study and the p-value is 0.000. The findings above are supported by qualitative findings that indicated that some academics find it easy-going to employ different data sources in one study and I have a strong edge of using data source triangulation.

This study therefore shows that academics use data source triangulation. Vogt, Gardner and Haeffele (2012) argues that confident researchers are more likely to excel in the research activities as they have self-assurance in their personal ability, judgement and power to use data source triangulation. Warfield (2010) said that researchers who have confidence often find themselves

sure of their research work, and able to use sophisticated research approaches that can enhance their performance.

5.27.2 The Reasons for Using Data Source Triangulation

Findings show that data source triangulation is mainly used to validate findings (96.1 per cent) a finding that is also reported in the qualitative study when academics said that they use several sources of data when investigating a research issue in order to validate findings. The findings indicate that data source triangulation is mainly used to validate and refute findings when there are other reasons of applying data source triangulation. In other words, data source triangulation is used to help researchers ensure that their findings have the quality of being factually and logically sound. The promotion of the application of data source triangulation should also highlight its capability to explain findings and enrich research instruments. In support of the findings, Warfield (2010) said that the philosophy of data source triangulation considers multidimensional reasons of using data source triangulation and emphasises quality of research through addressing the capacity of data source triangulation to clarify findings, enhance research instruments and disprove findings.

5.27.3. The Frequency of Using Data Source Triangulation

The frequency of using different data sources among academics is 80 per cent and the p-value is 0.000. The finding resonates well with the qualitative study that found that academics apply data source triangulation in their studies on a consistent basis. These findings resonate well with Oates (2009), who argued that using different data sources frequently in IS research is an emerging research movement with a distinct identity. In agreement, Morgan (2007) states that data source triangulation is evolving to the point where IS researchers are increasingly articulating the technique and attaching it to their research practices.

The findings above point to the fact that the level of pragmatism demonstrated by the IS discipline allows for a fusion of data sources approaches, challenging the sterile, old notion of

incompatibility by embracing the new philosophies of research. In support of this finding, Wheeldon (2010) also attributes the regularity of the use of data source triangulation to pragmatism, which offers a basis for seeing mixed data sources approaches as options open to researchers if they realise that no data source alone can provide comprehensive findings for a particular research problem (see also Tashakkori and Creswell, 2007; Johnson and Turner, 2007).

Only six per cent of academics frequently use different sources outside their discipline and 78.8 per cent frequently use different data sources from within their disciplines. The p-value was 0.000 for all variables. IS academics' over-reliance on using data sources within the discipline and the paucity of the use of data sources from other disciplines may be linked to factors intrinsic to different data sources, peer pressure, research funding, the predispositions and preferences of IS academics and of the IS discipline (Venkatesh, Brown and Bala, 2013; Oates, 2009).

5.27.4. Usability of Data Source Triangulation

The study found that 49.0 per cent of the academics find it is easy to use different data sources, and 54.9 per cent experience problems in using different data sources in a study. The p-value is 0.019. Both findings on usability and confidence are agreement with qualitative findings that revealed that some academics use data source triangulation but not without challenges. The finding points to one finding that almost half of the academics find using data source problematic while another half find using data source triangulation easy. This may be indicating the reluctance or challenges of IS researchers to accept pragmatism as a philosophical partner for the mixed data sources approach. In agreement, Agerfalk (2013) argued that this *status quo* is influenced by the strong, traditional, positivist beliefs about knowledge and enquiry that underpin IS research, which is quantitative in approach, thus not being open to innovative approaches using qualitative data sources based on constructivism or interpretivism (Johnson and Onwuegbuzie, 2004).

Findings also show that 94.0 per cent of academics were confident in using different data sources. The p-value is 0.000. In support of the finding, the qualitative study found that some academics use data source triangulation successfully.

PhD qualifications holders (47 per cent) rated themselves higher than Master qualifications holders (17 per cent) in using data source triangulation. The p-value is 0.000. The study shows that academics trust in themselves and, in particular, in their aptitude to engage at least adequately with data source triangulation in their research activities. This confirms why some academics use data source triangulation. In support of this view, Torrance (2012) said that a confident researcher is ready to rise to using new and different research methods, seizes research opportunities, deals with difficult research situations, and takes responsibility when research processes do not go according to plan.

Tirole (2011) adds his voice by stating that self-confidence enables researchers to have positive self-evaluations of their research abilities and positive expectations of their performance. This means that when researchers trust in their own capacities, abilities, judgments, and belief they can successfully apply data source triangulation. Torrance (2012) explained that confidence in one's research abilities brings about more happiness as it results in success. In addition, when researchers are feeling better about their research capabilities, they become more motivated to use different research techniques and achieve their research goals.

5.28 ANALYST TRIANGULATION

The research objective was to understand the interpretation and application of analyst triangulation.

5.28.1 Usage of Analyst Triangulation

The study found that 52.9 per cent of academics do not use different analysts in the same study, 56.9 per cent do not use analysts outside the discipline, and 71 per cent do not use different analysts within their disciplines. The p-value for all variables is 0.000. This finding is in agreement with the qualitative findings that indicated that some academics *have never* used multiple analysts within or outside their discipline to analyse findings but knew some academics who were using multiple analysts as a method of verifying research findings. The finding show

that analyst triangulation is underused by IS academics. This may be attributed to the academics' lack of knowledge and skills on how to apply the technique in a study, as indicated both in the qualitative and quantitative research findings. The need to promote the knowledge of analyst triangulation to encourage academics to use different analysts in their studies to get practical exposure to the usage of analyst triangulation cannot be overemphasised. This is in agreement with Patter (2009), who said that using multiple analysts in the same study requires one to have knowledge of engaging different researchers. Nevertheless, knowledge of analyst triangulation alone, i.e. information obtained through sensory input such as reading, can only give academics information and theoretical concepts on analyst triangulation but not the ability to apply the knowledge in a research process. Therefore, in addition to requiring knowledge of analyst triangulation, academics need research practice, which is one sure way of developing research skills on analyst triangulation. Huysmans (2013) argued that research is a challenging activity, but if one conducts research guided by factual knowledge, the more a researcher conducts research, the better the researcher gets at doing research.

In addition, the finding that academics do not use analysts from within and outside their disciplines shows that there is little engagement with intradisciplinary and interdisciplinary analyst triangulation. This finding may be because of lack of information and well-established formal relationships between individual academics or disciplines that are important in initiating successful analyst triangulation and research collaboration in general (see also Huysmans, 2013).

5.28.2 The Reasons for Using Analysis Triangulation

The study found that 96.1 per cent of academics use analyst triangulation to explain findings. This findings is supported by the qualitative study that revealed that academics use analysts to review findings, check on selective perceptions and then illuminate blind spots in their research analysis which is a form of validation. The findings therefore indicate that analyst triangulation is used to confirm findings. Warfield (2010) reinforces the finding by arguing that analyst triangulation helps to ensure valid results for a specific research problem under study. In addition, Caruth (2013) said that data validation, as a planned process, provides certain well-defined assurances of accuracy and consistency of the findings. Furthermore, the study suggests that academics apply

analyst triangulation to explain findings but the method is rarely used to refute findings and enrich research instruments. Thus, the usage of analyst triangulation is very limited. There is a need to promote knowledge of the usage of analyst triangulation as this may enhance the correct and full application of the technique. The researcher can therefore safely argue that academics lack the ability to apply analyst triangulation. Thus, developing academics' knowledge of analyst triangulation may have a positive influence on the application of triangulation in general. As long as IS researchers do not agree on the meaning of analyst triangulation and the deliverables that form its basis, this technique will remain underused and misused. Therefore, there is a need to have precise and agreed-on meanings and clear stages at which analysts may be employed in a research process, to enable correct and effective implementation of analyst triangulation

5.28.3. The Frequency of Using Analyst Triangulation

The study shows that 49 per cent of the academics never use analyst triangulation, never use different analysts within (67.0 per cent) and outside (64.0 per cent) their disciplines in a study. The p-value is 0.000. The finding agrees with the qualitative study that found that some academics have never used two or more researchers to analyse the same data. Thus, the rate of the usage of triangulation within and across disciplines is generally low. One of the most intriguing issues coming from this study is how analyst triangulation is understood, in particular, its usage. The understanding of analyst triangulation as a method for validation purposes affects the frequency of its usage. In the opinion of the researcher and several IS researchers, the success or failure of the usage of analyst triangulation largely depends on the issue of the understanding or misconception of analyst triangulation (Hemmings et al., 2013; Onwuegbuzie, 2012 and Creswell and Plano Clark, 2011).

5.28.4. Usability of Analyst Triangulation

The findings show that 57.0 per cent of academics find it not easy to use different analysts in a study, 47.0 per cent have problems in using different analysts in a study, and the p-value is 0.000. This finding is in agreement with qualitative findings that indicated that academic find the technique of using different analysts in one study cumbersome to employ especially that a researcher has to use multiple analysts to independently review data collected from the study and

data has to be constantly compared. Both quantitative and qualitative findings show that academics have challenges in using analyst triangulation. In particular, in-depth interviews, participants said that analyst triangulation is a controversial topic as there are many challenges that arise when trying to break down its meaning and, worse still, its usability in a study. In agreement with this finding, Huysmans (2013) explained that there are currently no agreements that can be used to formalise the usability of analyst triangulation in IS research. Therefore, there is a need to formalise the use of analyst triangulation in order to avoid or reduce challenges, misunderstandings and disputes related to the interpretation and application of analyst triangulation.

The study found that 45.0 per cent of academics are confident in using analyst triangulation. PhD holders (63.2 per cent) rated their competence level higher than Masters holders (48.3 per cent). The finding may suggest that Masters holders rate their competence as good out of ignorance or because of lack of data analysis experience they tend to seek analysts' expertise more than PhD holders.

The confidence reported by academics suggest that there are academics who accept new experiences of conducting research such as using analyst triangulation and are ready to make research mistakes and learn how to use analyst triangulation. Venable, Pries-heje and Baskerville (2012), in agreement said that when researchers are confident they give their best in their research work and believe that whatever happens in the research process they will still realise the intended research goals. There is therefore need to put in place measures to promote in academics a positive outlook that would stir-up their best mental state to master the use of analyst triangulation. In other words, academics are confident that they can use analyst triangulation because of their positive attitude and realistic expectations. Therefore, all IS academics need to be helped to have faith in their own research abilities that they can use analyst triangulation.

5.29 SPACE TRIANGULATION

The research objective was to determine the interpretation and application of space triangulation.

5.29.1 Usage of Space Triangulation

Sixty-one per cent of the academics do not use different spaces when conducting a study, 89.8 per cent use spaces within and 67.0 per cent outside their disciplines to conduct research. The p-value is 0.000. This finding is supported by qualitative findings that show that academics use locations within and outside their disciplines to collect data and contribute to deal with the research problem under study and contribute to the body of knowledge.

The study therefore shows that that some academics did not use different spaces when conducting a study. This finding may be linked to findings in the qualitative study where some academics said that time is not an important factor when conducting research. Some academics stated that space triangulation is not used because of the view that research findings are not influenced by environmental dynamics. Some academics said that space triangulation is time consuming, that it cannot be used in all situations and that they lacked understanding of the interpretation and usage of space triangulation. This finding is of interest as very few studies have been conducted in the IS discipline showing a thorough understanding of space triangulation (Venables, Pries-Heje and Baskerville, 2012). This implies that many academics conduct research without taking into account the influence of different settings, locations and other critical factors associated with the environment in which the studies take place. Denzin (2012) argues that failure to take into consideration key environmental factors that could influence the information collected during a study, can compromise the credibility of the findings.

The study however, shows that academics use intradisciplinary space triangulation. In support of the finding, Tashakkori and Teddlie (2010) argued that researchers find it easy to conduct research in spaces they are familiar with. Thus, it is much easier to have a valuable practical research timetable, guide to research activities, and have some foresight into what the researcher wants to achieve when in a familiar environment where one understands systems and operations (Venable, Pries-heje and Baskerville, 2012). It is therefore important to promote intradisciplinary and space triangulation in general because when research findings remain unchanged when

collected in different spaces or under different environmental conditions, this shows that the study has achieved credibility.

The study found that academics take into account different cultures when conducting research (94.0 per cent). The p-value is 0.000. The qualitative study reinforces the finding because the study found that academics use space triangulation in their research projects to identify environmental or cultural influences that may affect the data collected during research. The findings suggest that IS academics take into account external factors that would affect the study such as the place and organisation in which research is conducted. In agreement with this finding, Wheeldon (2010) states that culture is an unseen phenomenon but a powerful force able to influence research results because of its influence on the researcher and participants' behaviour. In other words, the study is suggesting that perception factors such as the way a researcher and participant interpret the environment in which the study is conducted, including their background and experiences, beliefs, values, expectations and interests can influence the research findings, and therefore need to be addressed under space triangulation. In agreement, O'Cathain, Murphy and Nicholl (2008) mentioned that organisational issues that affect the research process, such as the research policies and procedures in the institution where the research is conducted, should be addressed through formalised research procedures. Addressing these space triangulation issues can help to resolve common problems and to guide IS research. In addition, space triangulation cannot be effective in enhancing the credibility of a study if organisational hierarchy factors, for example, the need to inform the management structure of the institution in which the research is conducted, are not accounted for (Greene, 2006). This is important because institutions have different levels of management that carry different degrees of authority and have to be informed about any research activities because authorities' reactions can directly affect the nature of the research to be conducted. Denzin (2012) states that space triangulation should take into account organisational politics by addressing the behaviour displayed, for example, by research participants, intended to influence others' perceptions of the research process. In short, beliefs, values and interests should be addressed in a research process, as they are the driving forces behind organisational politics that can positively or negatively affect the credibility of the research findings.

5.29.2 The Reasons for Using Space Triangulation

Academics mainly use space triangulation to validate findings (96.1 per cent). The finding is supported by qualitative findings that revealed that academics use space triangulation to authenticate findings. Therefore, findings indicate that space triangulation is mainly used for validation purposes. There is, therefore, a need to bridge the practice gap. Tashakkori reinforces this finding and Teddlie (2010), who argued that space triangulation maximises confidence in research findings through validation. Thus the study suggests that the majority of the academics rarely use space triangulations to refute findings and to enrich research instruments that are key purposes of using triangulation (Patrick, 2009). The findings therefore show a gap in space triangulation best practices.

5.29.3. The Frequency of Using Space Triangulation

Findings indicate that 45.1 per cent of academics occasionally use different spaces in a study. The p-value is 0.000. This finding shows that academics use space triangulation, but there is a low rate in the usage of space triangulation. This problem may not be because of academics' unwillingness to use space triangulation but rather by the failure to have a correct understanding of space triangulation and to identify and be conscious of critical factors that have the potential to influence the integrity of the research results.

The findings show that 56.9 per cent of academics frequently use different spaces within their workplace when conducting a study. The p-value is 0.000. This finding may be attributed to the finding that academics find it easy to conduct research within their organisations because they are familiar with the people, and processes that need to be followed to conduct research. Yin (2012) in agreement said that conducting research in a familiar environment makes research easy because a researcher is able to quickly put together the research protocol with detailed set of activities for the project proposed and who is to be contacted for the activities to be effected. Besides, the frequency of using space triangulation may be quite high because researchers are aware of the benefits found in effecting space triangulation including the ability of space

triangulation to overcome the limitations of research conducted in one setting or culture attracts researchers, even in the IS discipline, to use space triangulation (Venkatesh, Brown and Bala, 2013). Morse and Niehaus (2009) stated that space triangulation is popular and is used frequently in some research communities because it influences research to generate truth-value by aggregating the truthfulness of the research findings. In agreement, Denzin (2012) said that space triangulation, to some degree, promotes the consistency and dependability of the research findings.

Further, the study found that academics rarely use different spaces from outside their workplace when conducting a study (59 per cent) and the p-value is 0.000. The low rate in the use of space triangulation outside one's organisation can be attributed to the challenges of getting hold of authorities or those with the ability to control access to premises where research is to be conducted. Yin (2009) found that it takes a long time for gatekeepers to make decisions to allow researchers to conduct research. Thus, the challenges of gaining entrance to other organisations to be studied and getting formal permission to enable a conducive research environment hinder the application of interdisciplinary space triangulation. The other possible challenges include budgeting in terms of costs, administrative and facilities costs, and cost commitments.

5.29.4. Usability of Space Triangulation

Academics find it easy to use different spaces when conducting a study (56.9 per cent), and 92 per cent have problems in using different spaces when conducting a study. The p-value is 0.000. Qualitative findings reinforce these findings because the study found that space triangulation works for some academics although academics face challenges related to ensuring that space factors capable of influencing the research process are dealt with. These findings are in agreement with Morgan's (2007) finding that space triangulation is easy to use because the majority of researchers employ it with ease, when they select, for example, quiet places to conduct interviews regarding the research problem. However, some academics find space triangulation hard to use because they do not understand what it entails in terms of social, spiritual, cultural, physical and emotional issues that can influence the trustworthiness of the research process and findings, and need to be addressed in a research process.

Academics are very confident in using different spaces when conducting a study (73.0 per cent). The p-value is 0.000. Almost all academics are competent in using space triangulation for both PhD (47.4 per cent) and Masters qualifications (38 per cent). Deducing from the findings above, it is logical to argue that confidence is one of the most influential motivators and regulators of IS academics' behaviour to employ space triangulation. A growing body of scientific knowledge indicate that confidence in a researcher is an indication that one is aware of his or her research abilities, which is a key that acts as a go-between construct of being able to use space triangulation. In agreement, Yin (2012) argues that the major influence in using a research technique is the confidence and motivation a researcher has to persevere in deliberating space triangulation practices.

Therefore, IS academics especially PhD holders may have a higher motivational perspective but more important a judgment about their capabilities supported by empirical research skills to carry out space triangulation. Therefore, as long as researchers make research goal choices and practice self-regulation, they will be able to engage in self-monitoring, self-evaluation, and self-reactions towards the effective use of space triangulation.

5.30 TIME TRIANGULATION

The research objective was to ascertain the interpretation and application of time triangulation.

5.30.1 Usage of Time Triangulation

The study found that 49.0 per cent of the academics do not use different times to conduct the same study. The p-value is 0.000. This view is supported by the qualitative study that found that some academics use time triangulation to collect data at different times on the same research problem while others do not use time triangulation. Findings show that while time triangulation is not widely used, academics use time triangulation easily, as it is obvious to them that they need favourable times to collect data. In agreement with the finding above, Youngs and Piggot-Irvine (2012) stated that

time triangulation often occurs in the absence of conscious awareness, when compared to the consciousness needed when using other types of triangulation, such as theoretical and analyst triangulation. Overall, the study shows significant differences in the application of time triangulation and those that use the method mainly do it automatically.

5.30.2 The Reasons for Using Time Triangulation

Findings show that 96.1 per cent of the academics use time triangulation to validate findings and to explain findings (37.0 per cent). The quantitative findings are supported by the qualitative findings that revealed that majority of academics collect data about a research problem at different times. The findings show that the application of time triangulation is limited, as it is seldom used to enrich research instruments and to refute research findings as reported in the study. There is therefore a need to promote knowledge on the understanding of time triangulation, to improve the usage of time triangulation. Thus, the considerably limited way of using time triangulation shows that academics lack the aptitude to fully apply time triangulation. This finding is supported by the 'continuum theory for research work knowledge' that advocates for the need to narrow the gap between research knowledge and practice. In the same way, there is a need to invest in developing academics' knowledge of time triangulation in order to promote its use.

The study also shows the misapplication of time triangulation. A good example of time triangulation is conducting research at different times using the same research questions and evaluating the findings. IS academics seem to interpret time triangulation as merely the use of different times to conduct research. However, time triangulation goes beyond this understanding and usage and is a powerful technique that facilitates the corroboration of data through cross-verification of two or more sets of data collected at different times (HesseBiber, 2010).

5.30.3. The Frequency of Using Time Triangulation

Only 20 per cent of academics frequently use time triangulation. The p-value is 0.000. The study shows that different times are not consciously used regularly when conducting research. Therefore, the frequency of the application of time triangulation is not a problem. The problem

is that IS academics are most of the times not aware that they are using time triangulation as it is obvious that they need a time or environment in which to conduct research without interruption. Therefore, being unconscious that a person is making an effort to conduct research for example, in different quiet places where the researcher and participants cannot easily be distracted does is using time triangulation though the researcher may not be aware that time triangulation is being implemented. Choosing different times when a researcher and participant can carry out a study on the same research questions when there is no trouble keeping their attention focused and comparing the findings is time triangulation. In agreement, Anderson and Braud (2011) said that almost all researchers use time triangulation frequently because they all want to conduct research at different times when it is possible to shut off all external disturbances and compare data. Barone and Eisne (2012) said that carrying out research in quiet times and zones and comparing the results could assist researchers to generate considerably higher quality research results. Therefore, all researchers know that for them to focus entirely on conducting research, they need to give their all to find suitable times. Bernard (2011) said that researchers are able to carry out quality research projects if they choose different distraction free times and ensure that data collected from different times is compared. In agreement, Boyd and Horacio (2012 said that conducting research in a reduced destruction zone helps researchers to achieve their research goals easily and within less time. In other words, all researchers want to conduct research at different times they are unlikely to be disturbed. However, avoiding distractions by choosing different appropriate times to conduct research is not something researchers are so much conscious of because they do it automatically. Findings show that while time triangulation is not widely used, academics use time triangulation easily, as it is obvious to them that they need different good times to conduct research and use data collected at times in one study.

Findings show that 80.9 per cent of academics frequently use different times within their workplace when conducting a study and the p-value is 0.000. The study suggests that academics engage in intradisciplinary time triangulation by using different times to conduct research within their disciplines. Yin (2012) argued that it is easy for researchers to find different times and conduct research in their disciplines because they can easily identify suitable times and facilitate the research preparations to carry out research. Bryman (2012) said that in intradisciplinary time triangulation researchers take advantage of their progressive knowledge and decision-making ability in their

discipline. This makes it easy to find suitable times to conduct research. Braun and Clarke (2013) said that it is so easy for researchers to put in place research plans in their disciplines because they understand the dynamics of their environments such as times when venues and people are free to conduct research.

Academics rarely (59.0 per cent) use different times outside their workplace when conducting a study. The p-value is 0.000. The low rate in the use of intradisciplinary time triangulation can be attributed to the challenges of getting resources to meet research costs. The findings may also mean that researchers are uncomfortable to conduct research at different times outside their disciplines as they feel that it is not easy. The low rates of the application of interdisciplinary time triangulation implies that academics are missing out on the opportunity to conduct research that would generate deep insights as a result of using different times to conduct research. Archibald (2015) said that benefits of interdisciplinary time triangulation include gains in the ability to think critically, recognize bias, acknowledge and appreciate diversity, and generate high quality research results.

5.30.4. Usability of Time Triangulation

Fifty-eight per cent of the academics find it easy to use different times in a study, 92.2 per cent have problems in using different times in a study, 51 per cent are not confident in using different times in as study. The p-value for all variables is 0.000. The study indicates that academics have problems with using time triangulation. This may be attributed to academics' limited know-how of time triangulation as they use the method without conscious thought. Strategies such as seminars and workshops should be implemented to empower academics with better knowledge of time triangulation. It is however, important to note that the in spite of the low rate in the application of time triangulation, academics have confidence that they can use time triangulation. This implies that academics feel they can effectively use time triangulation. David and Jennifer (2014) said that when people convey to others that they can carry out the challenge before them, then they are likely to do so. However, Caruth (2013) cautioned that there is need to distinguish between research confidence based on people's honesty evaluation of their skills and arrogance, which typically is when researchers believe that they can use time triangulation when they are

not able to do so. There is need to take advantage of academics' close self-assessments that they can use time triangulation and use this belief as an entry point to promote the application of time triangulation so that academics can display healthy research confidence.

5.31 COMPARISON OF THE USAGE OF THE DIFFERENT TYPES OF TRIANGULATION

The comparison indicates that data source (p=0.000) and methodological (p=0.000) triangulation in this order are the most used types of triangulation in research. The findings are in agreement with the earlier findings on the usage of individual types of triangulation that show that data source and methodological triangulation were the most used types of triangulation. This means that academics conduct studies that employ evidence from different types of data sources, for instance journal articles, books, internet pages, interviews, and observations and evaluate results to have a better understanding of the research problem. To some extent, this finding is expected. This is because studies conducted by academics are most of the times supported by different data sources including journal articles, books, internet pages, notebooks, narrative field logs, research diaries, interviews, observations, questionnaires, evaluation reports, photographs, and participants' notes.

The other most used type of triangulation is methodological triangulation. This finding is in agreement with the existing research trend in IS research that is slowly appreciating the use of methodological pluralism. In agreement to the finding above, Venkatesh, Brown and Bala (2013) and Patton (2009) said that IS researchers are gradually using methodological triangulation because the method is effective in mapping out and explaining more comprehensively the depth and complexity of research problems by investigating research problems from multiple perspectives.

The least used types of triangulation include analyst triangulation (32.0%), theory triangulation (30.0%), and others. The findings on the least used methods of triangulation suggest that these techniques are not popular in IS research in spite being critical in enriching research instruments, refuting findings, validating findings, and explaining unexpected research findings to have a comprehensive understanding of the research problem. There is a need to promote the correct and comprehensive understanding and usage of triangulation among IS academics. Academic resources should be put in place to promote the least used types of triangulation.

5.32 COMPARISON OF THE REASONS FOR USING DIFFERENT TYPES OF TRIANGULATION

The comparison shows that data source (p=0.000), investigator (p=0.000), theoretical (p=0.000), methodological (p=0.008), analyst (p=0.000), space (p=0.001) and time triangulation are mainly used to validate and explain findings. The findings are supported by Mingers (2003) who argues that slow innovation in research methodology is one of the reasons different types of triangulation are mainly used as techniques for checking and proving the accuracy of the findings. The finding on the use of the different types of triangulation to explain findings resonates well with Mitchell and Jolley (2010)'s view that that different types of triangulation are mostly used to describe sets of research findings which help to clarify the nature of the findings generated in a study. The findings therefore are in agreement with findings reported when all types of triangulation were studied individually indicating that the different types of triangulation are mainly used to validate and explain findings. The findings therefore confirm the argument that there is limited understanding of the reasons for using different types of triangulation because little is reported on the application of different types of triangulation to enrich and refute research findings.

5.33 COMPARISON OF THE USABILITY OF THE DIFFERENT TYPES OF TRIANGULATION

The comparison shows that data source (p=0.000) and methodological (p=0.000) triangulation are the most usable types of triangulation in research. The findings may be attributed to a number of factors. Data source and methodological triangulation are the most documented types of triangulation making it easy for researchers to read about their operationaliation and benefits in research and therefore apply the techniques accordingly. O'Cathain, Murphy and Nicholl (2007) argue that data source and methodological triangulation are the most used in research because they are easy to apply compared to other types of triangulation. The view above confirms the findings presented earlier on individual types of triangulation that indicated that data source and methodological triangulation are easy to use in research because their application process is less demanding in terms of knowledge and skills needed.

5.34 COMPARISON OF THE FREQUENCY OF USING DIFFERENT TYPES OF TRIANGULATION

The study shows that data source (p=0.000) and methodological (p=0.000) triangulation are the frequently used in research. The findings may be attributed to the earlier findings when different types of triangulation were studied independently that show that data source and methodological triangulation are the most used making it probable for researchers to use these techniques regularly in research. The findings are reinforced by the qualitative study that found that data source and methodological triangulation are regularly used in research because of the abundance of documentation on their application and benefits to research.

5.35 SUMMARY

The chapter presented, discussed and interpreted research results on the interpretation and application of triangulation. The chapter highlighted the research objectives the study set out to achieve and discussed the characteristics of the target population. Characteristics discussed include age, gender, place of work, department, level of study, ethnicity, education level, and years of work experience. The chapter also discussed the understanding, usage, usability, and frequency of use of the seven types of triangulation; data source, investigator, theoretical, methodological, analyst, space, and time triangulation. The chapter closes with this summary.

The next chapter presents the conclusions and recommendations of this study.

CHAPTER SIX

CONCLUSIONS ON THE STUDY

6.1 INTRODUCTION

The study investigated the interpretation and application of triangulation in Information Systems (IS) research. The preceding chapter presented findings, discussion and interpretation of the findings. This chapter draws conclusions based on the findings of this study. Briefly, the chapter has several key sections presenting the summary and discussion of the meaning of the results beyond qualitative and quantitative meaning, that is, interpreting the findings and drawing conclusions from the findings. The chapter starts by presenting the conclusions on seven themes informed by the conceptual frameworks underpinning the study that informed the research objectives. The themes include the interpretation and application of data source, investigator, theoretical, methodological, analyst, space and time triangulation, centering on the usage, usability, reasons for using, and frequency of the use of the seven types of triangulation.

The following sections summarises the findings and conclusions on the seven types of triangulation reported in this study.

6.2 KNOWLEDGE OF THE DIFFERENT TYPES OF TRIANGULATION

The most known type of triangulation among IS academics is data source triangulation (100 per cent) and methodology triangulation (82.4 per cent). The least known each at 16.0 per cent are analyst, time and space triangulation. The low levels of knowledge of investigator, analyst, time and space triangulation is attributed to lack of the systematic investigation into these forms of triangulation compared to data source and methodology triangulation that are widely studies and applied. There is also lack of existing materials and sources in order to

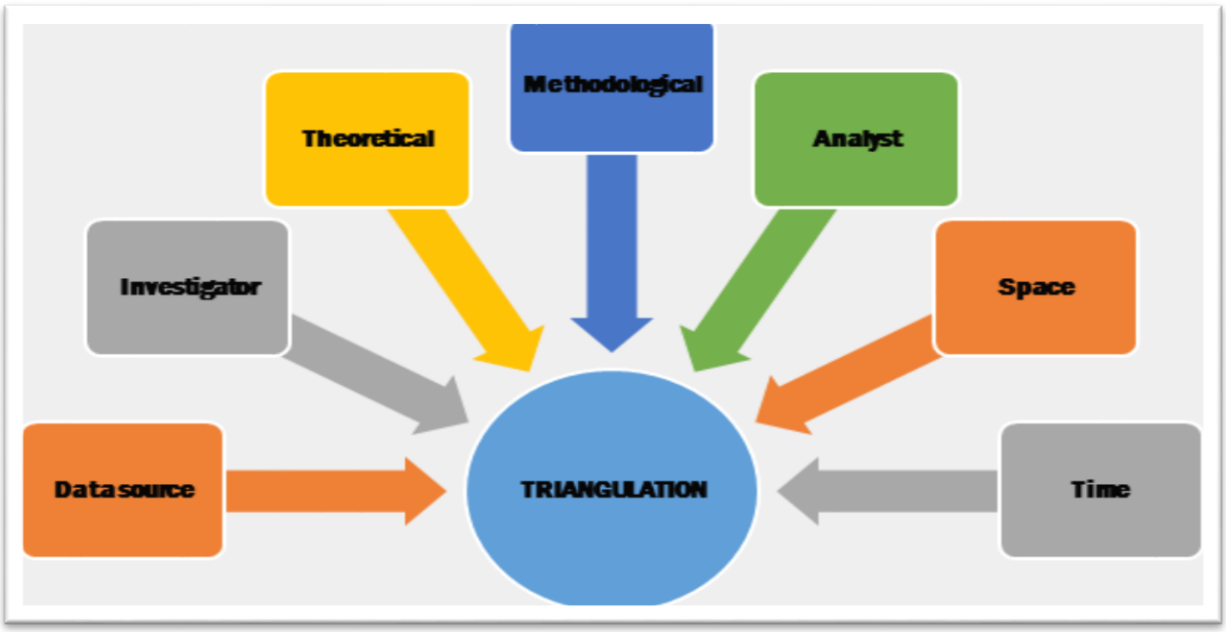
ascertain facts and reach conclusions on the understanding of the different types of triangulation.

A limited understanding of triangulation may also be seen in Fidel's (2008) study, which claimed to have studied triangulation and found that only 13.0 per cent of empirical studies used triangulation. However, the study investigated methodological triangulation not triangulation in general, thereby reducing triangulation to methodological triangulation. Denzin, Jick and Patton (1990) explained triangulation as consisting of: methodological triangulation; a technique of using more than one method in a study; data source triangulation; a technique of using more than one source of data in the same study; and investigator triangulation; a method employing more than one researcher to conduct the same study. Subsequently the process of assessing and comparing the research results takes place. In addition, the same authors mention theoretical, space and time triangulation in passing, but do not acknowledge these concepts as additional types of triangulation. Cohen and Manion (1997) shared Denzin, Jick and Patton's (1990) understanding of triangulation but added another type of triangulation, analyst triangulation; a method of using multiple analysts or analysis techniques to review and compare the findings.

Thus, there is no agreement between the IS academics and previous studies on the understanding of triangulation. The IS academics who participated in this study have little knowledge of triangulation, in particular space, time, analyst, and investigator triangulation, which are equally critical in assuring high quality research. Thus, this study is justified in concluding that though IS academics have heard of triangulation, they have a limited understanding of the technique. Based on the findings of this study, triangulation should be interpreted as the application of two or more research options in a study to evaluate the results of other research options or compare results for enhanced research results. The concept of triangulation, according to previous studies, derives from navigational and land surveying techniques for determining single points in space with the convergence of measurements taken from two other points (Bhasin, Linsky, Hayden and Tseng, 2005). The notion holds that a person can be more certain with research results when different methods bring about the same results (Denzin, 2012). Thus, triangulation can be understood as a seven-sided concept

of mixing research techniques in a study to generate more certain research results, as presented in figure 6.1 below.

Figure 6.1: The DITMAST Triangulation Conceptual Framework



Source: synthesised by the Author (2019)

The seven components or meanings of triangulation are: data source, investigator, theoretical, methodological, analyst, space and time triangulation, as they can all help to promote excellence in IS research and research in general.

The majority of the academics are aware of triangulation from readings. This finding may be attributed to a number of factors, including the brevity and accuracy of readings such as journal articles, books, research reports, and others in disseminating research findings, their accessibility and the valuable insights they offer into a phenomenon, enhanced by extensive

peer review processes. In addition, the university encourages academic staff to read critically and widely to develop stronger analytical thinking skills, and expand the frontiers of their knowledge.

6.3 USAGE OF THE DIFFERENT TYPES OF TRIANGULATION

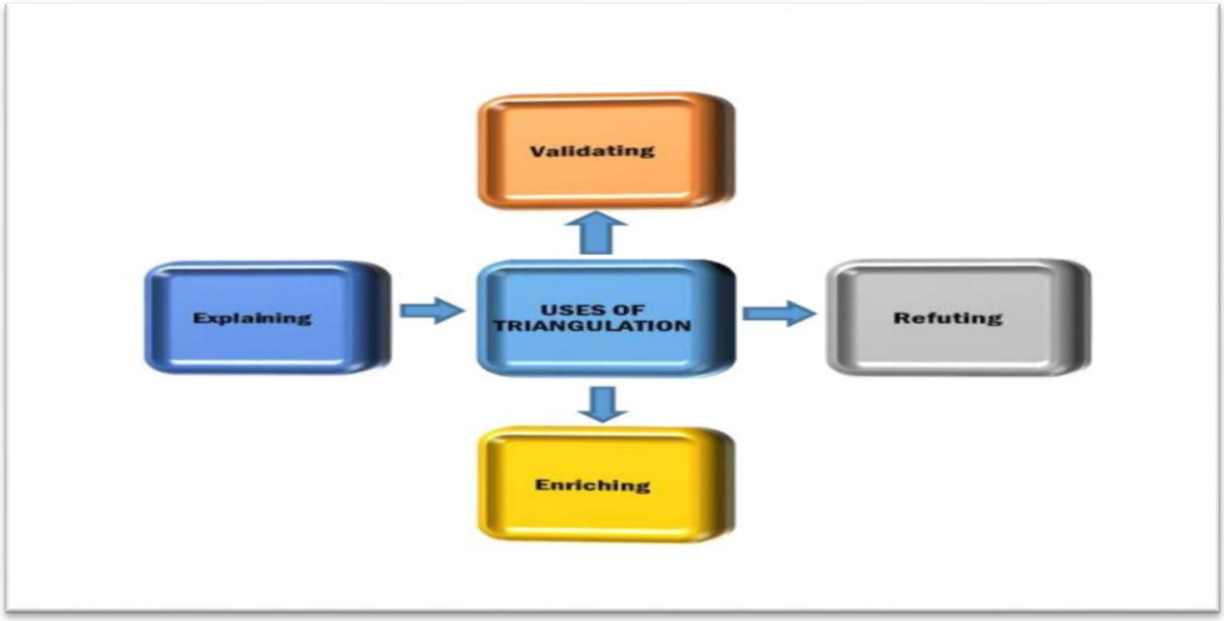
The study found that data source triangulation (p=0.000) and methodological triangulation (p=0.000) are the most used types of triangulation. The finding that data source triangulation and methodological triangulation are the most used in the IS discipline may be linked to the promotion of these methods in IS research. Jokonya (2016) states that the realisation of the benefits of triangulation has caused the IS discipline to promote triangulation, especially that the IS discipline is already interdisciplinary in nature as it works with different disciplines and paradigms making the use of triangulation indispensable (Warfield, 2010). Scholars such as Tremblay, Hevner and Berndt (2010) explained that the IS discipline is now embracing triangulation because of an awareness that some research problems can only be effectively investigated using research techniques. Collins, Onwuegbuzie and Sutton (2006) pointed out that source triangulation, methodological triangulation, investigator triangulation and space triangulation, has been common in IS research since the 1900s. For this reason, IS researchers have built and enhanced their competencies in their application, hence the high levels of their application. There is however need to promote the usage of time, theoretical and analyst triangulation the least used types of triangulation. As long the current *status quo* remains, the application of triangulation will be limited to data source triangulation and methodological triangulation at the expense of other types of triangulation that are equally beneficial to research processes, and above all to research findings.

6.4 REASONS OF USING DIFFERENT TYPES OF TRIANGULATION

The study found that the different types of triangulation (p=0.000) respectively are mainly used to validate findings and explain findings. In the nutshell, triangulation is mainly used to validate and describe research findings. The reason of using the different types of triangulation to validate research findings is supported by Audrey (2013), who said that the

initial reason of using triangulation has been to provide a more exhaustive and balanced way of confirming and disconfirming research findings by comparing different research findings relating to the same problem. In agreement, Denzin (2009) said that the limited usage of triangulation is because of the continued outdated understanding of triangulation as a technique mainly for validating research findings when there are other usages as presented in figure 6.2 below.

Figure 6.2: Reasons of Using Different Types of Triangulation



Source: synthesised by the Author (2019)

The limited reasons of using different types of triangulation may also be attributed to IS academics' lack of deeper and wider understanding of the rationale of using different types of triangulation. This may partly be influenced by the strong positivist research approach in IS, which is mono-method and is therefore not open to different reasons of using triangulation. Moreover, there is no agreement on what triangulation is, the stages at which triangulation can be used in the research process and the purpose or reasons of using triangulation.

6.5 FREQUENCY OF USING THE DIFFERENT TYPES OF TRIANGULATION

The study found that the frequency of using the different types of triangulation among IS academics is low. The frequently used technique was data source (p=0.000), methodological (p=0.000), space (p=0.000) and time triangulation (p=0.000). The finding that some of the IS academics have never or rarely use the different types of triangulation may be partially attributed to lack of a culture of research innovation conducive to intradisciplinary and interdisciplinary triangulation. This is worsened by the problem of variability in the use of triangulation, and the dearth of thorough and detailed writings on the types of triangulation procedures in IS disciplines. IS academics who frequently use different types of triangulation may be doing so because of their understanding of the ability of the influence of triangulation in deepening and widening researchers' understanding of research problems. Sale, Lohfeld and Brazil (2002) stated that IS researchers use triangulation as it leads to multi-perspectives and interpretations that benefit research.

6.6 USABILITY OF THE DIFFERENT TYPES OF TRIANGULATION

The study found that methodological triangulation (p=0.000) and data source (p=0.000) were the most usable types of triangulation. The findings are attributed to finding that methodological and data source are the most used and well documented therefore providing information on how to use them in research.

The study found that all the types of triangulation are more applied in intradisciplinary than interdisciplinary settings. A considerable high number of academics engage in intradisciplinary triangulation because it is easy for them to work out research plans in their workplaces or disciplines because they understand the forces at work in their disciplines or universities and how to deal with them compared to when conducting research in other disciplines or universities they are not familiar with.

The high number of academics who do not use interdisciplinary triangulation may be attributed to the challenges of getting formal permission to use other disciplines or universities for research, administrative costs, facilities costs, and other internal and external challenges.

There is also lack of understanding of the different concepts of triangulation such as intradisciplinary and interdisciplinary triangulation; a lack of clarity at which stage the types of triangulation can be applied in research processes; and at which level intradisciplinary and interdisciplinary triangulation may be applied. In agreement, Archibald (2016) argues that the concepts of intradisciplinary and interdisciplinary triangulation have different meanings to different stakeholders and, as a result, there are disagreements on issues of expectations as to what the nature of the research relationship between stakeholders should be. There are also disagreements on the rights and responsibilities of researchers, making it difficult to use intradisciplinary and interdisciplinary triangulation. Besides, the IS academics' views suggest that the underutilisation of interdisciplinary triangulation is caused by a lack of explanation of why interdisciplinary triangulation is useful and how it can be carried out. In addition, the study found that interdisciplinary triangulation takes different forms, ranging from cross disciplinary where academics view one research problem from the viewpoint of another to multidisciplinary where academics from different disciplines work together each drawing on their disciplinary knowledge to transdisciplinary triangulation where academics generate a unity of intellectual frameworks going beyond disciplinary perspectives. Interdisciplinary triangulation also takes different forms ranging from offering broad insight and advice, to active participation in the research process (Archibald, 2016). Tremblay, Hevner and Berndt (2010) argued that the strong positivist paradigm in IS research makes it hard for IS academics to use intradisciplinary triangulation with researchers from different disciplines, especially those coming from a strong interpretivist paradigm.

The findings show that academics feel competent to use all the different types of triangulation. This may be caused by considerable available systematic studies of properties and phenomena and their relationships, making academics feel able to use the different types of triangulation, which is however not the same as having expertise to practically use the technique in a study.

The study found that academics with PhDs rated themselves higher than those with Masters degrees in knowledge, usability, and reasons of using, and not in the usage and frequency of using all seven types of triangulation.

This may be attributed to the finding that doctorate holders have knowledge as to what triangulation is, as well as skills regarding the understanding and application of triangulation acquired through their doctoral education. However, they do not frequently use the different types of triangulation because they are able to conduct credible research even without using different research approaches at the same time.

This may also be attributed to the finding that academics with doctorates are more knowledgeable and trained through their doctoral education and thus able to understand and easily the use triangulation. The study therefore indicates that having a doctorate gives academics the necessary expertise to use triangulation. This is supported by studies that argue that doctorates, unlike master's degrees, are based on extensive and original research, allowing doctorate holders to acquire rich experience in research triangulation (McGillivray, Potts, Gareth and Polly, 2002; Dinham and Scott, 2001). In addition, doctoral research enables academics to reason independently about research problems and deal with them in sophisticated ways, thereby making it easier for doctorate holders to use theoretical triangulation than is the case with master's degree holders, who have less research experience due the nature of their degrees (McGillivray et al., 2002).

Dinham and Scott (2001) mentioned that a doctorate is filled with intangible rewards including critical thinking, which is an intellectual and disciplined process of being able to skillfully conceptualise, apply, analyse, synthesise and/or evaluate information through reflection and reasoning, making it easier to understand and use triangulation, confirm this finding. Wisker (2005) adds that a doctorate empowers people with self-driven and self-

controlled thinking to reason at the highest level in an open-minded way, making it possible for doctorate holders to understand and employ triangulation.

Except for data source, time, space and methodological triangulation, academics said that they have problems in using other forms of triangulation. This is attributed to academics' lack of knowledge on the different types of triangulation as existing literature mainly focuses on methodological and data sources triangulation (McGillivray, Potts, Gareth and Polly, 2002). Archibald (2016), who argued that triangulation is not always practical because it is difficult to operationalise, supports this finding. Besides, there are issues of procedural challenges concerning how and when to use triangulation in a study, individual schedules and time constraints (Morgan, 2007).

It is therefore reasonable to conclude that the IS academics have challenges in using investigator, theoretical and analyst triangulation as seen for example, in the manner theoretical triangulation is loosely used in form of a conceptual framework. These findings may be caused by the academics' limited knowledge, expertise and time to use investigator, theoretical, analyst and time appropriately. In agreement, Bogdan and Biklen (2011) stated that since research knowledge is contained in the head of a researcher, while skills are what a researcher does in the research process, it is important for IS academics to have both knowledge and skills to efficiently use triangulation especially investigator, theoretical, analyst and time triangulation.

In addition, the limited usability of investigator, theoretical and analyst triangulation may be due to a lack of understanding of the types of triangulation. Some researchers argue that triangulation is not easy to use due to misunderstandings among researchers in the field of IS on its actual meaning (Mingers, 2003). Bogdan and Biklen (2011) argued that the limited use of triangulation in IS disciplines results from the challenges of practically integrating and making sense of the facets of triangulation in a research process (see also Babbie, 2009).

The findings also point to one issue: that IS academics experience practical challenges in using investigator, theoretical and analyst triangulation. Academics for example see investigator, theoretical, analyst and time triangulation as demanding in terms of knowledge, time and resources. These findings are supported by Denzin's (2009) study that argued that triangulation is a contentious phenomenon that confounds research design, therefore hindering the use of the technique in research.

It is therefore justifiable to deduce that academics lack knowledge and skills to effectively implement investigator, theoretical and analyst triangulation. This negatively affects academics' confidence that they can successfully use investigator, theoretical, analyst and time triangulation.

These findings are also attributed to the finding that investigator, theoretical, analyst and theoretical triangulation are the newest types of triangulation and not adequately scientifically documented as those that are the most used.

These findings highlight the issue of the need to make information available regarding the practical use of triangulation; in general, to academics through discipline research talks, seminars and workshops, rather than having academics depend on their personal ideas and experiences of the usage of triangulation, which may be deficient.

The next chapter presents the contribution of the study.

CHAPTER SEVEN

CONTRIBUTION OF THE STUDY TO THE BODY OF KNOWLEDGE AND IMPLICATION FOR PRACTICE

7.1 INTRODUCTION

The previous chapter presented the conclusions of the study. This chapter presents the contribution of the study to the body of knowledge in the discipline of IS. Scholars argue that research for the qualification of Doctor of Philosophy involves contributing to the body of knowledge (Marian, 2010; Wellin et al., 2005; Wisker, 2005). The University of KwaZulu-Natal's requirement for doctoral research is explained in the academic policy that defines doctoral degrees. The University of KwaZulu-Natal requires that doctoral research is an original, important and extensive contribution to the body knowledge, as ascertained by impartial specialists employing recognised current international benchmarks. Thus, the rationale of this chapter is to demonstrate that the interpretation and application of triangulation in Information Systems (IS) research has not been studied before. The chapter therefore highlights what makes this research an original contribution. To achieve this, the chapter presents the understanding and usage of triangulation in the IS discipline. The chapter proceeds to show the practical implications of this research by stating how this research fills gaps and addresses weaknesses in the existing research on data source, investigator, theoretical, methodological, analyst, space and time triangulation. The chapter deepens, expands and consolidates the interpretation and application of triangulation in IS research, thereby demonstrating the depth required for doctoral research and justifying this study as a rigorous piece of scholarly research.

The study was driven by gaps and weaknesses in the existing empirical literature on triangulation research in IS research, as well as by the limited interpretation and usage of triangulation. Therefore, the study makes a significant contribution by both adding to the body

knowledge and contributing to the discourse on triangulation research by providing evidence to confirm the conclusions reached in this study.

As mentioned above, this research is an original study which makes the following significant contributions to academia in the following ways.

It confirms and expands the concepts of triangulation, contradicts existing conceptual aspects of triangulation, combines concepts of triangulation to formulate conceptual frameworks on the interpretation and application of triangulation, respectively, and demonstrates that the composition reveals contemporary and useful applications in the field of IS research. Additionally, recommendations showing how triangulation can be applied in practice in IS research is presented.

7.2 CONCEPTUAL FRAMEWORKS

The assertions of Denzin, Jick and Patton's (1990) concepts of triangulation informed this study that there is currently no conceptual framework on triangulation. Denzin, Jick and Patton (1990) only identified three types of triangulation: data source, investigator and methodological triangulation. Cohen and Manion's (1997) understanding of triangulation was adopted from Denzin, Jick and Patton's (1990) understanding of triangulation but added investigator triangulation as another type of triangulation. Denzin, Jick and Patton (1990) and Cohen and Manion's (1997) concepts of triangulation, do not acknowledge theoretical, space and time triangulation as stand-alone types of triangulation. Thus, this study shows that triangulation is a technique of using different Data sources, Investigators, Theories, Methods, Analysts, Spaces, and Times (DITMAST) respectively in one study and then comparing the different results. The DITMAST triangulation conceptual framework is not only useful in informing studies to ensure that research plans are rich, robust and thorough, but can help studies to generate comprehensive findings on the interpretation of triangulation in IS research to include investigator, theoretical, methodological, analyst, space and time triangulation. Therefore, the synthesis of the findings with literature provides evidence of the

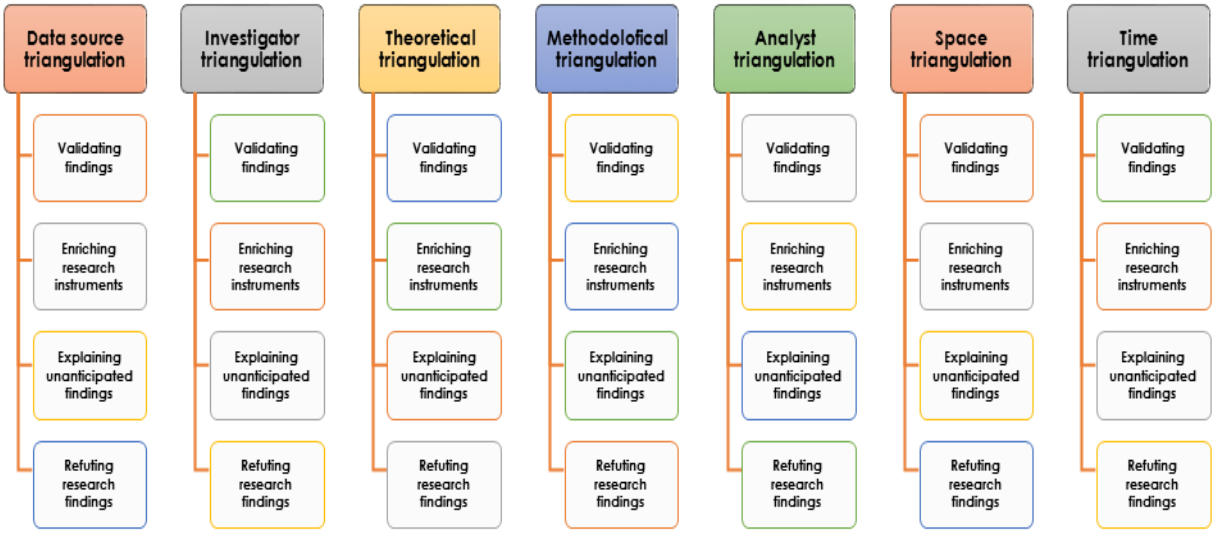
explanation of triangulation as data source, investigator, theoretical, methodological, analyst, space and time triangulation. In other words, the findings plausibly explain triangulation from a different and comprehensive perspective.

In addition, the study indicates that data source, investigator, theoretical, methodological, analyst, space, and time triangulation are used to Validate findings, Explain unforeseen findings, Enrich the research instruments, and Refute findings, known as the VEER triangulation conceptual framework. Thus, the study shows the dependability of the VEER triangulation conceptual framework in explaining the application of triangulation. This study demonstrates how each of the four applications of triangulation are measuring principles for the application of data source, investigator, theoretical, methodological, analyst, space and time triangulation by investigating the usage, reasons, frequency of use and usability of all seven types of triangulation.

Based on the findings of this study, it is logical to argue that by using the DITMAST and

VEER triangulation conceptual frameworks, IS researchers may be able to develop a 'map' to guide them in the interpretation and application of triangulation, especially as the conceptual frameworks are supported by empirical evidence and literature, synthesised by the researcher to explain the understanding and application of triangulation. The DITMAST and VEER triangulation conceptual frameworks map out logically connected variables to explain the interpretation and application of triangulation in IS research. Thus, the DITMAST and VEER triangulation conceptual frameworks identify the variables that need to be taken into account in a study and should be used to map research investigations on the understanding and application of triangulation. The study findings are persuasive that there is need to test the DITMAST and VEER triangulation conceptual frameworks to see if it can stand rigorous scrutiny by scholars by conducting further research on the interpretation and application of triangulation on large scale. Figure 7.1 is a diagrammatic presentation of the DITMAST and VEER triangulation conceptual frameworks combined followed by elucidatory findings on the same.

Figure 7.1: The DITMAST and VEER Triangulation Conceptual Frameworks

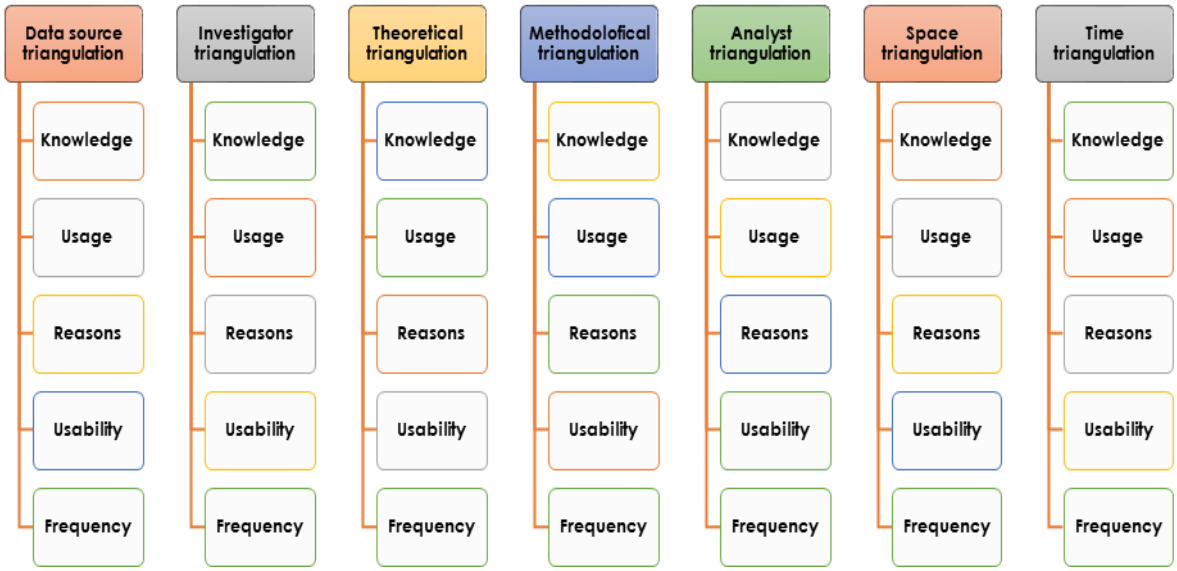


Source: synthesised by the Author (2017)

In addition, based on the approach used in this study and the outcome, the effective way of studying triangulation is to ascertain the knowledge levels, usage, reasons of use, usability and frequency of using seven types of triangulation. As another contribution to the body of knowledge, this study therefore, presents a comprehensive or multidimensional approach for studying triangulation. This was achieved by using a novel data presentation and analysis triangulation technique where data from the in-depth interviews and questionnaires were analysed at the same time to validate, explain, enrich and refute data through cross-verification. Analysing qualitative and quantitative data simultaneously helped to confirm and corroborate research findings. In others words, concurrent mixed methods of data analysis strategy used in this study allowed quantitative data presented to be corroborated using qualitative data. The analysis of embedded qualitative responses helped to augment and explain complex, agreeing and contradictory quantitative responses. This triangulated method of data analysis technique is complex and exhausting as it requires linking quantitative and qualitative data, however, the process was useful because it enhanced the interpretation and

application of triangulation in this study. This concurrent mixed method of data analysis strategy should be used as it enhances the understanding and application of triangulation.

Figure 7.2: The DITMAST and Methodological Conceptual Frameworks



Source: synthesised by the Author (2017)

7.3 INVESTIGATOR TRIANGULATION

The study found that thirty six per cent of the IS academics use investigator triangulation. This finding may be attributed to the finding that IS academics are not aware of the benefits of using the technique to increase the progress and improve the quality of the research work and grow the repertoire of the research associates. In support of the finding, Denzin (2012) said that research collaboration increases the breadth of academics' knowledge and learning of diverse methods to solve research problems. Only 29.0 per cent frequently use investigator triangulation and only 29.9 per cent frequently use intradisciplinary and 32.4 per cent frequently use interdisciplinary investigator triangulation. This finding may be linked to lack of knowledge in the interpretation and application of investigator triangulation. This finding may be also attributed to the difficult barriers to effective collaboration such as concerns about authorship of research findings, ownership of data and ideas. These are critical issues to be

dealt with as many academics research alliances have fallen apart because of poor communication concerning these issues. The study suggests that the discipline of IS by and large have neglected this valuable tool of investigator triangulation. This explains why majority (58.6 per cent) of IS academics reported that it was not easy to use investigator triangulation in spite of their strong feelings (62 per cent) that they can use investigator triangulation. There is need for academic policy makers and the academic leadership in the IS discipline to address this weakness and opportunity respectively as soon as possible in well-planned manner. Both intradisciplinary and interdisciplinary investigator collaboration must be promoted and brought to a state where they can influence and improve the quality, capabilities and resources of both academics, disciplines and institutions involved in research collaboration. There is therefore a need to promote an academic culture that promotes corporation and partnerships instead of individualism.

The study found that IS academics with doctorates interpret and use investigator triangulation better than those with masters degrees. The same trend was found with data source, theoretical, methodological, analyst, spaces, and time triangulation. The finding is attributed to the finding that a doctorate as the pinnacle of science and arts education, provides rigorous research training for academic and professional careers. Hence, IS academics with docotrates are subjected to rigorous reading and research that exposes them to all sorts of research techniques compared to those with masters degrees who specialise within a cetin field to gain new knowledge and skills not in labourious manner as for the doctorate. Thus, there is need to promote doctoral programmes for IS academics to be empowered with knowledge and skills that can help them to understand the interpretation and application of triangulation.

The study shows that investigator triangulation is mainly used to validate (90.2 per cent). However, there are other usages of investigator triangulation, such as refuting findings, enriching and explaining findings that are not adequately used by IS academics. There is thus a gap between academics' usage and reasons of using investigator triangulation. Youngs and Piggot-Irvine (2012) underscores this finding by stating that investigator triangulation is a method that should be used in research to enable investigators to examine the same research

problem with emphasis on the investigator's knowledge and skills when conducting research, so that results from different investigators are diligently compared to achieve rigour in the research process, and convincing research results. It is therefore coherent to conclude that investigator triangulation should be understood as a technique of using multiple investigators in the same study with diverse research training backgrounds to examine the same phenomenon. The finding of the study advances the notion that investigator triangulation in IS research should be seen as a research collaboration team made of up researchers within or outside the IS disciplines, in which investigators can study the same research problem as a group at the same time, working through the research stages individually and comparing research results. In other words, implementing investigator triangulation correctly is not only a matter of collaborating with other researchers within or outside the IS discipline, but also of correctly applying the tool to ensure that the findings from different investigators are compared to come up with a deeper and more comprehensive understanding of a phenomenon. If the findings generated by different investigators come to the same conclusion, this would increase confidence in the research results.

7.4 THEORETICAL TRIANGULATION

The study found that only 33.0 per cent of the IS academics use theoretical triangulation and the frequency of use is equally low (14.0 per cent). This finding is attributed to the limited understanding of theoretical triangulation. Thus, theoretical triangulation is not popular among IS academics. There is therefore a need in the IS discipline to share specialised theoretical techniques, expertise and reagents as they are part of the engine that accelerates academics' research projects, and bring about new theoretical ideas and theoretical scientific innovations. The findings show that theoretical triangulation is used to validate results (90.2 per cent) and explain research findings (31.4 per cent). Theoretical triangulation should also be used to refute findings and enrich research intruments as ascertained in this study. Thus, the low usage of theoretical triangulation seems to be signalled in IS academics' dissatisfactory reasons of using theoretical triangulation.

The study found that 41.2 per cent and 25.5 per cent of the IS academics use intradisciplinary and interdisciplinary theoretical triangulation respectively. These findings show that academics are more comfortable to use theories within and not outside their disciplines attributed to the comfort of working within their disciplines or comfort zones. Both intradisciplinary and interdisciplinary theoretical triangulation must be encouraged to empower IS academics and disciplines with knowledge on theoretical triangulation. This finding is in agreement with Denzin's (2009) argument that theoretical triangulation involves using theories and professional views within or outside the researcher's discipline or institution to bring different views to studies, resulting in a better understanding of research problems. Dellinger and Leech (2007) stated that, if theories or professional views used within or outside the discipline help to interpret data collected in a study in the same way, then confidence in the findings is heightened. The findings in this study are in agreement with

Denzin's (2012) concept of theoretical triangulation that different theories used in a study do not have to be similar or compatible; in fact, the more divergent they are, the more likely they are to identify different research issues. It is therefore, logical to conclude that theoretical triangulation should be understood as a research technique of using multiple theories, models, conceptual frameworks or professional views when studying the same research problem and then comparing research results in order to validate, explain and refute findings, and enrich research instruments.

7.5 METHODOLOGICAL TRIANGULATION

The study found that ninety six per cent of the IS academics use methodological triangulation making it one of the most used types of triangulation. This finding may be attributed to the finding that methodological triangulation is one of the oldest types of triangulation therefore adequately documented making it easy for people read and understand the technique (Denzin, 2012). The frequency of using methodological triangulation is low (14.0 per cent) and methodological triangulation is mainly used to enrich research instruments (94.1 per cent) and refute findings (23.5 per cent). Thus, the reasons of using methodological triangulation are limited, an indication that there is a gap between usage and correct usage of the technique.

Therefore, the application of methodological triangulation should include explaining findings and enriching research instruments as some of the purposes of using the technique.

Methodological triangulation can be 'within-method', or 'between-method' triangulation. This implies that methodological triangulation can be for example be at the level of using quantitiative data collection instruments on their own, or of using qualitative data collection instruments on their own respectively in the same study, and the results should be compared to ascertain whether the findings are similar. The findings show that 68.8 per cent of the IS academics have problems in using methodological triangulation but confident that they can learn (78.4 per cent) to effectively using methodological triangulation. IS academics' belief or show of confidence about using methodological triangulation was also reported in other six types of triangulation, and the finding should be used as an entry point to promote not only methodological triangulation but data source, investigator, theoretical, analyst, space and time triangulation. Confidence reflected by academics is an indication that they believe and feel that they can apply triangulation successfully if basic measures are put in place to help them do so. Quantitative methodology (82.4 per cent) is the most frequently used compared to qualitative research methodology (12.0 per cent). This is because the IS discipline is mainly informed by the quantitative research paradigm that collects, analyses and quantifies numerical data, which subscribes to a positivist worldview. Therefore, key to this finding is that in order to achieve methodological triangulation, results from different research methods should be compared and conclusions drawn from each in order to arrive at quality research results.

7.6 ANALYST TRIANGULATION

The study found that 77.9 per cent of the IS academics do not use analyst triangulation. This is attributed to the dearth of knowledge on how to use analyst triangulation, which is also reflected in the low frequency of the use of analyst triangulation (2.0 per cent). In addition, 96.1 per cent of the academics use analyst triangulation to validate findings and 21.6 per cent to explain findings. The usage of analyst triangulation is limited because the widely accepted understanding of analyst triangulation is that it is a method of using multiple analysts or analysis techniques on the same data set, be it primary or secondary data, in order to compare

results to enrich research instruments and refute findings, besides validating and explaining findings. The incomplete application of analyst triangulation is reinforced by the report that academics do not find it easy (56.8 per cent) to use analyst triangulation. The study found high levels of academics who never use analyst triangulation both within (49.0 per cent) and outside (52.9 per cent) their disciplines to achieve the intended purposes of using analyst triangulation. Both intradisciplinary and interdisciplinary triangulation should be promoted to enable academics draw from inside and outside their disciplines analysts to work with and create powerful research learning experiences which is another way of enhancing integrative research learning, critical research thinking, and creative research problem solving. In supporting the use of analyst triangulation, Torrance (2012) stated that analyst triangulation should enable researchers to employ multiple analysts or analysis practices within or outside their disciplines to assess the same data at different stages of data analysis to generate credible and valid research results.

7.7 SPACE TRIANGULATION

The study found that 61.0 per cent of the IS academics do use space triangulation. However, space triangulation is frequently used 'within' (56.9) and only 6.0 per cent frequently use the tool 'outside' academics' disciplines or universities. Thus, academics seem not to appreciate the benefits of corroborating findings through geodetic relationships or cross verification using different spaces within their workplaces to conduct the same study. The study found that academics find it easy to use space triangulation because they can unconsciously apply the technique to explain fully, the richness and intricacy of a phenomenon by investigating it from more than one place or culture and comparing the results. However, interdisciplinary space triangulation should be encouraged to make use of the benefits of combining creative and integrative methods from different spaces, culture and disciplines to study research problems.

The study found that space triangulation is mainly used to validate research findings (96.1 per cent) and explain findings (21.6 per cent). Therefore, IS academics' use of space triangulation is partial despite reporting high levels of the usage of space triangulation. This suggests that

space triangulation is inadequately used for other reasons such as to enrich research instruments and refute research results, which assist in heightening the credibility of the research findings. Therefore, there is a gap between the usage of space triangulation and the correct application of the tool in research practice. The study found that, for space triangulation to be effective, external environmental factors and the dispositions of researchers and participants should be taken into account, as they can negatively or positively influence research findings. Moreover, merely conducting a study using different places or settings as reported by IS academics does not constitute space triangulation, unless the research results generated from different locations or settings are compared. This finding is in agreement with Fielding (2012) who argued that when space factors are changed to determine if the results are similar under varying spaces or conditions, then the findings are sound.

There is need to promote the usage and correct application of space triangulation to have research results from different contexts compared to help academics to reach deeper understanding of research problems.

7.8 TIME TRIANGULATION

Thirty-three per cent of IS academics use time triangulation. Time triangulation is mainly used to validate research results (90.2 per cent) and explain research results (31.4 per cent), whereas the technique can also be used to enrich research instruments and refute research results (Leedy and Ormond, 2005). This limited application practice gap in time triangulation needs to be addressed. Time triangulation should be understood as a technique for conducting the same research at different occasions, and, if findings are reported to be the same, then the findings are reliable. The study also found that time triangulation is mainly used in academics' workplaces (41.2 per cent) than outside their workplaces (17.0 per cent). Both interdisciplinary and interdisciplinary space triangulation must be promoted to allow academics to draw data at different times to gain a broad understanding of research problems and generate novel views on existing research problems.

7.9 DATA SOURCE TRIANGULATION

Seventy-six (76.0 per cent) of IS academics use data source triangulation, and (60.0 per cent) use data source triangulation mainly to validate research findings (96.1 per cent), explain results (37.3 per cent) and refute findings (31.4). Therefore, there is a satisfactory level of application of data source triangulation. However, data source triangulation should also be used to enrich research instruments to obtain diverse views of the phenomenon under study. In other words, the ability of data source triangulation to enrich research instruments is one reason data source triangulation should be employed by IS academics in their research practice. The small gap between the level of usage and the correct practical application of data source triangulation needs to be bridged. The small gap may be attributed to IS academics' knowledge of data source triangulation available in journal articles, books, theses, dissertations, and other sources. Thus, data source triangulation seem to be popular among IS academics. Denzin (2012) argues that data source triangulation is popular because it is one of the old types of triangulation, as result well documented. Torrance (2012) said that data source triangulation is the most used because it provides deeper insight into research problems and minimises shortfalls found in one-source of data.

The study found that 41.2 per cent and 25.5 per cent of the IS academics use more sources 'within' than 'outside' their disciplines respectively. Thus, academics are more poised in using data sources in their disciplines. This may be attributed to the contentment of working within familiar contexts. Maxwell (2012) states that the application of data source triangulation is incomplete if researchers only use primary and secondary sources within their disciplines. Both intradisciplinary and interdisciplinary data source triangulation should be promoted to strengthen academics and their disciplines to conduct studies with increased credibility.

7.10 IMPLICATIONS FOR PRACTICE

- The most frequently used type of triangulation are methodological (p=0.00) and data source (p=0.00); the most used type of triangulation is data triangulation (p=0.001) and

methodological triangulation (p=0.001); theoretical (p=0.00), methodological (p=0.00), investigator (p=0.00), data source (p=0.00), space (p=0.00), analysis (p=0.00) and time triangulation (p=0.00) are used to validate and explain findings; and the most usable types of triangulation are methodological (p=0.00), data source (p=0.00), space (p=0.00) and time triangulation (p=0.00). The findings imply that the IS discipline should promote the understanding of the different types of triangulation, use of triangulation, reasons of using triangulation, usability of triangulation, and frequency of the application triangulation through disseminating factual information. This can be done through workshops and seminars that are effective in promoting research capacity development and creating supportive and enabling research environments. This may result in a greater ability to understand and use triangulation to undertake high quality research.

- The underutilisation of investigator, space, time, theoretical and analyst triangulation shows that there is a need to invest in triangulation research through research capacity building activities in the IS discipline, specifically targeting students and academics. This would make it easy to reap the lasting benefits of triangulation.

- There is a need at IS discipline level to build a methodology research base to ensure the development of appropriate capabilities in rapidly developing fields, such as research collaboration, theories, methods, data analysis and others such as:

- Appropriate research capabilities across the full spectrum of methodology research should be developed, while focusing on areas with limited capacity such as triangulation.

- Facilitation of greater involvement in triangulation research by academics from different IS disciplines should be prioritised. There is thus a need to create networks of research collaboration. Interdisciplinary, cross disciplinary, multidisciplinary and transdisciplinary triangulation constructions should be promoted to allow IS academics to work within and across disciplines and institutions. These interactions can create different expectations and bring many research benefits, including higher impact publications, more creativity, less

work, criticism, efficient learning, a wider array of research techniques, deeper research, increased funding, increased number of publications, knowledge of what others are doing, flexibility and many other benefits.

- There is a need to develop a strong human resource base for triangulation research at the national level in South African universities. This can be done through individual training, career development, discipline-related programmes and establishing academic or scholarly journals, which focus on developing initiatives on triangulation.

- There is also a need to encourage research capacity-building that includes encouraging IS academics to read for their Doctor of Philosophy (PhD) degrees as this would increase their capacity to conduct research independently, using different research methods, including data source, investigator, theoretical, methodological, analyst, space and time triangulation. There is a particular need for academics to study research methodology; research methods, paradigmatic assumptions and design, as this would enable academics to make a well-defined contribution to the body of knowledge of triangulation and accumulate evidence of originality and coherence in support of excellent, independent and critical research in IS study areas.

- In addition, capabilities to promote triangulation within a specific range, through curriculum development, are also needed to create a well-planned, purposeful, progressive and systematic process of teaching triangulation as a way of bringing about positive improvements in IS teaching, learning and research systems. There have been several developments in the area of triangulation research affecting university education and research methodology curricula. Therefore, there is a need to update existing research methodology curricula to include a strong component of triangulation to address the needs of the discipline, institutions and society.

The findings show that most of the academics first heard of all the seven types of triangulation from readings. There is need to start a traditional peer review model academic journal "Triangulation of Research Methods Journal" to be run by consensus of respected individuals in the field of IS.

- There is a need to promote correct knowledge of triangulation; information, ideas, concepts and principles of data source, investigator, theoretical, methodological, analyst, space and time triangulation and to encourage IS academics to use this knowledge correctly in employing different triangulation techniques in their studies so as to get practical exposure to triangulation.

This can be achieved by having well-defined and agreed-on meanings and clear stages in which data source, investigator, theoretical, methodological, analyst, space and time triangulation can be employed in the research process to enable a smooth execution of triangulation and increase quality of IS research. There is a need to promote the correct usage of data source, investigator, theoretical, methodological, analyst, space, and time triangulation, without limiting triangulation to a few uses, such as validating findings. The usage of triangulation should include enriching research instruments by adding value to generate findings on different aspects of research problems, refuting findings and explaining unanticipated research findings in a deeper and wider manner. This will help to effectively outline the richness and complexity of some research problems by investigating them from different standpoints.

In addition, there is a need for agreements to formalise the application of triangulation in IS research. This will help to avoid or reduce challenges, misunderstandings and disputes related to the interpretation and application of triangulation.

Academic policy makers and the academic leadership in IS discipline should address the weakness of the understanding and application of triangulation as soon as possible in well-

planned manner. Triangulation must be brought to a state where it can influence and improve the quality, resources and capabilities of both academics, disciplines and institutions involved. This can be easy to achieve if the IS discipline promotes an academic culture that promotes triangulation instead of individualism in research approaches.

7.13 RECOMMENDATIONS FOR FURTHER RESEARCH

- Based on this research project, future researchers could design a series of focused studies at the national, university and discipline levels in South Africa to verify and expand the interpretation and application of triangulation. This may allow the collection of more accurate and university/discipline specific information.

- There is also a need to conduct a comparative study of all the universities to ascertain if there are differences in the understanding and application of triangulation from different institutional sites.

- Using the same methodological approach, another study could be conducted with non-IS disciplines, whereby findings from non-IS disciplines can be compared to those from IS disciplines to ascertain how findings from varying disciplines can mutually benefit from each other. In particular, the study should use the DITMAST and VEER conceptual frameworks and study among other things the usage, reasons of use, usability and frequency of the use of triangulation.

- There is a need to conduct studies to evaluate how triangulation is covered in research methodology courses by assessing the course design frameworks (curricula); considering which triangulation aspects are covered, what resources on triangulation are available to lecturers and students, what learning goals are set for students and whether students achieve the objectives for the modules.

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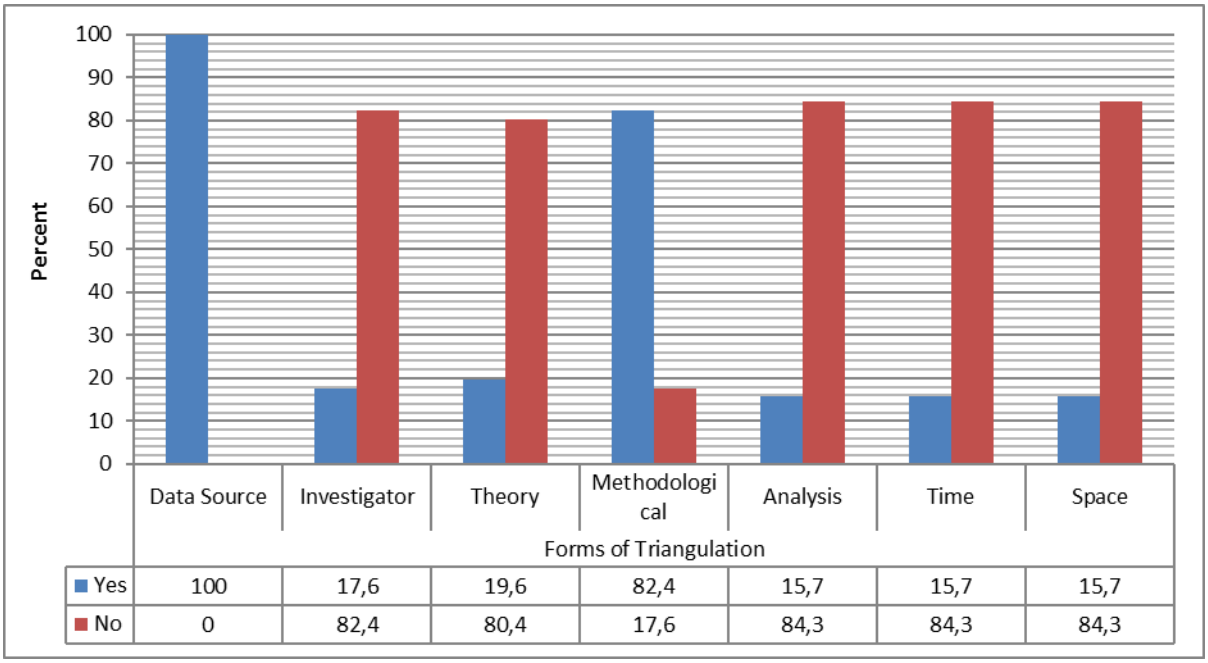
APPENDIX I

TABLES

Figure 10: Knowledge of Different Types of Triangulation



	Data Source	Investigator	Theory	Methodological	Analysis	Time	Space
Yes	100	17,6	19,6	82,4	15,7	15,7	15,7
No	0	82,4	80,4	17,6	84,3	84,3	84,3

Figure 11: Understanding of Triangulation by Qualification

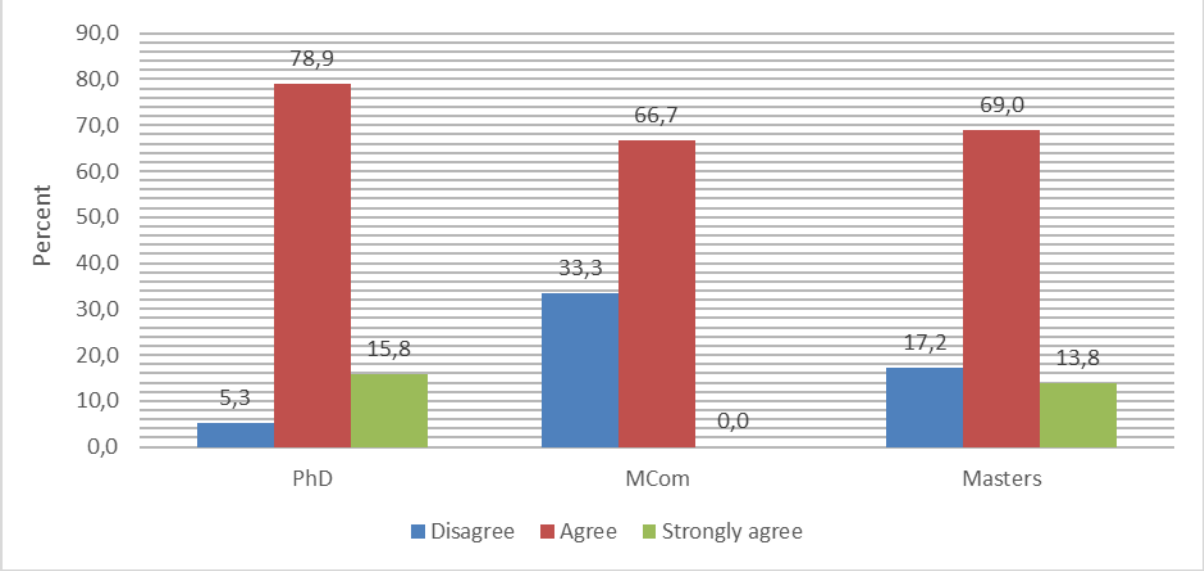


Table 7: Frequency of using Methodological Triangulation

	Never		Rarely		Occasionally		Frequently		Very Frequently		Chi Square
	n	%	n	%	n	%	n	%	n	%	p-value
How often do you use different	4	7.8	8	15.7	31	60.8	7	13.7	1	2.0	0.000

methods in a study?											
How often do you use qualitative method alone in a study?	6	11.8	15	29.4	24	47.1	4	7.8	2	3.9	0.000
How often do you use quantitative method alone in a study?	0	0.0	5	9.8	4	7.8	26	51.0	16	31.4	0.000

Table 8: Usability of Methodological Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value
It is easy to use different methods in a study	2	3.9	27	52.9	3	5.9	15	29.4	4	7.8	0.000
There are problems in using different methods in one study	0	0.0	4	7.8	2	3.9	31	60.8	14	27.5	0.000
I am not very confident in using different methods in one study	12	23.5	28	54.9	10	19.6	1	2.0	0	0.0	0.000

:

Table 10 Frequency of using Investigator Triangulation

	Never		**Rarely**		**Occasionally**		**Frequently**		**Very Frequently**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value
How often do you collaborate with different researchers in a study?	2	3.9	4	7.8	28	54.9	15	29.4	2	3.9	0.000
How often do you collaborate with researchers within your discipline in a study?	2	3.9	3	5.9	24	47.1	16	31.4	6	11.8	0.000
How often do you collaborate with different researchers from other disciplines in a study?	6	11.8	19	37.3	19	37.3	4	7.8	3	5.9	0.000

Table 11: Usability of Investigator Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value

:

It is easy to collaborate with different researchers in a study	9	17.6	20	39.2	4	7.8	13	25.5	5	9.8	0.002
There are problems in collaborating with different researchers in a study	0	0.0	6	11.8	4	7.8	22	43.1	19	37.3	0.000
I am not very confident in collaborating with different researchers in a study	14	27.5	18	35.3	10	19.6	7	13.7	2	3.9	0.005

:

Figure 15: Reasons for using Data Source Triangulation

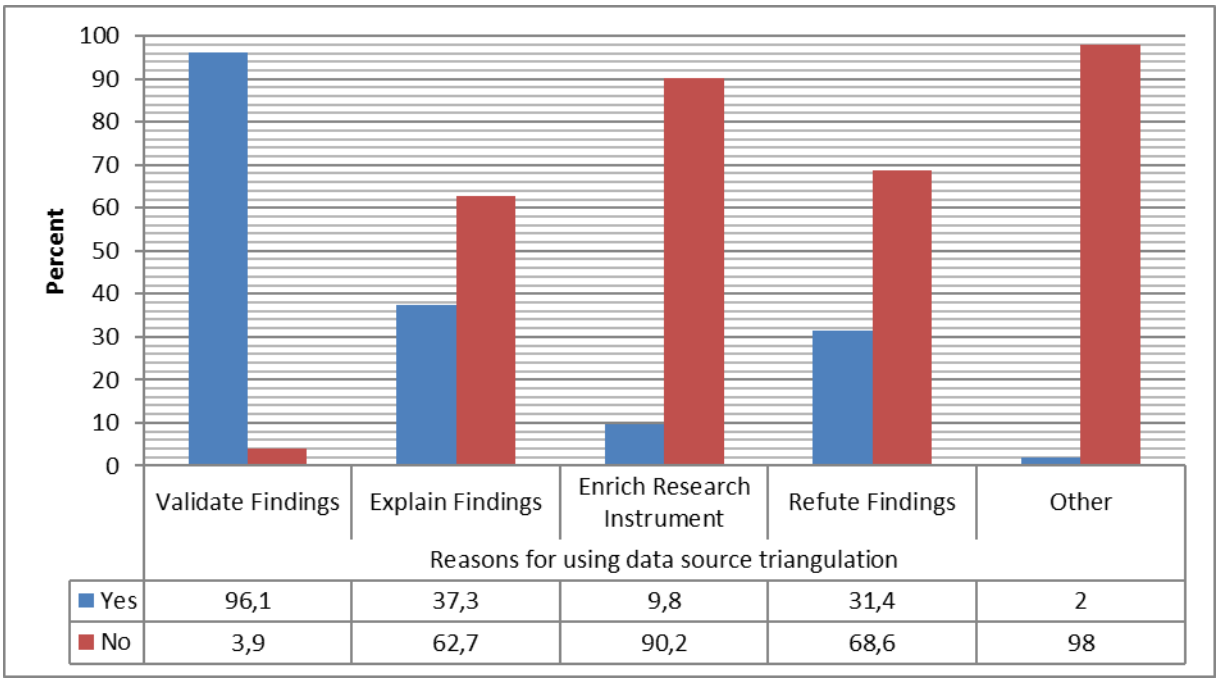


Table 14 Usability of data Source Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value
It is easy to use different data sources in a study	6	11.8	11	21.6	0	0.0	25	49.0	9	17.6	0.001
There are problems in using different data sources in a study	4	7.8	19	37.3	0	0.0	16	31.4	12	23.5	0.019

:

I am not very confident in using different data sources in a study	16	31.4	30	58.8	2	3.9	3	5.9	0	0.0	0.000

Table 15: Usage of Analysis Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	N	%	n	%	n	%	p-value
I use different analysts in the same study	11	21.6	27	52.9	6	11.8	7	13.7	0	0.0	0.000
I use different analysts outside my discipline in a study	9	17.6	29	56.9	10	19.6	3	5.9	0	0.0	0.000
I use different analysts within my discipline in a study	2	3.9	36	70.6	8	15.7	5	9.8	0	0.0	0.000

:

Table 16: Reasons for using Analysis Triangulation

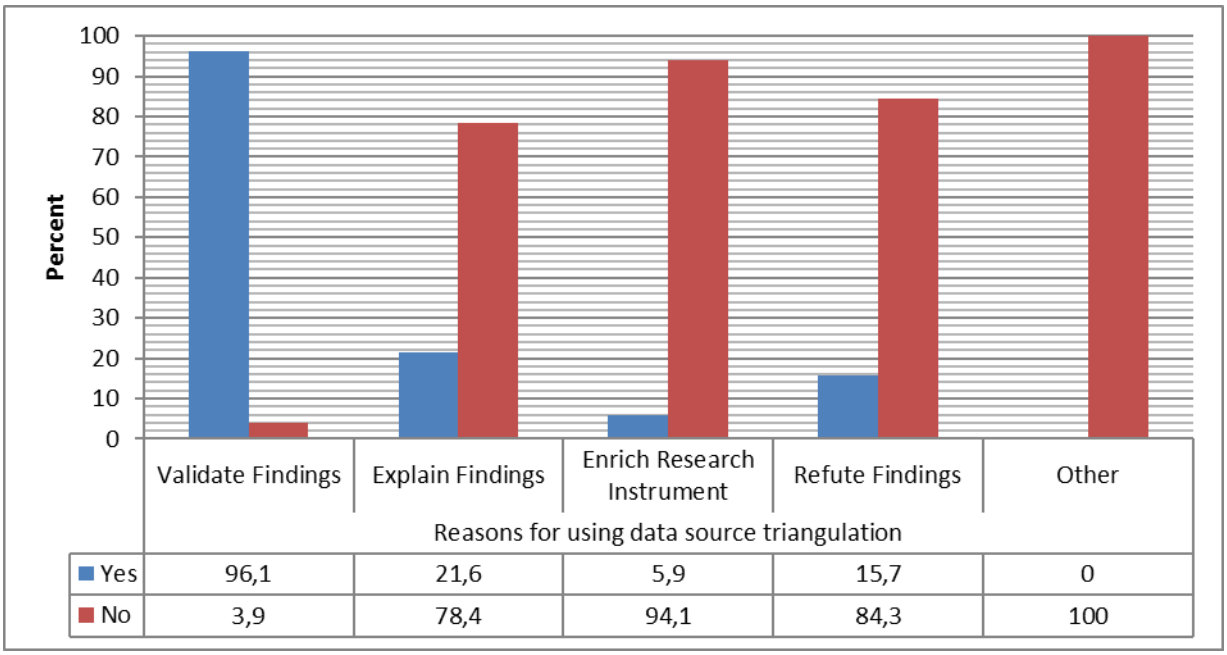


Table 18 Usage of Space Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	N	%	N	%	n	%	n	%	p-value
I use different spaces when conducting a study	**1**	**2.0**	**14**	**27.5**	**5**	**9.8**	**20**	**39.2**	**11**	**21.6**	**0.000**
I use different spaces within my disciplines when conducting a study	1	2.0	1	2.0	3	5.9	30	58.8	16	31.4	0.000

:

I use different spaces outside my discipline when conducting a study	10	19.6	16	31.4	8	15.7	11	21.6	6	11.8	0.234
I take into account different cultures when conducting research	0	0.0	0	0.0	3	5.9	28	54.9	20	39.2	0.000

Table 19: Frequency of using Space Triangulation

	Never		**Rarely**		**Occasionally**		**Frequently**		**Very Frequently**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value
How often do you use different spaces in a study?	0	0.0	16	31.4	23	45.1	10	19.6	2	3.9	0.000
How often do you use different spaces within your workplace when conducting a study	1	2.0	2	3.9	7	13.7	29	56.9	12	23.5	0.000
How often do you use difference spaces from outside your workplace when conducting a study	3	5.9	30	58.8	15	29.4	3	5.9	0	0.0	0.000

:

Table 21: Usage of Time Triangulation

	Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Chi Square
	n	%	n	%	N	%	n	%	n	%	p-value
I use different times to conduct the same study	2	3.9	23	45.1	5	9.8	17	33.3	4	7.8	0.000
I use different times to ask the same research questions in the study	13	25.5	21	41.2	3	5.9	10	19.6	4	7.8	0.000
I conduct research at the beginning of the year	1	2.0	5	9.8	3	5.9	26	51.0	16	31.4	0.000
I conduct research at the end of the year	1	2.0	3	5.9	3	5.9	33	64.7	11	21.6	0.000

Table 22: Frequency of using Time Triangulation

	Never		Rarely		Occasionally		Frequently		Very Frequently		Chi Square
	n	%	n	%	n	%	n	%	n	%	p-value
How often do you use different	0	0.0	16	31.4	23	45.1	10	19.6	2	3.9	0.000

times in a study?											
How often do you use different times within your workplace when conducting a study	1	2.0	2	3.9	7	13.7	29	56.9	12	23.5	0.000
How often do you use difference times from outside your workplace when conducting a study	3	5.9	30	58.8	15	29.4	3	5.9	0	0.0	0.000

Table 24: Usability of Time Triangulation

	Strongly disagree		**Disagree**		**Neutral**		**Agree**		**Strongly agree**		**Chi Square**
	n	%	n	%	n	%	n	%	n	%	p-value
It is easy to use different times in a study	7	13.7%	22	43.1%	4	7.8%	11	21.6%	7	13.7%	0.001
There are problems in using different times in a study	0	0.0%	2	3.9%	2	3.9%	28	54.9%	19	37.3%	0.000
I am not very confident in using different times in a study	14	27.5%	26	51.0%	9	17.6%	2	3.9%	0	0.0%	0.000

APPENDIX 2

INFORMED CONSENT LETTER

Informed Consent Letter 3C

UNIVERSITY OF KWAZULU-NATAL

GRADUATE SCHOOL OF BUSINESS AND LEADERSHIP

Dear Respondent,

DBA/PHD Research Project

Researcher: Given Mutinta

Supervisor: Prof Brian McArthur

Supervisor: Prof Irene Govender

Research Office: Ms P Ximba 031-2603587

I am Given Chigaya Mutinta, a Doctoral student, at the School of Management, Information Technology and Governance, of the University of KwaZulu-Natal. You are invited to participate in a research project entitled ***The Interpretation and Application of Triangulation Research in Information Systems Research***. The proposed study explores how the academics understand and use triangulation in research.

Through your participation, I hope to understand how the academics understand and apply triangulation. The results of the study in intend to contribute to the knowledge and utilisation of the triangulation.

Your participation in this project is voluntary. You may refuse to participate or withdraw from the project at any time with no negative consequences. There will be no monetary gain achieved from participating in this survey/focus group. Confidentiality and anonymity of records

identifying you as a participant is assured and records will be lodged with the School of Management, Information Technology and Governance, University of KwaZulu-Natal.

If you have any questions or concerns about completing the questionnaire or about participating in this study, you may contact me or my supervisor at the numbers listed above. The questionnaire should take you about 16 minutes to complete. I hope you will take the time to complete this survey.

Sincerely

Researcher's signature_____

Date_____

UNIVERSITY OF KWAZULU-NATAL

SCHOOL OF MANAGEMENT, INFORMATION TECHNOLOGY AND GOVERNANCE

PHD Research Project

Researcher: Given Mutinta

Supervisor: Prof Brian McArthur

Supervisor: Prof Irene Govender

CONSENT

I hereby confirm that I understand the contents of this document and the nature of the research project and I hereby consent to participation in the research project.

I understand that I am at liberty to withdraw from the project at any time, should I so desire.

Do you agree?

Y

DATE

APPENDIX 3

GATEKEEPERS' LETTERS

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

11 February 2015

Dr Given Mutinta
School of Management, Information, Tech & Gov
College of Law and Management Studies
Westville Campus
UKZN
Email: Mutinta@ukzn.ac.za

Dear Dr Mutinta

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN) towards your postgraduate studies, provided Ethical clearance has been obtained. We note the title of your research project is:

"The interpretation and application of triangulation in information systems research".

It is noted that you will be constituting your sample by conducting interviews with academic staff from the College of Law and Management Studies on all campuses.

Data collected must be treated with due confidentiality and anonymity.

You are not authorized to contact staff and students using 'Microsoft Outlook' address book.

Yours sincerely

[redacted]

MR B POO
REGISTRAR (ACTING)

UNIVERSITEIT • STELLENBOSCH • UNIVERSITY
jou kennisvennoot • your knowledge partner

26 February 2015

Dr Given Mutinta
School of Management, Information Technology and Governance
University of KwaZulu-Natal

Dear Dr Mutinta

Concerning research project: ***The Interpretation and Application of Triangulation in the Disciplines of Information Systems at Four Universities in South Africa***

The researcher has institutional permission to proceed with this project as stipulated in the institutional permission application. The researcher has permission to solicit the participation of Stellenbosch University (SU) academic staff in this study. This permission is granted on the following conditions:

- The researcher must obtain ethical clearance from the UKZN Research Ethics Committee before data collection can commence. Proof of ethical clearance must be forwarded to the Division for Institutional Research and Planning, Stellenbosch University (SU).
- The researcher must obtain permission from the Head of the Department of Information Science, SU, before commencing with data collection at SU.
- Participation is voluntary.
- Persons may not be coerced into participation.
- Persons who choose to participate must be informed of the purpose of the research, all the aspects of their participation, their role in the research and their rights as participants. Participants must consent to participation. The researcher may not proceed until he is confident that all the before mentioned has been established and recorded.
- Persons who choose not to participate may not be penalized as a result of non-participation.
- Participants may withdraw their participation at any time, and without consequence.
- Data must be collected in a way that ensures the anonymity of all participants.
- The data must be responsibly and suitably protected.
- The use of the collected data may not be extended beyond the purpose of this study.
- Individuals may not be identified in the report(s) or publication(s) of the results of the study.
- The privacy of individuals must be respected and protected.
- The researcher must conduct his research within the provisions of the Protection of Personal Information Act, 2013.

Best wishes,

[redacted]

Prof Ian Cloete
Senior Director: Institutional Research and Planning

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& BUSINESS SCIENCES

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University of the Witwatersrand, Johannesburg

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Private Bag X3, Wits, 2050, South Africa
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29 July 2015

Dr Given Mutinta
University of KwaZulu-Natal

Dear Given

Permission to Conduct Research

This letter serves to confirm that the Division of Information Systems in the School of Economic & Business Sciences at the University of the Witwatersrand gives its permission to conduct your research into the interpretation and application of triangulation in Information Systems research with all staff that give their consent.

The Division also notes that the University Registrar has provided gatekeeper permission for the research to be conducted.

Should you require any further information, I can be reached at the contact details listed above.

Yours sincerely

[redacted]

Mitchell Hughes
Head of Division
Division of Information Systems

CENTRE FOR HIGHER EDUCATION DEVELOPMENT
UNIVERSITY OF CAPE TOWN

PD Hahn Building, North Lane, Upper Campus
Postal Address: Private Bag Rondebosch 7701
Telephone: (021) 650-5027
Fax No.: 650-5045

27 March 2015

Dr Given Mutinta
School of Management, Information Technology and Governance
University of Kwazulu-Natal

Dear Dr Mutinta

Re: Study on the Interpretation and Application of Triangulation in Information Systems Research

The Research Ethics Committee of the Centre for Higher Education Development has reviewed the documentation you submitted to it in respect of the above proposed national comparative research study.

I am very pleased to confirm that the REC has approved the research to proceed at the University of Cape Town on the terms specified in your submissions to the Committee. Should the research focus and process change in any substantive way, you are requested to make a new submission to the Committee.

We wish you all the best with the work.

Yours sincerely

[redacted]

Alan Cliff

Dr Alan Cliff
Chair, CHED REC
(on behalf of the Committee)

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

OFFICE OF THE REGISTRAR

TO WHOM IT MAY CONCERN

"The interpretation and application of triangulation in information systems research"

It is hereby confirmed that the enclosed research material has been distributed in accordance with the University's approval procedures for such a project. Please be advised that it is your right to withdraw from participating in the process if you find the contents intrusive, too time-consuming, or inappropriate. The necessary ethical clearance has been obtained.

Should the University's internal mailing system be the mechanism whereby this questionnaire has been distributed, this notice serves as proof that permission to use it has been granted.

Students conducting surveys must seek permission in advance from Heads of Schools or individual academics concerned should surveys be conducted during teaching time.
Kindly contact Mitchell Hughes, Head of Division-Information Systems, School of Economic and Business Sciences on email Mitchell.Hughes@wits.ac.za

[redacted]

Carol Crosley
University Registrar
20th July 2015

Private Bag 3, WITS 2050, South Africa | **T:** +27 11 717 1201/2 | **F:** +27 11 717 1217 | **E:** registrar@wits.ac.za

APPENDIX 4

ETHICAL CLEARANCE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

23 April 2015

Dr Given Mutinta (209502317)
School of Management, IT & Governance
Westville Campus

Dear Dr Mutinta,

Protocol reference number: HSS/0362/015D
Project title: The Interpretation and Application of Triangulation in Information Systems Research

Provisional Approval - Expedited

I wish to inform you that your application received on 16 April 2015 in connection with the above has been granted provisional approval, subject to:

1. **Gatekeeper permission letter(s) being obtained**

Kindly submit your response to Dr Shenuka Singh (Chair), as soon as possible.

This approval is granted provisionally and the final approval for this project will be given once the above condition has been met. Research may not begin until full approval has been obtained from the HSSREC.

Yours faithfully

[redacted]

Dr S Singh (Chair)

/ms

Cc Supervisor: Dr Irene Govender and Professor Brian McArthur
cc Academic Leader Research: Professor Brian McArthur
cc School Administrator: Ms Angela Pearce

Humanities & Social Sciences Research Ethics Committee
Dr Shenuka Singh (Chair)
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban 4000
Telephone: +27 (0) 31 260 3587/8350/4557 **Facsimile:** +27 (0) 31 260 4609 **Email:** ximbap@ukzn.ac.za / snymanm@ukzn.ac.za / mohunp@ukzn.ac.za
Website: www.ukzn.ac.za

APPENDIX 5

LETTER FROM THE EDITOR

7 Woodlands Rd
GLENWOOD
DURBAN
4001
083 415 2531

27 January 2017

Reg. No. 2006/156780/23

Given Mutinta

EDITING OF PHD THESIS OF GIVEN MUTINTA

I have an MA in English from University of Natal (now UKZN) and have been performing editing services through my company for eleven years. My company regularly edits the research dissertations, articles and theses of the School of Nursing, Environmental Studies and various other schools and disciplines at the University of KwaZulu-Natal and other institutions, as well as editing for publishing firms and private individuals on contract.

I *hereby confirm that Shirley Moon edited the thesis of* ***Given Mutinta*** *which aimed to "THE INTERPRETATION AND APPLICATION OF TRIANGULATION IN INFORMATION SYSTEMS RESEARCH"* on behalf of WordWeavers cc and commented on the anomalies she was unable to rectify in the MS Word Track Changes and review mode by insertion of comment balloons prior to returning the document to the author. Corrections were made in respect of grammar, punctuation, spelling, syntax, tense and language usage as well as to sense and flow. Additional guidelines and comments were provided to assist with corrections. It must be noted that the pages relating to cover, abstract, acknowledgements, dedication and declaration were not edited, nor were the Reference section and the Appendices at the student's request.

I trust that the document will prove acceptable in terms of editing criteria.

Yours faithfully

C Eberle
Catherine P. Eberle (MA: University of Natal)

APPENDIX 6

QUESTIONNAIRE

RESEARCH TOPIC

THE INTEPRETATION AND APPLICATION OF TRIANGULATION IN THE INFORMATION SYSTEMS RESEARCH

	SECTION 1: BIOGRAPHICAL DATA					
1.1	**Name of your university**					
1.2	**Name of your discipline**					
1.3	**Your gender**				Male	Female
1.4	**Your race**	Black	Coloured	Indian	White	Other (specify): _____
1.5	**Your age**	under 26	26-35	36-45	46-55	56+
1.6	**Your position**	Part-time lecturer	Lecturer	Senior Lecturer	Researcher	Other academic (specify): _____
1.7	**Status of your post**	Permanent			Temporal	
1.8	**What is your highest academic qualification held?**					
	SECTION 2: KNOWLEDGE OF TRIANGULATION					
2.1	**Have you heard about triangulation in research?**				Yes	
2.2	**If yes, from whom?**	Colleagues	Seminar	Conference	Supervisor	Readings	Oth _____

2.3	**I understand what triangulation is**		Strongly disagree		Disagree	Neutral	Agree	Stro
2.4	**I understand the different types of triangulation**		Strongly disagree		Disagree	Neutral	Agree	Stro
2.5	**I understand the different types of triangulation**		Strongly disagree		Disagree	Neutral	Agree	Stro
2.6	**Tick all the forms of triangulation you use**	2.6.1 Data	2.6.2 Investigat	2.6.3 Theory	2.6.4 Methodological	2.6.5 Analysis	2.6.6 Space triangulation	Time
	in your research	source triangulation	or triangulation	triangulation	triangulation	triangulation		
2.7	**Tick all the reasons why you use triangulation in your research**	2.7.1 To validate findings	2.7.2 To explain findings	2.7.3 To enrich findings	2.7.3 To refute findings	2.7.4 Other (Specify) _____		
	SECTION 3: THEORETICAL TRIANGULATION **3.1 Usage**							
3.1.1	**I use different theories in the same study**		Strongly disagree		Disagree	Neutral	Agree	Stron
3.1.2	**I use different academic professional views in my research**		Strongly disagree		Disagree	Neutral	Agree	Stron

3.1.3	**I use different academic professional views outside my discipline in my research**		Strongly disagree	Disagree	Neutral	Agree	Stron
3.1.4	**What was the context the last time you used different theories in one study? (select ONE option only)**	Non-degree purposes research project	Doctoral research project	Masters research project		Diplomat research project	(s ———
3.1.5	**How do you use theoretical triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings	3.1.5.4 To refute findings	3.1.5.5 To validate findings	3. (s ———
3.1.6	**How do you rate your competence in using different theories in one study?**			Poor	Fair	Good	Very good
3.2 Frequency of use							
3.2.1	**How often do you use theories in a study?**		Never	Rarely	Occasionally	Frequently	Very
3.2.2	**How often do you use different theories in one study?**		Never	Rarely	Occasionally	Frequently	Very
3.2.3	**How often do you use theories to get a different perspective in a study?**		Never	Rarely	Occasionally	Frequently	Very

3.2.4	**How often do you use theories from other disciplines to get a different perspective in a study?**		Never	Rarely	Occasionally	Frequently	Very
3.2.5	**How often do you use more than two theories in one study?**		Never	Rarely	Occasionally	Frequently	Very
3.2.6	**When last did you use more than two theories in a study?**	This year	A year ago	Two years ago	Three years ago		More ye
3.3 Usability of theory triangulation							
3.3.1	**It is easy to use different theories in a study**		Strongly disagree	Disagree	Neutral	Agree	Stron
3.3.2	**I would need the support of an expert researcher to use different theories in a study**		Strongly disagree	Disagree	Neutral	Agree	Stron
3.3.3	**Using different theories in a study works well for me**		Strongly disagree	Disagree	Neutral	Agree	Stron
3.34	**There are problems in using different theories in a study**		Strongly disagree	Disagree	Neutral	Agree	Stron
3.3.6	**I find using different theories in a study cumbersome**		Strongly disagree	Disagree	Neutral	Agree	Stron
3.3.7	**I am not very confident in using different theories in a study**		Strongly disagree	Disagree	Neutral	Agree	Stron
3.3.8	**I needed to learn a lot about theories before I could start using different theories in a study**		Strongly disagree	Disagree	Neutral	Agree	Stron

	SECTION 4: METHODOLOGICAL TRIANGULATION

	4.1 Usage					
4.1.1	**I use different research methods when conducting research**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.1.2	**I use mixed methods in a study**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.1.3	**I use qualitative methods when conducting research**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.1.4	**I use quantitative methods when conducting research**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.1.5	**What was the context the last time you used mixed methods in one study? (select ONE option only)**	Non-degree purposes research project	Doctoral research project	Masters research project	Diplomat research project	Other (specify) _____
3.1.5	**How do you use methodological triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings	3.1.5.4 To refute findings	3.1.5.5 To validate findings
4.1.6	**How do you rate your competence in using mixed methods in a study?**	Poor	Fair	Good	Very good	Excellent
	4.2 Frequency of use					
4.2.1	**How often do you use mixed methods in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
4.2.2	**How often do you use qualitative method alone in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
4.2.3	**How often do you use quantitative method alone in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently

4.2.4	**When did you last use mixed methods in a study?**	This year	A year ago	Two years ago	Three years ago	More than three years ago
	4.3 Usability of method triangulation					
4.3.1	**It is easy to use mixed methods in a study**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.3.2	**I would need the support of an expert researcher to use mixed**	Strongly	Disagree	Neutral	Agree	Strongly Agree
	methods in one study	Disagree				
4.3.3	**I find using mixed methods in one study easy**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.3.4	**There are many problems in using one mixed methods in one study**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.3.5	**I find using mixed methods in one study cumbersome**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.3.6	**I am not very confident in using mixed methods**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
4.3.7	**I needed to learn a lot of research techniques before I could use mixed methods in a study**	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

	SECTION 5: INVESTIGATOR TRIANGULATION					
	5.1 Usage					
5.1.1	**I collaborate with different researchers in one study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

5.1.2	**I collaborate with researchers from different disciplines when conducting research**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.1.3	**I collaborate with researchers from my discipline when conducting research**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

5.1.4	**What was the context the last time you used different theories in one study? (select ONE option only)**	Non-degree purposes research project	Doctoral research project	Masters research project	Diplomat research project	Other (specify) _____
3.1.5	**How do you use investigator triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings	3.1.5.4 To refute findings	3.1.5.5 To validate findings

5.1.5	**How do you engage different**	5.1.5.1	5.1.5.2	5.1.5.3	5.1.5.4	5.1.5.5	5.1.5.6
	researchers in a study? (You can tick more than one)	To conduct literature review	To formulate research designs	To collect data	To analyse data	To report data	Other (specify) _____

								–
5.1.6	**How do you rate your competence in research collaboration?**			Poor	Fair	Good	Very good	Excelle nt
5.2 Frequency of use								
5.2.1	**How often do you collaborate with different researchers in a study?**			Never	Rarely	Occasionally	Frequently	Very Frequently
5.2.2	**How often do you collaborate with different researchers within your discipline in a study?**			Never	Rarely	Occasionally	Frequently	Very Frequently
5.2.3	**How often do you collaborate with different researchers from other disciplines in a study?**			Never	Rarely	Occasionally	Frequently	Very Frequently
5.2.4	**How often do you collaborate with more than two researchers in one study?**			Never	Rarely	Occasionally	Frequently	Very Frequently
5.2.5	**When last did you collaborate with more than two researchers in a study?**	This year	A year ago	Two years ago	Three years ago		More than three years ago	
5.3 Usability of investigator triangulation								

5.3.1	**It is easy to collaborate with different researchers in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.3.2	**I would need the support of an expert researcher to collaborate with different researchers in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.3.3	**Collaborating with different researchers in a study works well for**	Strongly disagree	Disagree	Neutral	Agree	Strongly
	me					agree
5.3.4	**There are problems in collaborating with different researchers in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.3.5	**I find collaborating with different researchers in a study cumbersome**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.3.6	**I am not very confident in collaborating with different researchers in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.3.7	**I needed to learn a lot about research before I could start collaborating with different researchers in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

	SECTION 6: DATA SOURCE TRIANGULATION **6.1 Usage**					
6.1.1	**I use different data sources in the same study when conducting research**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

6.1.2	**I use the same data sources to collect different data in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
6.1.3	**I use the same data sources to collect same type of data in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	
6.1.4	**What was the context the last time you used different data sources in one study? (select ONE option only)**	Non-degree purposes research project	Doctoral research project	Masters research project	Diplomat research project	Other (specify) _____	
6.1.5	**What are the different data sources you use when conducting research? (You can tick more than one)**	6.1.5.1 Stakeholders	6.1.5.2 Books	6.1.5.3 Journals	6.1.5.4 Internet	6.1.5.5 Pamphlet	6.1.5.6 Other (specify) _____
3.1.5	**How do you use data source triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings	3.1.5.4 To refute findings	3.1.5.5 To validate findings	3.1.5 Other (specify)
6.1.6	**How do you rate your competence in using different data sources in one study?**	Poor	Fair	Good	Very good	Excellent	
6.2 Frequency of use							

6.2.1	**How often do you use data from one source in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
6.2.2	**How often do you use data from different sources in one study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
6.2.3	**How often do you use books as a data source in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
6.2.4	**How often do you use journals as a data source in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
6.2.5	**How often do you use internet as a data source in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
6.2.6	**How often do you use more than one data source in a study?**	Never	Rarely	Occasionally	Frequently	Very Frequently
6.2.7	**When last did you use more than two data sources in a study?**	This year	A year ago	Two years ago	Three years ago	More than three years ago
6.3 Usability of theory triangulation						
6.3.1	**It is easy to use different data sources in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.3.2	**I would need the support of an expert researcher to use different data sources in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.3.3	**Using different data sources in a study works well for me**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.3.4	**There are problems in using different data sources in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.3.5	**I find using different data sources in a study cumbersome**	Strongly	Disagree	Neutral	Agree	Strongly agree
		disagree				

6.3.6	**I am not very confident in using different data sources in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.3.7	**I needed to learn a lot about research before I could start using different data sources in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

	SECTION 7: SPACE TRIANGULATION **7.1 Usage**					
7.1.1	**I take into account different cultures when collecting research**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7.1.2	**I use different spaces when conducting a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7.1.3	**I take into account different sub-cultures when conducting research**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
7.1.4	**I engage different stakeholders when conducting a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
3.1.5	**How do you use space triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings	3.1.5.4 To refute findings	3.1.5.5 To validate findings

7.1.6	**What was the context the last time you used different spaces in a study? (select ONE option only)**	Non-degree purposes research project	Doctoral research project	Masters research project	Diplomat research project	Other (specify) _____

3.1.5	**How do you use space triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings		3.1.5.4 To refute findings	3.1.5.5 To validate findings
7.1.7	**How do you rate your competence in using different spaces in one study**	Poor	Fai r	Good	Very good	Excellent	
7.2 Frequency of use							
7.2.1	**How often do you use different spaces in a study**	Never	Rarel y	Occasionall y	Frequentl y	Very Frequently	
7.2.2	**How often do you use spaces within your workplace when conducting a study**	Never	Rarel y	Occasionall y	Frequentl y	Very Frequently	
7.2.3	**How often do you use spaces from outside your workplace when conducting a study**	Never	Rarel y	Occasionall y	Frequentl y	Very Frequently	
7.2.4	**How often do you use more than two spaces when conducting a study**	Never	Rarel y	Occasionall y	Frequentl y	Very Frequently	
3.2.5	**When last did you use more than two spaces when conducting a study**	This year	A year ago	Two years ago	Three years ago	More than three years ago	
7.3 Usability of space triangulation							
7.3.1	**It is easy to use different spaces when conducting a study**	Strongly disagree	Disagree	Neutr al	Agree	Strongly agree	
7.3.2	**I would need the support of an expert researcher to use different spaces when conducting a study**	Strongly disagree	Disagree	Neutr al	Agree	Strongly agree	
7.3.3	**Using different spaces when conducting a study works well for me**	Strongly disagree	Disagree	Neutr al	Agree	Strongly agree	

7.3.4	**There are problems in using different spaces when conducting a study**	Strongly disagree	Disagree	Neutr al	Agree	Strongly agree
7.3.5	**I find using different spaces when conducting a study cumbersome**	Strongly disagree	Disagree	Neutr al	Agree	Strongly agree
7.3.6	**I am not very confident in using different spaces when conducting a study**	Strongly disagree	Disagree	Neutr al	Agree	Strongly agree
7.3.7	**I needed to learn a lot about research before I could start using different spaces when conducting a study**	Strongly disagree	Disagree	Neutr al	Agree	Strongly agree

	SECTION 8: ANALYSTS TRIANGULATION **8.1 Usage**					
8.1.1	**I use different techniques to analyse data in the same study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.1.2	**I use different data analysts to analyse data in the same study**	Strongly disagree	Disagree	Neutral	Ag ree	Strongly agree
8.1.3	**I use different data analysts outside my discipline when conducting a study**	Strongly disagree	Disagree	Neutral	Ag ree	Strongly agree
8.1.4	**I use different data analysts within my discipline when conducting a study**	Strongly disagree	Disagree	Neutral	Ag ree	Strongly agree

8.1.5	**What was the context the last time you used different data**	Non-degree purposes research project	Doctoral research project	Masters research project	Diplom at research project	Other (specify) _____

	analysts in one study? (select ONE option only)						
3.1.5	**How do you use analyst triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings	3.1.5.4 To refute findings	3.1.5.5 To validate findings	3.1.5 Other (specify)
8.1.7	**How do you rate your competence in using different analysts in one study?**	Poor	Fair	Good	Very good		Excellent
8.2 Frequency of use							
8.2.1	**How often do you use data analysts in a study?**	Never	Rarely	Occasionally	Frequently		Very Frequently
8.2.2	**How often do you use different data analysts in a study?**	Never	Rarely	Occasionally	Frequently		Very Frequently
8.2.3	**How often do you use data analysts within your discipline when conducting a study?**	Never	Rarely	Occasionally	Frequently		Very Frequently
8.2.4	**How often do you use data analysts from other disciplines when conducting a study?**	Never	Rarely	Occasionally	Frequently		Very Frequently
8.2.5	**How often do you use more than two data analysts in one study?**	Never	Rarely	Occasionally	Frequently		Very Frequently
8.2.6	**When last did you use more than two data analysts in a study?**	This year	A year ago	Two years ago	Three years ago		More than three years ago
8.3 Usability of theory triangulation							

8.3.1	**It is easy to use different data analysts in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.3.2	**I would need the support of an expert researcher to use different data analysts in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.3.3	**Using different data analysts in a study works well for me**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.3.4	**There are problems in using different data analysts in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.3.5	**I find using different data analysts in a study cumbersome**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.3.6	**I am not very confident in using different data analysts in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.3.7	**I needed to learn a lot about research before I could start using different data analysts in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

	SECTION 9: TIME TRIANGULATION **9.1 Usage**					
9.1.1	**I use different times to conduct research**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.2	**I conduct research at the beginning of the year**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.3	**I conduct research at the middle of the year**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.4	**I conduct research at the end of the year**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

9.1.5	**I conduct longitudinal research studies**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.6	**I conduct cross-sectional studies**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.7	**I conduct ethnographic studies**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

9.1.8	**What was the context the last time you used different times to**	Non-degree purposes research project	Doctoral research project	Masters h researc project	Diplomat research project	Other (specify)
	conduct one study? (select ONE option only)					_____

3.1.5	**How do you use time triangulation in a study? (You can tick more than one)**	3.1.5.1 To validate findings	3.1.5.2 To explain findings	3.1.5.3 To enrich findings	3.1.5.4 To refute findings	3.1.5.5 To validate findings	3.1.5 Other (specify)

9.1.10	**How do you rate your competence in using different times in one study?**	Poor	Fair	Good	Very good	Excellent

9.2 Frequency of use

9.2.1	**I collect data at different times in a study**	Never	Rarely	Occasionally	Frequently	Very Frequently
9.2.2	**I conduct longitudinal research studies**	Never	Rarely	Occasionally	Frequently	Very Frequently

9.2.3	**I conduct cross-sectional studies**	Never	Rarely	Occasionally	Frequently	Very Frequently
9.2.4	**I conduct ethnographic studies**	Never	Rarely	Occasionally	Frequently	Very Frequently

9.2.5	**When did you last conduct longitudinal research?**	This year	A year ago	Two years ago	Three years ago	More than three years ago
9.2.6	**When did you last conduct cross-sectional research?**	This year	A year ago	Two years ago	Three years ago	More than three years ago
9.2.7	**When did you last conduct ethnographic research?**	This year	A year ago	Two years ago	Three years ago	More than three years ago

9.3 Usability of time triangulation

9.3.1	**It is easy to use different times in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.3.2	**I would need the support of an expert researcher to use different times in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.3.3	**Using different times in a study works well for me**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.3.4	**There are problems in using different times in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.3.5	**I find using different times in a study cumbersome**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

9.3.6	**I am not very confident in using different times in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.3.7	**I needed to learn a lot about research before I could start using different times in a study**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.8	**I would need the support of an expert researcher to conduct longitudinal research?**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.9	**I would need the support of an expert researcher to conduct cross-sectional research?**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
9.1.10	**I would need the support of an expert researcher to conduct ethnographic research?**	Strongly disagree	Disagree	Neutral	Agree	Strongly agree

APPENDIX 7

IN DEPTH INTERVIEW GUIDE

WELCOMING REMARKS (RESEARCHER)

I will first greet the participant, introduce myself and then request the participant to the same

PURPOSE OF THE INTERVIEW (MODERATOR)

I will inform to the participants that all matters discussed are of great significance for the interpretation and application of triangulation in South African universities. I will encourage respondents to feel free to express their own views in terms of the research topic. I will remind them that there is no right or wrong answers. I will emphasize to the respondents that the main purpose of this research is to obtain in-depth information that would contribute to the understanding of the interpretation and application of triangulation in South African universities. I will remind the respondents that all information will be treated as confidential. Then I will inform the respondents that they are entitled to their opinions. All respondents will be informed about the expected duration of the interview and I will seek permission to record the whole interview.

INTERVIEW

I will begin the interview process by posing a general question on the triangulation in information systems research, and then proceed to more specific questions as set below

1) How is data triangulation interpreted and applied in IS research at four of the top ranking universities in South Africa?

a. Knowledge

b. Usage

c. Frequency

d. Usability

2) How is investigator triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?

a. Knowledge

b. Usage

c. Frequency

d. Usability

3) How is theoretical triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?

a. Knowledge

b. Usage

c. Frequency

d. Usability

4) How is methodological triangulation interpreted and applied in IS research at four of the top-ranking universities in South Africa?

a. Knowledge

b. Usage

c. Frequency

d. Usability

5) How is analysis triangulation interpreted and applied in IS research at four of the topranking universities in South Africa?

    a. Knowledge

    b. Usage

    c. Frequency

    d. Usability

6) How is space triangulation interpreted and applied in IS research at four of the top ranking universities in South Africa?

    a. Knowledge

    b. Usage

    c. Frequency

    d. Usability

7) How time triangulation is interpreted and applied in IS research at four of the top ranking universities in South Africa?

CLOSING REMARKS

I will provide an opportunity for any short final comments participants would like to make Thank you very much for your contribution today. Are there any last comments that anyone would like to raise.