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Assessing the readiness to adopt technologies of the fourth industrial revolution as a means to improve knowledge management practices in academic institutions

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2023
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ASSESSING THE READINESS TO ADOPT TECHNOLOGIES OF THE FOURTH INDUSTRIAL REVOLUTION AS A MEANS TO IMPROVE KNOWLEDGE MANAGEMENT PRACTICES IN ACADEMIC INSTITUTIONS

By

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2367616

Submitted in fulfilment of the requirements for the degree of

Master of Business Science

In the

Faculty of Commerce, Law and Management

University of the Witwatersrand

Johannesburg

2023

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ABSTRACT

Today's world is being transformed by technological advances in the fourth industrial revolution (4IR). In the education sector, the technological personalities of the academic staff associated with the acceptance of 4IR technologies play a crucial role in learning and teaching.

This study assessed the readiness of academic staff to adopt the technologies of the 4IR to improve Knowledge Management (KM) practices. The study used the technology readiness and acceptance model (TRAM). This framework combines two models, the Technologies Readiness Index (TRI) and the Technology Acceptance Model (TAM). TRI has four factors, optimism, innovativeness, discomfort, and insecurity. In the TAM model, the intention to use new technology is affected by two constructs, perceived ease of use and perceived usefulness.

This study adopted a mixed method. The research was conducted at the University of the Witwatersrand South Africa in the school of Commerce, Law and Management (CLM). One hundred thirteen questionnaires (113) were sent to academic staff in CLM; only 90 questionnaires were completed, and one was discarded. The remaining 89 questionnaires represented a 78,7% response rate. The questionnaire had two sections, a section with closed-ended questions designed to collect quantitative data and a section with open-ended questions devised to collect qualitative data.

Seven hypotheses were developed and tested following the research objectives of the study. These hypotheses were analyzed using multiple regression analysis and Pearson Product Moment Correlation (PPMC) via IBM SPSS statistics version 28. Thematic analysis was also used to assess qualitative data.

The study's findings revealed that only optimism significantly affected the perceived usefulness of 4IR technologies. Furthermore, only innovativeness significantly positively affected the perceived ease of use of 4IR technologies. In addition, the results showed no significant effect between perceived ease of use and the intention to use 4IR technologies. Finally, the findings indicated that perceived usefulness and ease of use are instrumental in determining the academic staff's intention to use 4IR technologies.

Today's world is being transformed by the advance of technologies of the fourth industrial revolution(4IR). In the education sector, the technological personalities of academic staff associated to the acceptance of 4IR technologies plays a crucial role in the way learning and teaching is done.

DEDICATION

To the memory of my beautiful daughter Tania Kabati.

DECLARATION

I, Judith Bahagarhe Akonkwa, hereby declare that the whole of this dissertation is my own work and has not been submitted in part, or in whole to any other University. Where use has been made of the work of others, it has been duly acknowledged in the document. It is submitted in fulfilment of the requirements for the degree of Master of Business Science (management) at the University of the Witwatersrand, Johannesburg".

…… ……31/03/2023……

Judith Bahagarhe Akonkwa date

In my capacity as the candidate's mentor, I have given my endorsement for the submission of this thesis.

…….. …….

Althea Moodley date

ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisor Althea Moodley for her guidance, valuable suggestions, cooperation, motivation, and constant support. A special thanks to my loving husband, Serge K. Kabati, for his understanding and unconditional love. You are indeed sent from God.

Special thanks go to my father Bisimwa Bahagarhe Jean for always being there for me. Thank you for believing in me.

I equally appreciate my siblings, mother-in-law, family and friends for frequently supporting, praying, and calling to encourage me. I would not have made it without you.

I would like to acknowledge the school of commerce, law and management and everyone who took the time out of their day to answer to my survey. I would like to thank Irma Watson, our administrator, for her support.

Finally, I give thanks to my heavenly Father for the successful completion of this work,the glory is always his. Proverb 3:6.

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LIST OF ABBREVIATIONS

4IR	Fourth Industrial Revolution
AI	Artificial intelligence
CFA	Confirmatory Factor Analysis
CLM	Commerce Law and Management
CPC	Cyber Physical System
DF	Degree of Freedom
DISCOM	Discomfort
EFA	Exploratory Factor Analysis
ERP	Enterprise Resource Planning
INNO	Innovativeness
INSEC	Insecurity
iOS	Internet of Service
IoT	Internet of Things
IU	Intention to Use
KM	Knowledge Management
KMO	Kaiser-Meyer-Olkin
MES	Master Execution System
OPTI	Optimism
PCA	Principal Component Analysis
PEOU	Perceived Ease of Use
PPMC	Pearson Product Moment Correlation
PU	Perceived usefulness
RFID	Radio Frequency Identification
TAM	Technology Acceptance Model
TPB	Theory of Planned Behaviour
TRAM	Technology Readiness and Acceptance Model
TRI	Technology Readiness Index
WEF	World Economic Forum

CHAPTER 1: INTRODUCTION

1. 1 Introduction

The common characteristic of all industrial revolutions is their capability to transform society due to new technologies (Schwab, 2017). Over the past couple of years, there has been an increasing interest in the concept of the fourth industrial revolution (4IR). Debates about the nature and scope of the 4IR and driving technologies are ongoing. According to Schwab (2017), the fourth industrial revolution is blurring the lines between man and machine. The 4IR technologies include artificial intelligence (AI), the Internet of Things, robotics, cyber physical system among others (Gleason, 2018). These technologies will reshape every aspect of our lives, including our education system and knowledge management.

T. H. Davenport and Prusak (1998) believe that the only sustainable competitive advantage within an organization is what it collectively knows, how efficiently it uses what it knows, and how readily it acquires new knowledge. Thus, organizations rely on knowledge to sustain a long-term advantage.

Knowledge management (KM) is a strategy for creating an environment that encourages using, generating, sharing, and exploiting knowledge. The role of KM in educational institutions is critical as it is the main instrument of society for the constant pursuit of knowledge.

In higher education, the advancement of technology creates an environment that boosts efficient teaching and learning. This research, discusses the readiness of academic's staff to adopt technologies of 4IR in the knowledge management process in the context of South Africa

1.2 Background

South Africa faces many challenges, including unemployment, poverty, corruption and, inequality. Above all these challenges, the education system is one of the most critical concerns in South Africa (Naudé, 2017). Nation progress in terms of economic and political development depends on the level of education of the population. Without placing adequate measures in place, the 4IR could aggravate the situation as it may

increase inequality through the replacement of existing jobs with new specialized work. In the state of the nation address of 2018, President Cyril Ramaphosa announced a constitution of a Digital Industrial Revolution Commission in charge of investigating the 4IR (Ramaphosa, 2018). Chetty (2018), states that "an acknowledgement of the implications of digital technology and of the necessity for a broader approach in overseeing and dealing with the effect of such advancements contributes to the uncertainty of what the future holds". Therefore, a study of the readiness of academic staff regarding the 4IR technologies is essential.

1.3 Problem statement

Just like other African countries, South Africa faces a myriad of challenges resulting from a legacy which emanated from colonisation and oppression (Madumo, 2016). Among the various challenges, South Africa faces is the limitation of the widening digital divide (Janse van Rensburg, 2012). This gap is attributed to illiteracy rates and the reluctance to utilise new technological.

According to the World Economic Forum, 65% of children entering primary school today will end up working in completely new jobs that don't exist yet. This reality poses a serious threat to readiness for 4IR. Computer science skills are at the centre of the 4IR revolution, however, in South Africa very few primary and high school learners have access to computers and reliable internet. Nationwide academic staff lack training and development to capacitate them to teach a 4IR geared education to their learners (Leopold, Ratcheva, & Zahidi, 2016).

Furthermore, there is a lack of literature that focus on the readiness of academic staff and knowledge management in the south African education sector. This suggests the need for comprehensive explanations on the link between readiness to adopt 4IR technologies and the improvement of knowledge management practices in the south African education sector.

1.4 Objectives

This study's primary objective is to assess the readiness of academic staff to adopt the technologies of the 4IR as a means to improve KM practices. The secondary objectives of this research are:

- To establish whether the technology readiness index directly impacts the perceived usefulness of technologies of the 4IR
- To explore the relationship between the technology readiness index and the perceived ease of use of technologies of the 4IR
- To establish whether perceived ease of use is positively related to perceived usefulness.
- To examine if perceived usefulness and perceived ease of use of technology lead to the adopting of technologies of the 4IR in the KM practices.
- To ascertain the influence of the technology of the 4IR on KM practices.

31.5 Research questions

- Is there a relationship between the technology readiness index and the perceived usefulness of technologies of the 4IR?
- What type of relationship exists between the technology readiness index and the perceived ease of use of technology of the 4IR?
- Is there a positive relationship between Perceived ease of use and perceived usefulness?
- Do perceived usefulness and perceived ease of use of technology lead to the adoption of technologies of the 4IR in KM practices?
- How will the technologies of the 4IR contribute to the improvement of KM practices?

1.6 Research hypothesis

The following propositions will be empirically tested:

H1a. Optimism positively influences academic staff PU of 4IR technologies

H1b: Optimism positively influences academic staff PEOU of 4IR technologies

H2a: Innovativeness positively influences academic staff' PU of 4IR technologies

H2b: Innovativeness positively influences academic staff PEOU of 4IR technologies.

H3a: Insecurity negatively influences academic staff PU of 4IR technologies

H3b: Insecurity negatively influences academic staff PEOU of 4IR technologies

H4a: Discomfort negatively influences academic staff PU of 4IR technologies

H4b: Discomfort negatively influences academic staff PEOU of 4IR technologies

H5: Academic staff PEOU of 4IR technologies positively influences their PU of 4IR technologies.

H6: Academic staff PEU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process.

H7: Academic staff PEOU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process.

1.7 Motivation for the study

Gaps identified in the literature form the rationale for this study. This gap has created the need to extend the frontier of knowledge by explaining the link between the technology readiness index and the perceived usefulness and ease of use of technologies of 4IR in the academic sector.

1.8 Significance of the study

This research is vital in several ways as set out below.

- Extend the existing knowledge and literature on using new technologies in the university context.
- Help in creating a level of awareness and use of 4IR among academic's staff in teaching and learning.
- Provide recommendations on the use of technologies of the 4IR in KM practices to improve and access information resources quickly.
- Trigger further areas of research.

1.9 limitation of the study

Firstly, data were collected at one university (University of the Witwatersrand Johannesburg) in the faculty of commerce law and management (CLM); hence the result cannot be generalized.

Secondly, the study was constrained by the academic staff's dynamic nature and data collection delays due to COVID-19 restrictions. As a result, respondents were constantly reminded to complete the questionnaire. Academic staff might have felt the pressure, leading them to complete the questionnaire even though they did not want to. Therefore, it is essential to note this bias even if the participation was voluntary.

Finally, the TRAM model used in this study originates from developed countries. Therefore, application in Africa can lead to different outcomes that require the development of new technology adoption model for Africa.

1.10 Structure of the thesis

This study is composed of six chapters:

Chapter one: Introduction

Chapter one is an introduction chapter. This chapter discusses the background of the research, the problem statement, and the significance of the research and the limitation of the study. The research objectives, the research questions, the hypothesis are presented chapter.

Chapter two: Literature review

Chapter two thoroughly examines pertinent literature on the industrial revolution, KM, and the model for technology acceptance and readiness. The chapter is divided into three segments: The initial segment presents a general perspective on the literature regarding the industrial revolution and its influence on the domain of education. The second segment provides an overview of the literature on knowledge and knowledge management, and its relevance in the field of education. Lastly, the final segment of this chapter presents a comprehensive outlook on the literature concerning the Technology Readiness Index (TRI) and the Technology Acceptance Model (TAM).

Chapter three: Research methodology

Chapter three details different research philosophies, the research methodology, the research approach, and research design. Each method’s strengths and weaknesses and the justification for using the chosen model are discussed. This chapter also introduce the research population, the sampling techniques, and the research instrument and

discusses the procedures for collecting and processing data. Finally, the chapter ends with a discussion of limitations.

Chapter four: Data analysis and interpretation of results

Chapter four presents the results of the study. The demographic data, the reliability and validity of the instruments the regression analysis and the Pearson correlation matrix.

In the fourth chapter, the findings of the research are illustrated. This incorporates the demographic statistics, the reliability and validity of the instruments the regression analysis and the Pearson correlation matrix.

Chapter five: Discussion of findings

This chapter discusses the finding from chapter four by answering the study questions, the objectives, and the hypotheses.

Chapter six: Recommendations and conclusion

The conclusions and recommendations from this study are discussed in this chapter. Furthermore, this chapter discusses the contribution of this study to knowledge and gives suggestions for future research. Finally, this chapter presents the conclusion and recommendation of this research.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The world is facing diverse and fascinating challenges. The Fourth Industrial Revolution(4IR) is one of the most widely discussed concepts. The 4IR concept has changed economies and societies.

This chapter is divided into three main sections: the first section presents a review of the preceding industrial revolution and its impact on the education sector; it also describes the 4IR and reviews how emerging technologies affect the education sector. The second section of this chapter reviews the literature on knowledge and KM and the application in the education sector. The last section of this chapter reviews the Technology Acceptance and Readiness Model (TRAM).

2.2 Industrial revolution

2.2.1 Historical background of the industrial revolution

The Oxford English dictionary defines *Industrial Revolution* as:" a rapid development in the industry." According to Bloem et al. (2014a) the word "development" could imply a slow progress in the midst of a "revolution" that denotes a quick and radical transformation. However, it is clear that noteworthy modifications took place in the industrial sector within a brief span of time.

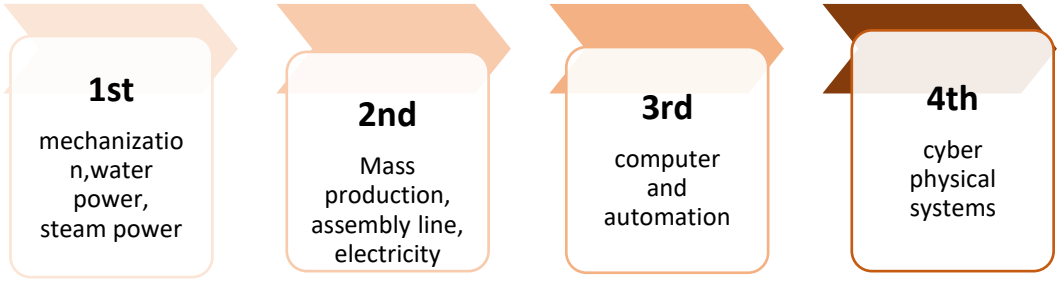


Figure 2. 1: Levels of Industrial Revolutions (Bloem et al., 2014b)

According to Bauernhansl, Ten Hompel, and Vogel-Heuser (2014), the first industrial revolution began towards the end of the 18th century. This revolution improved humanity's quality of life by introducing steam engines and mechanized production. The Second Industrial Revolution arose a century later and was characterized by electric power and mass-production processes. In this era, items that were once only within reach of the affluent became more economical to manufacture, enabling the masses to purchase them. The Third industrial revolution materialized in multiple developed nations around the close of the 1900s. This revolution is characterized by the advent of digital technologies, computers, the IT industry, and process automation (Bücker, Hermann, Pentek, & Otto, 2016; Rüßmann et al., 2015).

We have entered the fourth wave of technological development, the fourth industrial revolution (J. Lee & Lee, 2021; Rüßmann et al., 2015). The term became public in 2016 at the World Economic Forum (WEF) (Kagermann, Lukas, & Wahlster, 2011). 4IR, according to (scwab2016) blends the physical, digital, and biological worlds. Some technologies of the 4IR include 3D printing, quantum computing, smart robots, artificial intelligence (AI), the internet of things, nanotechnology, and biotechnology.

Discussions concerning whether new technologies are so fundamentally innovative as to warrant being referred to as a revolution or simply an extension of the third industrial revolution have garnered significant interest among writers (J. Lee & Lee, 2021). Some authors still argue that 4IR is just an extension of the 3rd industrial revolution. In contrast, some argue that technological innovation and growth, such as AI, will be more potent than in the past industrial revolution. So, it makes sense to talk about a new industrial revolution. Table 2.1 illustrates the distinctions between the 3rd and the4IR.

Table 2. 1: Comparison of the 3rd and the 4IR

	Third	Fourth
Trend of society	Information society	AI society, smart factory, smart city
Means of production	Automation, robot-controlled production and mass production	Automation, decentralized production and the customized production
Core product	Computer, internet	Drone, self-driving car

Core technology	Computer, internet	AI, IOT, Big data, Augmented reality, 3D printing
Communication	Web services(browsers)	Internet of thing and services

Schwab (2017) also argue and give three significant distinctions between the third and 4IR.

- **Velocity**:Compared to the previous three revolutions, 4IR evolves exponentially rather than linearly. (Schwab, 2017).
- **Scope**: the disruption of the 4IR is taking place in almost every industry and every nation (Schwab, 2017).
- **System impact**: the changes are transforming the entire system of production, management and governance (Schwab, 2017).

The following section discusses the 4IR in more detail.

2.2.2 Fourth industrial revolution

4IR was first presented as a technology concept by a team of federal scientists at the Hannover fair in 2011. The term was again mentioned at the World Economic Forum (WEF) in 2016 by Schwab Klaus, Executive Chairman of WEF.(Ružarovský, Holubek, Janíček, Velíšek, & Tirian, 2021).

The description of the Fourth Industrial Revolution (4IR) remains unclear since it is in its initial phase. Nonetheless, 4IR pertains to novel advancements utilizing contemporary technologies like 3D printing, Internet of Things (IoT), artificial intelligence (AI), massive data, and cloud computing (Užienė, 2021). These technologies will bring many changes in all aspects of our life, including production, distribution, consumption, and even teaching and learning.

As part of the definition, the following sections explore the components of the 4IR.

2.2.2.1 Fourth industrial revolution components

In the effort to define the 4IR, German scholars Hermann, Pentek, and Otto (2015) identified four main components of the 4IR. These four main components and the supporting tools or technologies of the 4IR enable the advancement of industry 4.0. These components include the Internet of things (IoT), cyber-physical system (CPCs), the Internet of service (IoS), and smart factories.

A. The Internet of things

The term "Internet of Things" (IoT) dates back to 1999 when the British technology pioneer Kevin Ashton described a system that could connect the physical world to the Internet via sensors (Dobkin, 2012). Ashton introduced the phrase to demonstrate the potential of linking Radio-Frequency Identification (RFID) tags utilized by supply chain companies to facilitate tasks like inventory management and item monitoring without the need for human intervention. Currently, the phrases are utilized to portray scenarios wherein internet connectivity and computational capabilities are expanded to numerous objects, gadgets, sensors, and ordinary items.

Sundmaeker, Guillemin, Friess, and Woelfflé (2010) suggest a method to defining "things" in the context of IoT. They grouped them into five functional areas or domains. The first functional domain addresses the most fundamental aspect of technology in the IoT. "things" will communicate and connect the real and the virtual worlds. Secondly, they address the increasing complexity of "things" to the point of adding some kind of intelligence. The third domain is the humanization of "things." Here, "things" can communicate and perform decision-based communication. Domain four explores how "things" can adapt to suits different needs and tasks. The last domain borders on AI in that "things" from this domain have human characteristics.

B. Cyber physical system

Cyber-physical systems (CPSs) or "smart" systems, is an emerging field encompassing engineering computing and communication systems connected to the physical world. Scholars have used phases and steps to understand CPSs.

According to Thiede, Juraschek, and Herrmann (2016), any CPSs go through three phases of development: the first stage is the identification of technologies. This phase allows entities inside the CPS to have a unique identity. The second phase involves allocating sensors and actuators to entities inside the CPS with a unique identity. The final phase of the CPS is comprised of components equipped with numerous sensors, actuators, and data processing capabilities .Plass (2015) supports Thiede et al. (2016) tripartite model for characterizing the CPS, depicting it as a tangible system featuring innate limited intelligence and decision-making abilities.three-stage approach to define the CPS and describe CPSs as a physical system with inherent partial intelligence and the ability to make decisions .

For designing, defining and implementing CPSs, Lee (2008) proposed a five-step framework. He named the first step smart connection; in this step data is collected from different machines and components. The second step is named data to information convention, which consists of converting data gathered from linked devices into usable information. This step gives machines self-awareness because they can now receive and create relevant information. Step three is called the cyber level and consist of creating a central point where all data is sent. Step four of the cognitive level deals with visual packaging and display of outputs from previous processes to give decision help to the user. Step five, or the feedback loop. This phase connects the consumer's decisions from step four to steps one through three, therefore starting a new process interaction.

C. The internet of service (IoS)

Plass (2015) describes the Internet of service as the development of networking and communication within the IoT, which eventually create massive amounts of data, knowns as big data, accessible via the cloud. Hermann et al. (2015) add that IoS allows providers to provide their products and services online. According to Al-Salman and Salih (2019), the IoS aims is to offer all internet-related services, which includes software programs, frameworks for building and providing these programs, and fundamental infrastructures, as a service.

D. The smart factories

A report by TWI (2022) refers to a smart factory as "a digitized manufacturing facility that uses connected devices, machinery, and production systems to continuously collect and share data ." The collected data is used to inform decisions to improve processes and address any issues that may arise**.** Smart factories use a range of technologies, including IoT, AI, and IoT, to improve efficiency and safety in the production process**.** Smart factories connect the digital and physical worlds to monitor production processes.

F. Summary

This section has covered the main components of the 4IR. The following section discusses 4IR technologies.

2.2.2.2 Technologies of the 4th industrial revolution

In a study by Rüßmann et al. (2015) confirmed that 4IR technologies are currently being used in the industry but in isolated cases. These technologies include big data analytics,

embedded electronics, simulation, cyber security, cloud computing, additive manufacturing, augmented reality, and digital factory.

A. Big data analytics

Big data analytics is used to analyze a vast data to generate insights from it (Rüßmann et al., 2015). These insights could be correlations, hidden patterns, market trends, customer preferences, or anything that could help businesses make better and more educated decisions. Manyika et al. (2011) refer to big data as datasets whose size is beyond the ability of typical data management systems tools to capture, store, manage, and analyze. Big data differs from traditional data in volume, velocity, and variety.

Volume is defined by Manyika et al. (2011) as the size of the datasets. Velocity refers to the pace at which data is created, and finally, variety refers to the varied sort of data that is being gathered. Some data sets include photos, audio and video recording, numerical data, text, and sensor data.

B. Embedded electronics

Embedded electronics are integrated into hardware and software to meet specific restrictions, such as power consumption and real-time needs (Mahbub, 2020). These devices form a critical part of the 4IR because of their ability to function without manual help. These devices function with sensors through CPSs and form part of the IoT.

An example of embedded devices is robots, which are equipped with the ability to replicate human actions. An excellent example of a robot is KUKA. This painting robot is used at Volkswagen to perform activities such as switching nozzles, painting, and spraying that were previously performed manually (KUKA, 2016).

C. Simulation

Simulation is a decision analysis and support tool. Previously simulations were used to analyze military problems. Simulation software is now used to solve complicated operations issues as a large volume of data continuously evolves in real-time(Gunal, 2019). Simulation software such as SIMIO allow organization to animate and understand real system behavior more easily, allows businesses to compare and optimize alternative designs, plans, and policies. Simulation may be used to forecast

how a system will evolve and respond to its surroundings to identify necessary changes. ("Tecnomatix," 2022)

D. Cyber security

The high volume and variety of data and information generated around the globe create problem attacks. The solution to this dilemma is cyber security. *Cyber security* is defined by Von Solms and Van Niekerk (2013) as "the collection of tools, policies, security concepts, security safeguards, guidelines, risk management approaches, actions, training, best practices, assurance and technologies that can be used to protect the cyber environment and organization and user's assets." Information security prepare organizations to threats by protecting sensitive information of organizations from unauthorized activities (Von Solms, 1998).

E. Cloud computing

The term Cloud computing refers to technologies that makes cloud works(Qian, Luo, Du, & Guo, 2009). Cloud computing enables entry to a communal reservoir of computational assets, such as networks, servers, storage, and amenities (Mell & Grance, 2011). According to Armbrust et al. (2010), cloud computing services may be quickly supplied with minimum administration work with little service provider involvement. For instance, Google Drive is considered as cloud computing technology (GoogleDrive, 2022). Besides data storage, Google Drive offers tools like Google sheets, presentations, and documents.

A cloud can be private or public. Anyone on the internet may access the public cloud, while the private cloud is only accessible to specific individuals with access and permission (Armbrust et al., 2010). The purpose of cloud computing, whether private or public, is to give quick, scalable access to computer resources and IT services.

F. Additive manufacturing

Additive manufacturing, often called 3D printing, is a revolutionary technique in industrial production that allows for the development of lighter, more robust components and systems (Rüßmann et al., 2015). The process of additive manufacturing involves the utilization of computer-aided-design (CAD) software or 3D object scanners to instruct hardware to apply material in a layered fashion, resulting in precise geometric shapes (Rüßmann et al., 2015). Essentially, additive manufacturing entails the addition of material to produce an object.

In the recent decade, additive manufacturing has made possible the customization of products to increase consumer satisfaction while also decreasing the cost and the time inefficiencies for the producer (Rüßmann et al., 2015).

G. Augmented reality

Augmented reality (AR) is an upgraded rendition of the tangible environment accomplished with the aid of digital visual components, audio, or other sensory cues conveyed through technology. Carmigniani and Furht (2011) have confirmed that there are many uses for AR in our everyday lives. For instance, today, some apps can help you find your car in a crowded parking lot, and shopping apps let you try on clothes without even leaving home; Neurosurgeons sometimes use an AR projection of a 3-D brain to aid them in surgeries.

H. Digital factory

The digital factory plays a mediating role between actual factory and a virtual copy of the factory (Bracht & Masurat, 2005; Gregor, Medvecky, Matuszek, & Stefánik, 2013).

The digital factory according to Bracht and Masurat (2005) has the following core objectives:

- Enhancement of industry through the avoidance of poor investments and the acceleration of the introduction of new products in the market by means of integrated planning of products and processes, utilizing precise and detailed simulations.
- Elevation of planning quality through the same approach as the industrial improvement, where complex scenarios can be simulated and analysed, based on the sophistication and precision of the simulation software.
- Enhancement of communication by employing cloud computing and visual representations of intricate problems
- Enhancement of communication by employing cloud computing and visual representations of intricate problems. Management of data through the utilization of cloud computing, integrated enterprise resource planning (ERP), and master execution systems (MES).

I. Summary

In this section, eight deemed essential technologies of the 4IR are discussed, and the four main components of the 4IR are discussed in Section 2.2.2.1. The following section review the evolution of the industrial revolution in academic institutions.

2.2.3 Evolution of Industrial Revolution in academic institutions

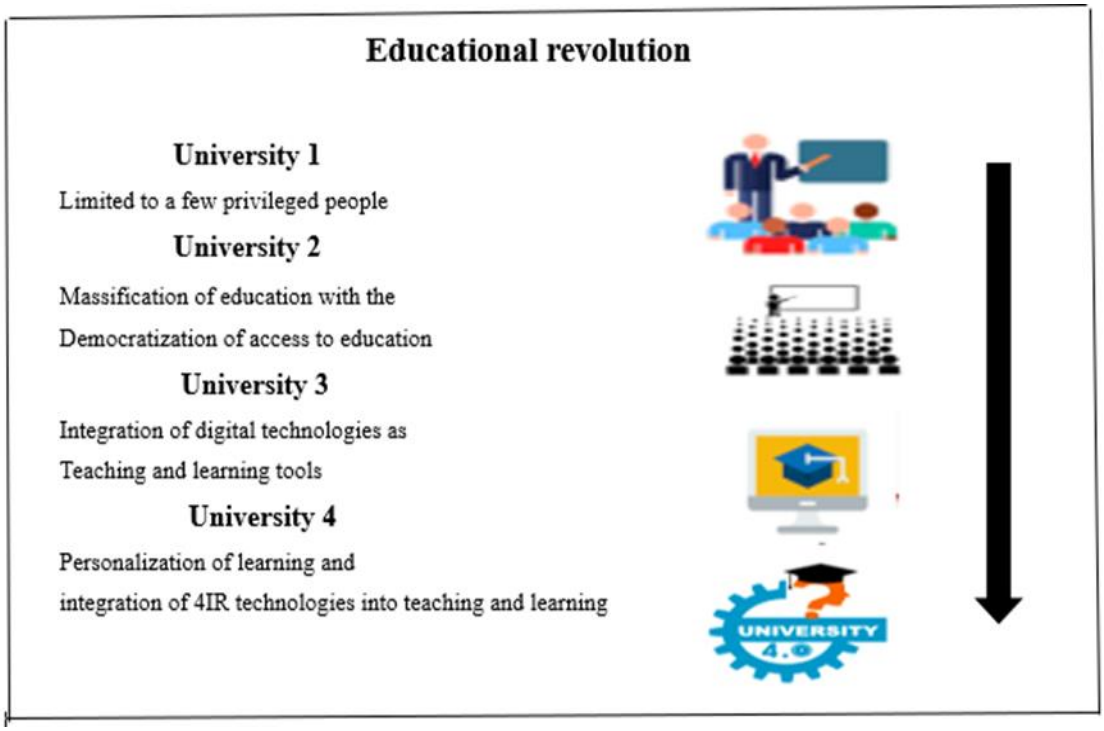


Figure 2. 2: Educational Revolution Meyer, Ramirez, Rubinson, and Boli-Bennett (1977)

The world of education has undergone a massive transformation due to the digital revolution (Collins & Halverson, 2018). Diwan (2017) states that the emergence of industry 4.0 requires that education also leapfrogs from the current education framework to Education 4.0. figure 1.3 depict the evolution of education over the years.

- **Education 1.0** was informal, church-controlled, and only accessible to a few privileged people from religious institutions and meanly boys(Gerstein, 2014). Education 1.0 is based on the three Rs (*receiving* by listening to the teacher, *responding* by taking notes, and *regurgitating* by taking the same assessments as all other students in the classroom))(Gerstein, 2014). In this education, all students were viewed as being equal. Furthermore, teachers were the primary gatekeepers of information.

- **Education 2.0** also known as the education of the masses, can be traced to the mid-15th century when the invention of the printing press transformed the education sector and helped increase literacy levels through books (Gerstein, 2014). During Education 2.0, there was an improvement in the interaction between educators and learners and between learners and learners. Education 2.0 has progressive, humanistic roots where the human element is essential to learning (Gerstein, 2014; Keats & Schmidt, 2007). Education 2.0 focused on the three Cs: communication, contribution, and collaboration (Keats & Schmidt, 2007). In this education, the teachers were still the orchestrator of learning.
- **Education 3.0**, learners of education 3.0 were characterized by self-determination and interest-based learning, innovation, and creativity (Keats & Schmidt, 2007).in this education, students played an essential role as creators of shared knowledge.just like the education 2.0 ; Education 3.0 is also about the three Cs but a different set: connectors, creators, and constructivists (Gerstein, 2014).
- **Education 4.0**: Because it develops around the learner, Education 4.0 differs from the last educational revolution. With education 4.0, students can design their learning pathways. It is distinguished by the personalization of the learning process, where the learner has the freedom to design his or her future and can aspire, approach, and accomplish personal goals per their preferences.

2.2.4 Summary

This section focused on the four industrial revolutions that have occurred, particularly emphasizing the fourth industrial revolution and its technology. These technologies contribute to the increased complexity of the business environment in which organizations operate. Firms must respond quickly to rapid technological advancements and shifting client demands to survive. As a result, proper knowledge management is critical for making accurate and fast decisions. The following section discusses knowledge management and its use in higher institutions settings.

2.3 Knowledge Management

2.3.1 Introduction

Previous studies have cited knowledge as the most valuable resource in today's organization (Holsapple & Joshi, 2004). Many authors describe knowledge as a source of wealth and competitive advantage for any organization (T. Davenport, 2010;

Nonaka, o Nonaka, Ikujiro, & Takeuchi, 1995). Hence, a lot of time and money is invested by a firm in using knowledge to achieve a competitive advantage. This section provides an overview of knowledge and knowledge management. The section ends with the application of knowledge management in the education sector.

2.3.2 Knowledge

Defining knowledge dates from the classic Greek era, leading to many epistemological debates (Alavi & Leidner, 2001). For this study, it is useful to consider different views and opinions in the literature. Some scholars define knowledge by distinguishing between data, information, and knowledge (Allee, 1997; Barquin, 2000; Dretske, 1981). Other (Hislop, Bosua, & Helms, 2018; Hoq & Akter, 2012; Y. C. Lee & Lee, 2007; Mostofa & Mezbah-ul-Islam, 2015) believe that knowledge can be defined by its forms, i.e., tacit knowledge and explicit knowledge. The following part of this section discusses what constitutes knowledge and what falls under data and information.

2.3.3 Data, information and knowledge

In the same manner, understanding the notion of knowledge is recommended to better understand KM. Understanding and comparing similar terms such as data and information is essential. These terms are used interchangeably (Hoq & Akter, 2012). Y. C. Lee and Lee (2007) suggest comparing data, information, and knowledge to elucidate semantic confusion and create consistency in the definition of knowledge.

A widely accepted perspective on the Sundry Minor variation is that figures are unprocessed numbers and truths, data is transformed figures, and wisdom is verified information (Aamodt & Nygård, 1995; Coukos-Semmel, 2002; Dretske, 1981). However, Tuomi (1999) disagrees with the hierarchical order of data to knowledge. According to him, knowledge exists before the development of information (Tuomi, 1999). Tuomi further argues that knowledge exists, and only when it is articulated and verbalized it becomes information that later transforms into data when representation and standard interpretation have been fixed. However, Tuomi (1999) disagrees with the hierarchical order of data to knowledge. According to him, knowledge exists before the development of information (Tuomi, 1999). Tuomi further argues that knowledge exists, and only when it is articulated and verbalized it becomes information that later transforms into data when representation and standard interpretation have been fixed.

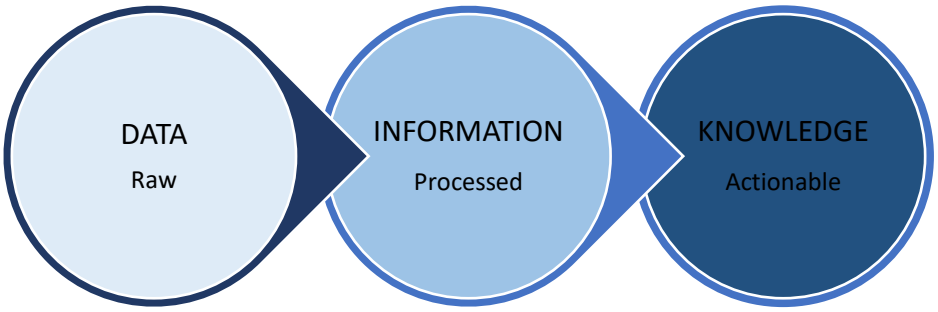


Figure 2. 3: The flow from data to knowledge.

2.3.4 Tacit knowledge and explicit knowledge

Another distinguishing feature of knowledge can be its forms. Knowledge exists in two forms: tacit knowledge and explicit knowledge (Hislop et al., 2018; Hoq & Akter, 2012; Mostofa & Mezbah-ul-Islam, 2015) .

According to Hoq and Akter (2012), Tacit knowledge is rooted in an individual's behavior, attitude, perception, ideology, and beliefs, draws on a person's cumulative experience and learning, and is difficult to reproduce or communicate with others. Tacit knowledge, according to Hislop et al. (2018) is the information that individuals hold that has the potential to dramatically impact their thinking and behavior but cannot be fully converted into explicit knowledge.

On the opposite side, explicit is the knowledge written down and accessible (Floyde, Lawson, Shalloe, Eastgate, & D'Cruz, 2013; Hoq & Akter, 2012; Mostofa & Mezbah-ul-Islam, 2015; Roy, 2015). In other words, explicit knowledge results from processing, organizing, structuring, and interpreting data. Edwards, Ababneh, Hall, and Shaw (2009) pinpoint that tacit and explicit knowledge are not mutually exclusive concepts.

Dorasamy, Raman, and Kaliannan (2013) also add that the effective management of implicit and explicit knowledge is the major challenge in knowledge management. Hoq and Akter (2012) support this view, acknowledging that organizations face challenges in managing tacit knowledge as it is found in the employees' minds.

Although Yazhou and Jian (2013) believe that the success of today's organization depends on the management of tacit and explicit knowledge; (Y. Kim, Krishnan, & Argote, 2012) argue that recording tacit knowledge and turning it into explicit knowledge is still a challenge in many organizations.

2.3.5 Knowledge management

Knowledge management (KM) can be traced back to antiquity, when people used to share their experiences with their love's ones, forecast the weather, business owners passing commercial wisdom to the next generations, engineers destroying buildings and rebuilding them to keep constructions skills alive (T. Davenport, 2010).

KM refers to frameworks that help in capturing, acquiring, and organizing tacit and explicit knowledge of employees for future use (Alavi and Leidner, 1999; Davenport et al., 1998).

2.3.6 Knowledge management processes

In the field of KM, different scholars have proposed the knowledge life cycle (see Figure 2.4), also known as the KM process (Chan, Go, & Pine, 1998; Karadsheh, 2009; Park, Ribière, & Schulte, 2004). KM processes enable knowledge creation, acquisition, capture, sharing, and application (Swartbooi, 2010) . KM processes are discussed in the following session.

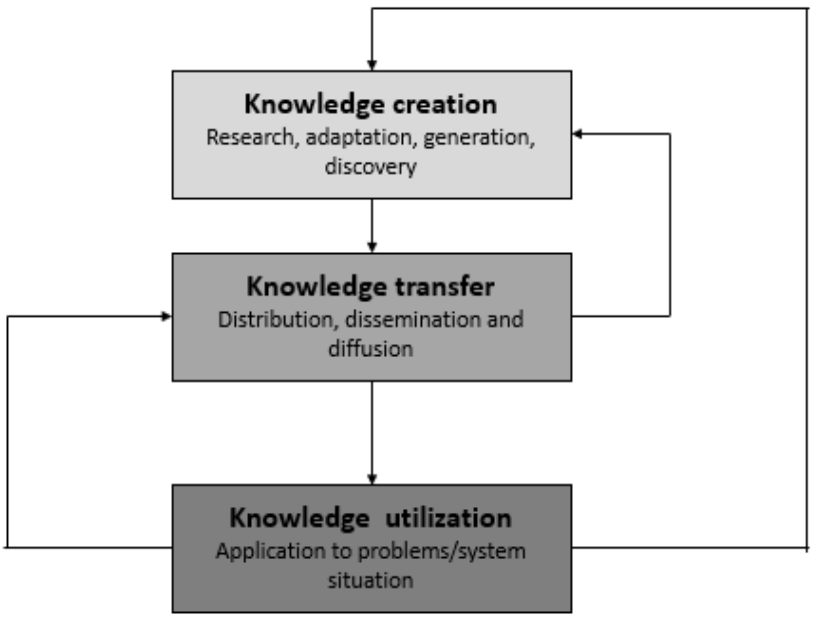


Figure 2. 4: Knowledge lifecycle (source adapted from (Park et al., 2004).

2.3.6.1 Knowledge creation/acquisition

According to Ni, Cui, Sang, Wang, and Xia (2018), the acquisition of knowledge is the first process in KM. This process is also called the creation and development of skills and insights (Tiwana, 2000). Swartbooi (2010) adds that knowledge creation is generating new knowledge or replacing existing content with new explicit or tacit knowledge. Darroch and McNaughton (2001) describe states that experiences and skills of employees are the origin of knowledge. Jiang, Su, and Zhang (2013) believe that knowledge is created in two different ways: through exploitation and exploration or codification. Ramachandran, Chong, and Ismail (2009) also add that discovery can create knowledge.

2.3.6.2 Knowledge storage, organisation and retrieval

The knowledge created is kept in its raw form in a database. Knowledge storage is essential to avoid permanently losing critical information when experts are fired or when they have retired, or in the worst-case scenario, when an employee die (Probst, Raub, & Romhardt, 2000). Most organizations use many different types of knowledge repositories to capture knowledge. Chou (2005) notes that complex storage technology enables the retrieval of knowledge, organisation and storage on knowledge.For instance, intranets, e-mail, expert systems, and multimedia databases enable people to retrieve and classify knowledge.

2.3.6.3 Kknowledge transfer/sharing

Ko, Kirsch, and King (2005) define *knowledge transfer* as "the communication of knowledge from a source so that it is learned and applied by a recipient." According to Karadsheh (2009), knowledge sharing offers a means of communication and an expedited approach for individuals to gain knowledge. Bernius (2010) remarked that the process of knowledge sharing comprises of two primary components: the originator or the supplier of the disseminated knowledge and the recipient of the obtained knowledge. Knowledge sharing enables the transfer of knowledge from different departments of the organization (Jiang et al., 2013). In addition, knowledge sharing enables the organization’s employees to improve work quality, problem-solving, and decision-making skills (Syed-Ikhsan & Rowland, 2004). Communication gaps can be bridged with good knowledge sharing Jiang et al. (2013).

Cheng, Ho, and Lau (2009) pointed out two primary forms of sharing knowledge: open-network sharing and closed-network sharing. In the first form individuals share their knowledge through a central repository or central database, the later form is done between two people or person to person. In the closed sharing the attitude, and the personality of an individual counts. Most organizations use open-network sharing (Cheng et al., 2009).

Technology plays an intermediary role in knowledge sharing(Cheng et al., 2009; Kumar, 2010). Technologies such as wikis, blogs, and social media services plays as robust solutions for knowledge sharing.

2.3.6.4 Knowledge application/utilization

Ni et al. (2018) believe that knowledge application is the main aim of KM. Through knowledge application, organizations can quickly become innovative and create new knowledge. Karadsheh (2009) pointed out that knowledge application allows organizations to learn from new environments. In addition, as per Karadsheh (2009),utilizing know-how enables the assimilation of information into the company's procedures and services. While Park et al. (2004) believe that knowledge is intended to ensure prevention and control in the organization.

2.3.7 Knowledge management in academic institution

Like in other organizations, KM has been identified as a critical asset for competitive advantage in academic institutions (Cheng et al., 2009; Daud & Hassan, 2008; Omona, van der Weide, & Lubega, 2010). In higher education, KM means relying on tech tools and solutions that support the institution's storage, organization, and dissemination of information.

If higher education has Knowledge management systems in place, they can be used to develop new courses and curricula; when it comes to research, scholars no longer have to start from scratch. However, researchers can considerably reduce their timelines when all previous studies, reports, and data are conveniently located.

Besides the advantages of the KM systems, organizations still face numerous challenges in nurturing and managing knowledge. Bhatt (2002) attributes part of these challenges to the organization internalizing only a part of knowledge; individuals internalize the other. Tippins (2003) concurs and affirms that numerous scholars and educators perceive knowledge as a personal commodity that should not be disseminated

openly. This is because some academics regard knowledge as a means of distinguishing themselves and are inclined to share only specific aspects of their expertise. Furthermore, tertiary institutions are commonly segmented into distinct functional domains (faculties, schools, research and development, student services) that operate autonomously and are required to exchange knowledge. TFPL (1999) argued that for organizations to compete effectively in the knowledge economy, they need to change their values and establish a new focus on creating and using intellectual assets. Kayembe and Nel (2019) Point out another challenge and state that the 4IR has created a significant issue in educational institutions regarding producing knowledgeable and skilled learners who match society's expectations. The transition from the third industrial revolution to the fourth revolution pushes academic institutions to incorporate innovative systems fuelled by research methodologies, data, and technology learning methods (Natarajan, 2018) . Pushpa (2019) believes that technologies of the 4IR, such as artificial intelligence, can improve knowledge management.

Summary

This section gives different views and perspectives on the definition of knowledge. This section discusses knowledge management and its application in education and the fourth industrial revolution. The following section will discuss theories on technology readiness and adoption and the model used in this study.

2.4 Theoretical Frameworks

2.4.1 Introduction

Many models have been used in the literature to predict individuals' cognitive acceptance behavior (Meade & Islam, 2006; Venkatesh, Morris, Davis, & Davis, 2003). The most commonly used models include the diffusion of innovations (DI) (Rogers, Singhal, & Quinlan, 2014), the theory of reasoned action (TRA) (Fishbein & Ajzen, 1975) the theory of planned behaviour(TPB) and the technology acceptance model (TAM)(Davis, 1985) .

TAM is widely used in literature due to its its economic structure and adequate explanatory capability (Venkatesh & Bala, 2008). Porter and Donthu (2006) state that two research paradigms elucidate the acceptance and adoption of novel technology. The first paradigm is system-specific and centers on how technology characteristics

influence individuals' perception of technology. TAM is widely employed within this paradigm (King & He, 2006; Porter & Donthu, 2006). The other paradigm concentrates on implicit personality dimensions (Porter & Donthu, 2006) .Within this paradigm the technology readiness index (TRI) is widely used (Parasuraman, 2000).

2.4.2 Technology Acceptance Model (TAM)

TAM was introduced in 1986 by Fred Davis and has become a dominant model in explaining the factors affecting users' acceptance of new technology. TAM, adapted from the TRA and TPB, assumes there are two variables that determine a person's acceptance of a new technology perceived usefulness(PU) and perceived ease of use (PEOU) (Holden & Karsh, 2010). TAM presumes a mediating role of the two variables PU and PEOU in a relationship between external variables and potential system usage. Despite this, scholars have urged additional investigation into whether PU and PEOU serve as mediators for the impact of antecedent factors(Venkatesh & Davis, 2000).

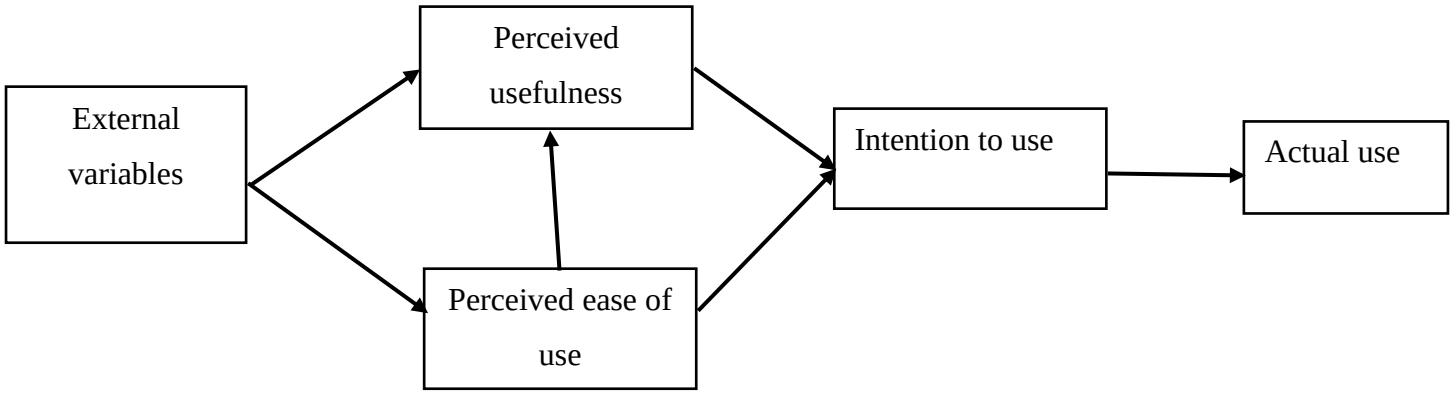


Figure 2. 5: Technology acceptance model Davis (1989)

Figure 2.5 above shows two technology beliefs PU and PEOU and how they influence attitudes that leads to the intention to use.

- **Perceived ease of use (PEOU)** is described by Davis (1985) as "the degree to which a person believes that using a particular system would be free of effort."

- **Perceived usefulness (PU)** is defined by Davis (1985) as previously as "the degree to which a person believes that using a particular system would enhance his or her job performance."

There are two additional structures within TAM which include attitude toward the use and behavioural intention to use.

- **Attitude towards** refers to the user's assessment of the attractiveness of utilizing a specific technology
- **Behavioral intention or intention to use** assesses the probability of an individual employing the application.

In the education setting, previous studies (Dumpit & Fernandez, 2017; Fathema, Shannon, & Ross, 2015; Teo, 2011) have adopted TAM to investigate the acceptance of different technologies. TRI has been used in literature as antecedents of PU and PEOU(Adiyarta, Napitupulu, Nurdianto, Rahim, & Ahmar, 2018; Godoe & Johansen, 2012). This study will also use TRI as antecedents of TAM (Venkatesh & Davis, 2000).

2.4.3 Technology Readiness Index (TRI)

Parasuraman (2000) defined the TRI as "a propensity or degree to accommodate new technologies in achieving goals set by individuals at work or in their daily lives." The structure can be considered as a general mindset that arises from cognitive motivators and deterrents working together to influence an individual's inclination towards adopting novel technologies (Kleijnen, Wetzels, & De Ruyter, 2004). TRI comprises four factors: optimism (OPTI), innovativeness (INNO), discomfort (DISCOM), and insecurity (INSEC). Parasuraman (2000) combines OPTI and INNO as (positive technology readiness) and DISCOM and INSEC as (negative technology readiness).

- **Optimism** relates to a positive view of technology and a belief that technology offers people increased control, flexibility, and efficiency. This dimension of TR mostly captures the positive state of mind about a technology".
- **Innovativeness**: or a tendency to be an early adopter of technology and opinion leader."
- **Discomfort** is a perception of being unable to control the technology and feeling overwhelmed by it." DISCOM measures anxiety, fear, and concerns individuals feel when they about to embrace new technology.
- **Insecurity** or suspect of technology and doubt its capability to work.

Categorization of TRI literature can be done into two types. The first type evaluates the technology readiness scores of subjects through TRI (Caison, Bulman, Pai, & Neville,

2008; Taylor, Celuch, & Goodwin, 2002). The majority of the findings show that TRI scores vary across subjects and contexts. The second type of literature utilizes TRI in conjunction with other theories to explore individuals' adoption of novel technologies (Kleijnen et al., 2004; Liljander, Gillberg, Gummerus, & Van Riel, 2006; Walczuch, Lemmink, & Streukens, 2007).

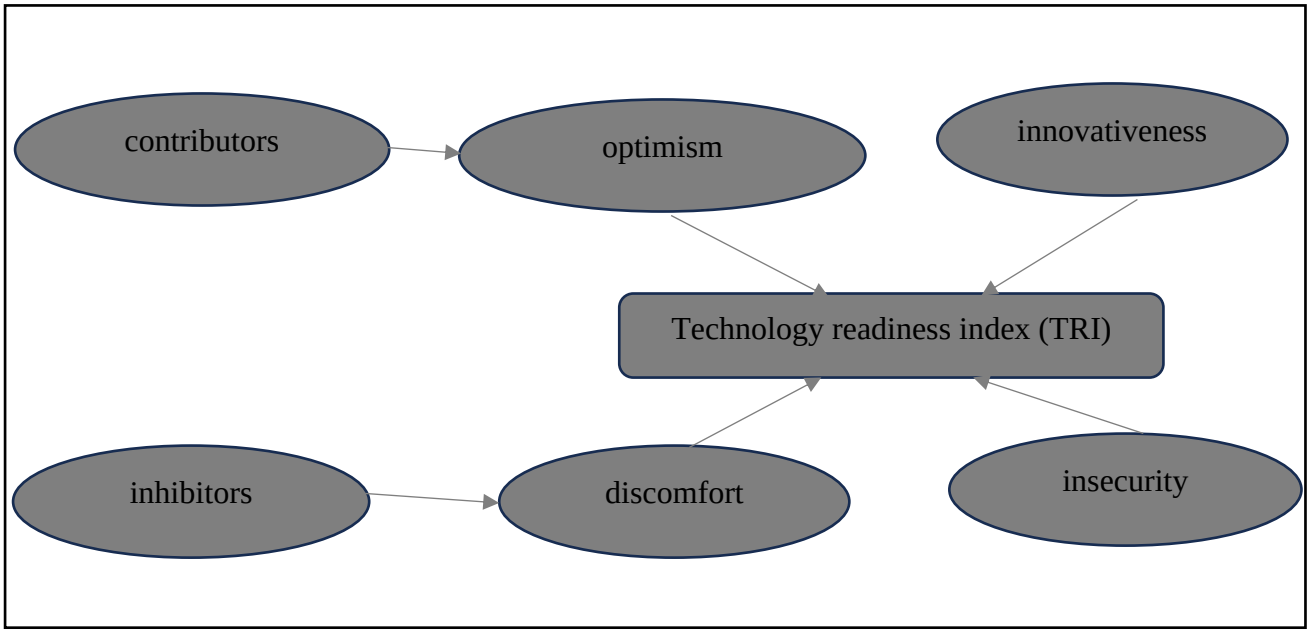


Figure 2. 6: Technology Readiness Index (TRI) Model

As shown in the above figure, OPTI and INNO are contributors and, DISCOM and INSEC are inhibitors of adopting new technology.

2.4.4 Research framework and hypothesis development

This research combines the Technology Acceptance Model (TAM) and the technology acceptance model (TAM) for the following justifications.

- TAM and TRI can be used to explain individuals acceptance of a new technology (Parasuraman, 2000; Venkatesh & Davis, 2000).
- While TAM relies on perceptions specific to the system to elucidate technology acceptance, TRI draws upon individuals' overall predisposition (Yi, Tung, & Wu, 2003).
- Finally the predictors PU and PEOU are employed to mediate the forecast of people's technology acceptance (Agarwal & Prasad, 1999).

For these reasons, the scholar believes it is theoretically appropriate to integrate TAM with TRI to investigate academic staff acceptance of 4IR technologies in the KM process. Figure 2.7 depicts the research framework. The framework involves the basic concept of TAM, which indicates academic staff's intention to use 4IR technology and will be affected by their PEOU and PU of 4IR technology. The variables of TRI (OPTI, INNO, DICOM and INSEC) are antecedents of PU and PEOU.

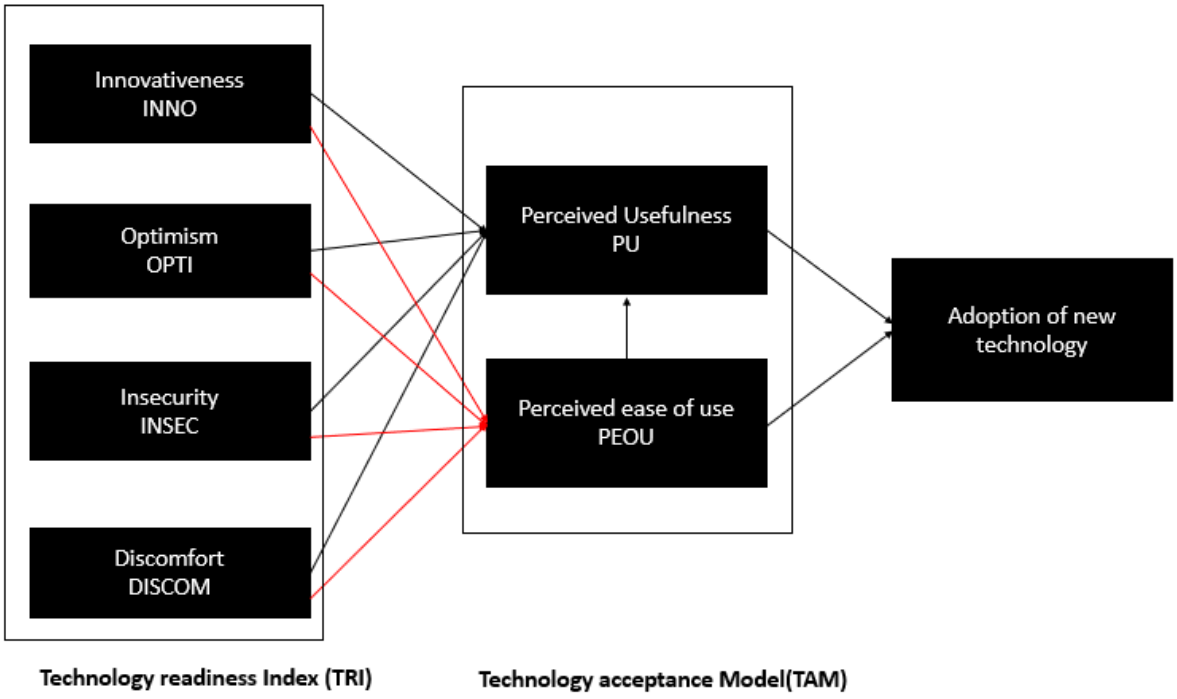


Figure 2. 7: TRAM model

A. Effect of optimism on PU and PEOU

OPTI is a feeling that makes people believe that technology is a good thing (Tsikriktsis, 2004). An optimist believes that adopting new technology will increase their productivity, flexibility and efficiency (Parasuraman, 2000). Therefore, optimists view technology as more beneficial and user-friendly as they are not bothered by it. From the above discussion we hypothesised:

- H1a: Optimism positively influences academic staff' PU of 4IR technologies.
- H1b: Optimism positively influences academic staff PEOU of 4IR technologies.

B. Effect of innovativeness on PEU and PEOU

INNO denotes the inclination to be a trailblazer in technology and a visionary (Parasuraman, 2000). Innovative people have strong intrinsic motivations to embrace

and enjoy new technology (Agarwal & Prasad, 1999). Moreover, previous studies have proved that high INNO have in general, a positive impression of the usefulness and ease of use of new technology(Walczuch et al., 2007). Therefore, we hypothesised:

- H2a: Innovativeness positively influences academic staff' PU of 4IR technologies
- H2b: Innovativeness positively influences academic staff PEOU of 4IR technologies.

c. Effect of discomfort on PEU and PEOU

DICOM pertains to the perceived absence of authority over technology and the sensation of being swamped by it (Parasuraman, 2000). It has been proved scientifically that individuals who are uncomfortable or believe that technology is designed to smarter people than them tend to neglected it because they believe technology is unsuitable for them and it was made for genius (Parasuraman, 2000). From this discussion the following hypothesis are proposed:

- H3a: Discomfort negatively influences academic staff' PU of 4IR technologies
- H3b: Discomfort negatively influences academic staff PEOU of 4IR That is, they may tend to have anxious feelings about the use of technology.

D. Effect of insecurity on PEU and PEOU

hesitation towards new technology, known as insecurity is a sense of doubt and mistrust in its effectiveness (Parasuraman, 2000). In general people with high INSEC assurance with new technology because they perceive risk everywhere (Parasuraman & Colby, 2001). (Lu, Hsu, & Hsu, 2005; Siegrist, 2000) have affirmed that the perception of risks greatly influences the perceived usefulness (PU) and perceived ease of use (PEOU) of new technology. People are only willing to take the risk of using new technology when they believe that it will provide them with significant benefits (Tsikriktsis, 2004). Hence, we hypothesis:

- H3a: Insecurity negatively influences academic staff' PU of 4IR technologies
- H3b: Insecurity negatively influences academic staff PEOU of 4IR technologies

E. Effect between PU and PEOU

PEOU pertains to the degree to which an individual perceives that utilizing the system will not require exertion, while *PU* pertains to the degree to which an individual believes that employing the system will improve their work efficiency. (Venkatesh & Davis, 2000). Some studies such as Davis (1989) have demonstrated that PU is affected by PEOU. However, some research failed to the relationship between PU and PEOU (Chau & Hu, 2002; Chismar & Wiley-Patton, 2003). Hence, we hypothesize:

- H5: academic staff PEOU of 4IR technologies positively influences their PU of 4IR technologies.

F. Effect among PU, PEOU and behavioral intention.

TAM proposes that an individual's intention to use technology is determined by two distinct behavioural beliefs, namely PEOU and PU (Davis, 1989). Earlier research has confirmed the correlation between PEOU and PU in relation to the intention to use technology (Chau & Hu, 2002; Chismar & Wiley-Patton, 2003; Van Schaik, Bettany-Saltikov, & Warren, 2002). However, other scholars do not support the relationship between PU, PEOU, and the intention to use (Chau & Hu, 2001; Van Schaik et al., 2002) . Therefore, we proposed the following hypotheses:

- H6: Academic staff PEU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process.
- H7: Academic staff PEOU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process.

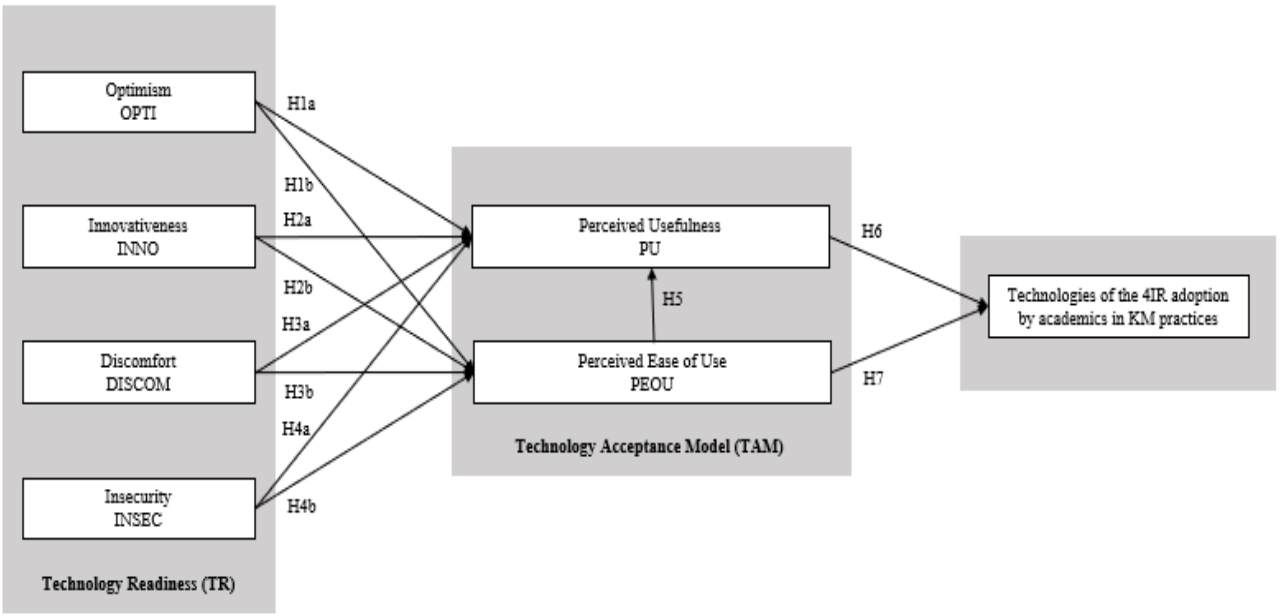


Figure 2. 8: Research framework

CHAPTER 3: METHODOLOGY

3.1 Introduction

The present chapter concentrates on the investigation techniques employed in this research. Scientific investigation is inquiry is carried out by applying a series of fundamental presumptions. The study takes into account the fundamental presumptions and the leading principles to choose the most suitable approach for addressing the research inquiries, accomplishing the research objectives, and examining the hypotheses.

Creswell (2014) defines *research* as the systematic process of collecting, recording, analysing, and interpreting information to create new knowledge. This research adopted the research onion suggested by Mark Saunders, Lewis, and Thornhill (2009). Figure 3.1 illustrates the research onion with its six main layers.

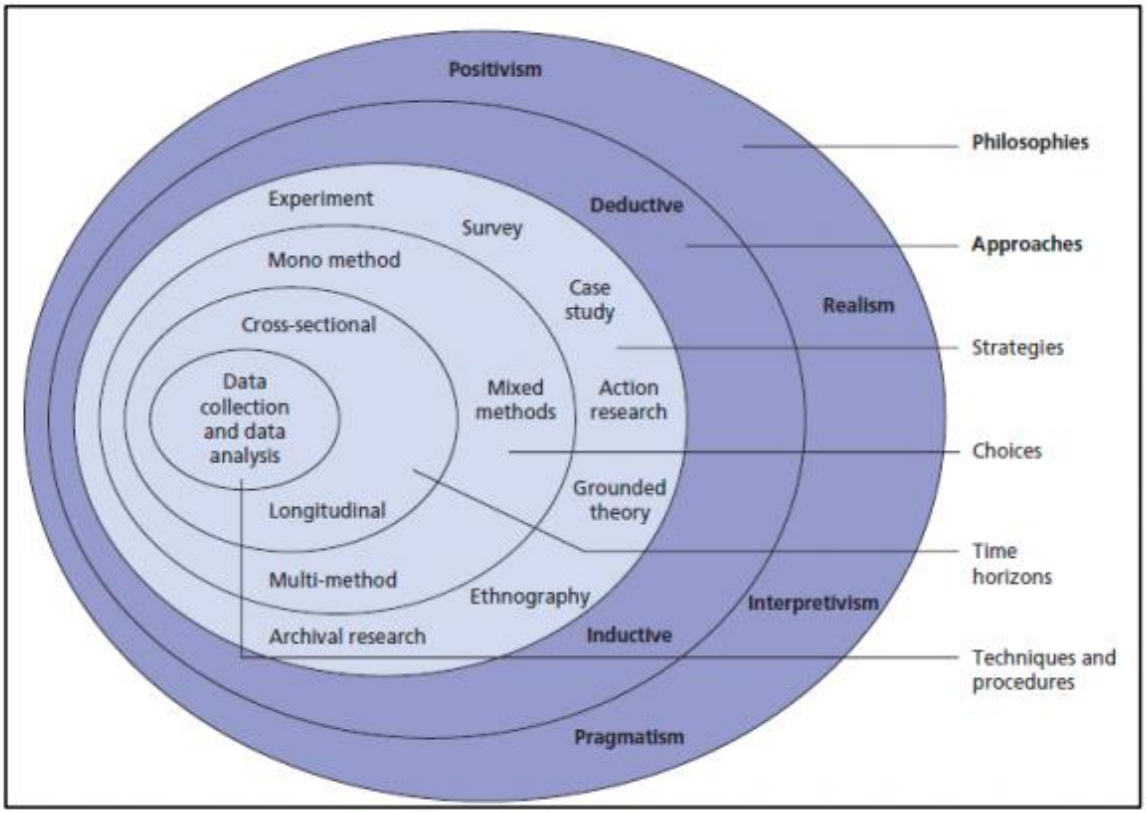


Figure 3. 1: Research Onion Source: (Mark Saunders et al., 2009)

This research followed the six main layers of the research onion to achieve the research objectives and the aim of the study. The advantages, disadvantages, and importance of

each research method were considered before adopting the appropriate research method. Creswell (2014) believes this kind of discussion is important because it can help researchers make informed decisions about the appropriate methods that will help achieve the research goals and test hypotheses to answer questions.

3.2 Research objectives, questions and hypothesis

The consistency of the research methods with the research objectives and questions is vital. Therefore, the first part of this chapter restates the research objectives, questions, and hypotheses.

3.2.1 Research objectives

The "primary aim of this research is to assess the readiness of academic staff to adopt the technologies of the 4IR to improve KM practices. Five objectives were formulated to address the main objective.

- To establish whether the technology readiness index effect the perceived usefulness of technologies of the 4IR
- To explore the relationship between the technology readiness index and the perceived ease of use of technologies of the 4IR
- To establish the relationship between perceived ease of use and the perceived usefulness of technologies of the fourth industrial revolution
- To establish if perceived usefulness and ease of use affect the intention to use the fourth industrial revolution in the knowledge management process.
- To ascertain the perceived benefits of adopting technologies of the 4IR on" KM practices.

3.2.2 Research questions

The following questions were formulated:

- Is there a relationship between technology readiness index and the perceived usefulness of technologies of the 4IR?
- What type of relationship exist between technology readiness index and the perceived ease of use of technology of the 4IR?
- What type of relationship exist between perceived ease of use and perceived usefulness

- Does perceived usefulness and perceived ease of use of technology influence the adoption of technologies of the 4IR in KM practices?
- What are the perceived benefits of adopting technologies of the 4IR in KM practices?

3.2.3 Hypothesis

The following hypotheses were formulated:

H1a. Optimism positively influences academic staff' PU of 4IR technologies

H1b: Optimism positively influences academic staff PEOU of 4IR technologies

H2a: Innovativeness positively influences academic staff' PU of 4IR technologies

H2b: Innovativeness positively influences academic staff PEOU of 4IR technologies.

H3a: Insecurity negatively influences academic staff' PU of 4IR technologies

H3b: Insecurity negatively influences academic staff PEOU of 4IR technologies

H4a: Discomfort negatively influences academic staff' PU of 4IR technologies

H4b: Discomfort negatively influences academic staff PEOU of 4IR technologies

H5: academic staff PEOU of 4IR technologies positively influences their PU of 4IR technologies.

H6: Academic staff PEU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process.

H7: Academic staff PEOU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process.

3.3 Research philosophies

Philosophy is defined by Elliott, Knight, and Cowley (1997) as the "use of reason or argument in seeking truth and knowledge, especially of ultimate reality or of general causes and principles". *Research philosophy* is related to the methods used in every research (Eriksson & Kovalainen, 2015; Wilson, 2014b). Research philosophy is the fundamental assumption that guides research behaviour. M Saunders, Lewis, and Thornhill (2016) believe that assumptions derived from personal worldviews involve research strategies and methods that support research. The following subsections

discuss the branches of the research philosophy proposed by M. N. Saunders, Lewis, Thornhill, and Bristow (2015) research "onions": positivism, realism, interpretivism, and pragmatism.

3.3.1 Positivism research paradigm

According to Henning (2004) , *positivist philosophy* is based on the philosophical idea that observations and reason are means to understand human behaviour. The positivist philosophy is based on the philosophical idea that observations and reason are means to understand human behaviour. M Saunders et al. (2016); Sekaran and Bougie (2016) concur that positivism is a research philosophy that endorses the scientific method as the most reliable means to achieve objective truth. Positivistic researchers believe that the universe operates according to the law of cause and effect, which can be substantiated through scientific methods (Sekaran & Bougie, 2016). Positivism is linked to quantitative data collection and analysis. Positivist researchers utilize a deductive approach to test established theories through hypotheses formulation and statistical analyses (Sekaran & Bougie, 2016; Wilson, 2014b). According to Dudovskiy (2016), According to Dudovskiy (2016), positivist philosophy can be summarized as follows

- The processes of investigation follow the same logic across sciences
- The aims of studies should be to provide explanations and make predictions
- It is based on empirical observation with the application of inductive logic to the development and formulation hypotheses
- Scientific methods must be value-free and be judged by logic

The positivism philosophy aims to study observable and measurable behaviour in a controlled environment (Mark Saunders, Lewis, & Thornhill, 2012). This study adopted the positivism philosophy to identify factors that can influence the adoption of technologies of 4IR in KM practices. The researcher adopted the positivist philosophy to identify factors that can be obstacles or accelerators to the knowledge management p.

3.3.2 Realism research paradigm

Bell, Bryman, and Harley (2018); Sekaran and Bougie (2016) contend that the realistic ideology asserts that the factual veracity is autonomous of the human psyche. For a pragmatic investigator, the veracity is solely what it appears to be and nothing beyond

that. Additionally, realism suggests that the most effective means of conducting research is through the scientific approach, and adherents of realism maintain that the truth is reflected in the reality we observe. To put it differently, objects possess an autonomous existence, separate from the human psyche (M Saunders et al., 2016). Similar to positivism, realistic epistemology uses a scientific approach to the development of knowledge (M Saunders et al., 2016), and there exist two categories of realism: direct realism and critical realism. The notion of realism asserts that objective truth is unrelated to the human mind. For a realistic investigator, reality exists as it is, without any embellishment. Additionally, realism emphasizes that the scientific approach is the most effective way to conduct research. Realists maintain that the reality we perceive is the truth, meaning that objects possess an independent existence from the human mind (M Saunders et al., 2016) . There are two types of realism: direct realism and critical realism.

Direct realists believe that the world can be described through sensory experience. Nevertheless, critical realists challenge the views of direct realists and contend that the authenticity we apprehend via our senses as veracity could be a deceptive delusion (Dudovskiy, 2016; Mark Saunders et al., 2012; Sekaran & Bougie, 2016). Critical realists maintain that an actuality exists, albeit it is impossible to verify such suppositions (Easton, 2010). In addition, Sekaran and Bougie (2016) affirmed that critical realists believe emotion, motivation, and satisfaction are subjective and, therefore, difficult to measure. Easton (2010) states that "critical realism acknowledges that social phenomena are intrinsically meaningful, and hence that meaning is not only externally descriptive of them but constitutive of them (though, of course, there are usually material constituents too) ."Our understanding of reality stems from social conditions and can only be understood by social participants participating in the knowledge derivation process that critical realism acknowledges that social phenomena are intrinsically meaningful, and hence that meaning is not only externally descriptive of them but constitutive of them (though of course there are usually material constituents too) . Due to the subjectivity of realist philosophy, this study did not adopt it.

3.3.3 Interpretivism research paradigm

Interpretivism is also called constructivism, qualitative or phenomenological research(Creswell, 2014; Dudovskiy, 2016; Gichuru, 2017). Scholars who utilize the

Interpretive philosophy endeavor to comprehend the personal and subjective significance of individuals within the research field (Goldkuhl, 2012). Simply put, this approach elucidates how individuals interpret and communicate their experiences and observations with others, which ultimately shapes their values and actions (Mark Saunders et al., 2009).

Interpretivism is an alternative to positivism in natural science research, emphasizing the importance of minimizing the divide between the researcher and the subject of study, both of which are social actors (Kelliher, 2011; Mark Saunders et al., 2009). This implies that the researcher and the social behavior being studied are intertwined, particularly in the fields of social and management studies. Thus, adopting an interpretive perspective is crucial to gain a comprehensive understanding of the social phenomenon being examined, and to avoid the researcher's perspective unduly influencing the interpretation and discussion of the study's findings (Mark Saunders et al., 2009) . The challenges of the interpretivism philosophy include determining the reality, validity, and generalization (Kelliher, 2011).

3.3.4 Pragmatism research paradigm

The pragmatic philosophy is a fusion of positivism and interpretivism philosophies. According to Sekaran and Bougie (2016), researchers who adhere to the pragmatic philosophy believe that any research based on either objective, observable phenomena or subjective meanings can yield valuable knowledge, depending on the research questions. They do not take a particular stance. Creswell (2014) also noted that pragmatists, unlike adherents of other research philosophies, do not concentrate on methods; instead, they focus on the research problem and employ all approaches to comprehend it. The pragmatic philosophy highlights the link between theory and practice (Sekaran & Bougie, 2016). Pragmatists contend that there are numerous ways of interpreting the world and that no single method can provide the complete picture(M. N. Saunders et al., 2015). This approach calls for pluralistic approaches to comprehending social problems and employs a mixed-method research strategy (Creswell, 2014). Hence, mixed methods researchers advocate using various methods, worldviews, assumptions, data collection forms, and analysis methods (Creswell,

2014) .The pragmatic approach facilitates triangulation, and the pragmatic philosophy is a suitable research approach for data collection and analysis.

After examination of all research philosophies, the researcher considered pragmatism the most appropriate philosophy to guide this study. The justification is that this study used mixed methods, qualitative and quantitative, to collect and analyse data. This research philosophy offers the opportunity to include different perceptions, approaches, and assumptions, leading to improve data collection, analysis and interpretation of the results to produce outstanding research outcomes. Morgan (2007) suggests that the adoption of pragmatic strategies, as a philosophical stance, is one the best ways to justify the combination of numeric and non-numeric methods of enquiry in a study in the management\social sciences. Johnson and Onwuegbuzie (2004) stated that the combination of numerical and non-numerical sources of data collection and analysis procedures within a study paves the way for paradigm shifts leading to reliable outcomes, which is more realistic through a pragmatic philosophical stance.

3.4 Research approaches

3.4.1 Deductive method

Collis and Hussey (2013) state that a study is considered deductive if it involves the development and testing of a theoretical framework through empirical observations to either confirm or disprove the theory. Scholars who utilize this approach rely on deductive reasoning. Deductive reasoning involves a logical progression from general to specific, allowing researchers to identify correlations within a study (M. N. Saunders et al., 2015). This method involves deriving conclusions from multiple premises. Positivistic researchers believe that social science utilizes deductive logic and empirical observation of individual behavior to validate theories that can predict human behavior (Neuman & Kreuger, 2003). According to Collis and Hussey (2013), deductive reasoning is often employed to determine the interrelationships between variables.

3.4.2 Inductive method

Collis and Hussey (2013)believe that inductive research involves the development of a theory from the observations of empirical reality. It is usually done through exploratory research (Wilson, 2014a). The inductive approach method starts with data collection,

from which generalizations are made based on the collected data (Morgan, 2007). In this approach, there's no need to formulate hypotheses but focus on the research questions that help achieve research goals (Dudovskiy, 2016). A unique feature of inductive methods is the qualitative data collection process, which allows the combination of similar characteristics of samples.

After examination of the deductive and the inductive method the researcher decided to use a combination of both deductive (quantitative) and inductive (qualitative) approaches. Saunders et al. (2009) observed that it is not impossible to combine deductive and inductive approaches. They maintained that, in their experience, the advantages of such combinations are significant. The combination of deductive (quantitative) and inductive (qualitative) methods in a single study based on the topic or research questions is referred to as mixed methods (Creswell, 2009). It is logical to integrate deductive and inductive approaches in management sciences research, due to the peculiar nature of business activities which involves objects, and constructs, as well as social actors.

3.5 Research design

Research design is the structural approach to creating a framework for solving research questions and obtaining answers. This process involves arranging data to achieve the required results (Sekaran & Bougie, 2016). *Research design* can also be defined as testing a hypothesis under predetermined, controlled conditions. Bless, Higson-Smith, and Kagee (2006), also describes the research design as testing a hypothesis under controlled conditions. Bryman (2012)states, "a research design provides a framework for collecting and analyzing data."

In 2015, California categorized various research designs, including action research design, case study design, causal design, cohort design, cross-sectional design, descriptive design, experimental design, exploratory design, historical design, longitudinal design, meta-analysis design, observational design, philosophical design, and sequential design. The research conducted in this study utilized both descriptive and exploratory research designs.

Descriptive research design was employed for close-ended questions section A and B of the questionnaire, while exploratory design was used for open-ended questions section C of the questionnaire. According to Sekaran and Bougie (2016), exploratory studies are conducted to expand knowledge on a particular situation, community, phenomenon, or person where information is scarce (Bless et al., 2006). M Saunders et al. (2016) suggested three critical steps in conducting exploratory studies: examining literature, conducting interviews with key informants, and conducting focus group interviews. They noted that during the initial phase of exploratory studies, researchers approach the phenomenon holistically. As the study progresses, the phenomenon becomes narrower, which is essential for making a valid contribution to the body of knowledge using exploratory studies (Sekaran & Bougie, 2016). Furthermore, this study employed the basics of exploratory study to review the literature on the link between fourth industrial revolution and knowledge management.

According to Sekaran and Bougie (2016), a descriptive study is undertaken to ascertain and be able to describe the characteristics of the variables of interest in a situation. Du. Plooy-Cilliers, Davis, and Bezuidenhout (2014) provide a similar explanation and explain that descriptive research identifies "the characteristics of phenomena, relations between variables or relationships between phenomena as accurately as possible. Mark Saunders et al. (2012) states, Descriptive research designs help answer the questions of who, what, when, where, and how associated with a particular research problem. The main aim of a descriptive study is to offer the researcher a profile or to describe relevant aspects of the phenomenon of interest from an individual, organizational, industry-orientated, or another perspective" (du Plooy-Cilliers et al., 2014; Sekaran & Bougie, 2016).

A descriptive investigation permits the examiner to acquire knowledge regarding a phenomenon within a particular research domain (Bless et al., 2006), such as the phenomenon of technology, the willingness to embrace technologies of the fourth industrial revolution, and its influence on the knowledge management process. A research plan can be developed in numerous ways. Qualitative and quantitative are two extensive techniques of data collection and interpretation in research. In this investigation, the quantitative research plan was implemented. Qualitative research pertains to information collected narratively through interviews or observations

(Sekaran & Bougie, 2016). Usually generating non-numeric data. The qualitative method is utilized to comprehend people's attitudes, experiences, conduct, and interaction (Pathak, Jena, & Kalra, 2013). Bryman (2012) also agrees that "qualitative research is a strategy that usually emphasizes words rather than quantification in the collection and analysis of data." Analysing qualitative data can be challenging as there are few commonly agreed-upon rules and guidelines for assessing such data (Sekaran & Bougie, 2016) .

In this study, both the quantitative and the qualitative plan was employed. The quantitative approach is research-based on numerical and objective methods (Creswell, 2014).This definition is supported by Bell et al. (2018), who state that quantitative research focuses on quantification in the gathering and processing data. A third definition is put forward by Bell et al. (2018). They state that quantitative research employs "measurement methods to record and investigate aspects of social reality." This study considered the above three definitions, with the common theme of mathematical value or quantification as the critical focus. Hoe and Hoare (2012), note that quantitative techniques can test hypotheses and determine whether a relationship exists between variables. Hoe and Hoare (2012) concur that quantitative data can be counted and measured, suggesting methods such as surveys, clinical trials, and questionnaires. For this research, the quantitative method was adopted to provide precise values and enumeration and enable the measurement of a potential relationship. Thus, the questionnaire constituted a crucial element of the research design which allowed the researcher to acquire information that could be coded and used to analyze the data.

3.6 Time horizons

Time horizon is referred to by Mark Saunders et al. (2009) as the estimated time to complete research. M Saunders et al. (2016) discussed the two main types of time horizons: longitudinal study and cross-sectional study. This study adopted the cross-sectional design.

3.6.1 Cross-sectional

A *cross-sectional study* is a study that collects data from participants once (Das, Williams, Drummond, & Wilson, 2010) . Hulley et al. (2001) agree with this definition and point out that the researcher draws measurements of all variables once without

requiring follow-up in a cross-sectional study. (Wilson, 2014a) defines a cross-sectional investigation as a survey approach that commonly employs a questionnaire to gather data. The cross-sectional study can be either descriptive or analytical. A descriptive cross-sectional study involves characterizing a particular population's study outcome within a specific period (Bell et al., 2018). The significant benefit of a cross-sectional study is its cost-effectiveness and time efficiency. This research's design was cross-sectional because the data was collected only once.

3.7 Target Population

The *target population* can be defined as people or objects of interest that are the subject of investigation (Sekaran & Bougie, 2016) . For (Wilson, 2014a), a target population is "research subjects that are being sampled." Trochim and Donnelly (2001)also add that the target population shares specific characteristics. The target population for this study comprised all academic staff in the faculty of commerce, law, and management, specifically in the school of business science and economics and finance at the University of Witwatersrand in the Gauteng province in South Africa. Gauteng province was selected for the following reasons: Gauteng is the financial hub of South Africa, and the location is convenient for the researcher.

The reasoning behind including different schools was to have a broader viewpoint of the readiness of academic staff to adopt the technologies of the 4IR. The estimated research population was approximately 163 academic employees.

Table 3. 1: List of academic staffs in the faculty of commerce, law and management

Name of the school	Number of academic staffs
School of business science	37
School of economics and finance	44
School of accountancy	82
Total	**163**

3.8 Sampling technique design

The sampling technique is defined by (Sekaran & Bougie, 2016)as "the approach by which a sample for a study arrives." There are two main sampling techniques, namely the probability and the non-probability sampling techniques (Wilson, 2014a).

3.8.1 non-probability sampling

As per Sekaran and Bougie (2016), non-probability sampling involves selecting a sample based on the researcher's personal judgement. This technique does not allow for generalization of the sample as it does not represent the entire population (Creswell, 2014). Non-probability sampling is more cost and time efficient than probability sampling (Welman & Kruger, 2001). Convenience sampling, purposive sampling, quota sampling, and snowball sampling are some examples of non-probability sampling designs.

3.8.2 Probability sampling

The technique of probability sampling involves giving each element of the population an equal opportunity to be selected for the sample (Wilson, 2014a). The statistical probability sampling technique represents an unbiased subset of the population (Collis & Hussey, 2013) .Nonetheless, the non-probability sampling design is more budget-friendly and less time-consuming than the former. Probability sampling comprises of various methods including simple random, systematic, stratified, cluster, and multi-stage sampling. Upon a thorough analysis of the pros and cons of both sampling designs, the investigator opted for the stratified random sampling technique, which is a probability sampling design employed in the research.

After carefully examining the advantages and disadvantages of the two-sampling design, the researcher adopted the stratified random sampling technique, a probability sampling design achieved in the study.

The technique of stratified random sampling involves dividing the desired population into distinct strata, from which samples are then drawn. This approach ensures that each stratum is well-represented in the study. For instance, in this investigation, the faculty of commerce, law, and management at the University of the Witwatersrand (South Africa) is considered one stratum, with other strata including the school of business science, the school of economics and finance, and the school of accountancy. Teddlie and Tashakkori (2010)outline two categories of stratified random sampling: proportionate and disproportionate. Proportionate stratified sampling involves taking samples from each stratum in proportion to its population, while disproportionate stratified random sampling does not maintain the same proportion of elements in each stratum.

3.8.3 Sample size

Sekaran and Bougie (2016)define a *sample size* as the number of elements that need to be incorporated into a study. "The Krejcie and Morgan sampling method is utilized in this study to identify the sample size. This technique uses a table for a limited population.

Krejcie and Morgan (1970)'s formula is:

$$s = X^2NP(1-P) \div d^2(N-1) + X^2P(1-P) \qquad \textit{Equation 3.1}$$

s = required sample size

X^2= the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841)

N= the population size

P= the population proportion (assumed to be .50 since this would provide the maximum sample size).

d = the degree of accuracy expressed as a proportion (.05).

As previously stated, the population (N) of this study is approximately 163 academic employees. At a 95% confidence level and a margin error of 5%, the sample size of this study is 113 participants.

Number of academic staff from each school with a target population of 163 academic employees and a sample size of 113 employees.

Table 3. 2: Sample size

Number of academic staffs		Sample
School of business science	37	(37/163) *113= 26
School of economics and finance	44	(44/163) *113= 30
School of accountancy	82	(82/163) *113= 56

3.9 Data collection procedures

According to Creswell (2014), the process of obtaining information is known as data collection, which aims to provide answers to a specific issue. The collection of data will involve the use of primary and secondary research techniques. Initially, secondary research will be conducted in the form of a literature review, followed by primary research, which will consist of a questionnaire with both open and closed-ended queries.

The technique employed for gathering information in this study involves sending out a questionnaire via email to the teaching staff in the commerce, law, and management departments of Wits University.

3.9.1 Secondary sources of data

Creswell (2014) defines the data collection procedure as gathering data to offer solutions to the identified problem. Data will be collected through primary and secondary research methods. The secondary research was conducted first in the form of a literature review. Then the primary research followed and consist of a structured questionnaire with both open and closed-ended questions.

The administrator of the school was in charge to send the questionnaire to all the academic staff in the faculty of commerce, law, and management at wits university.

3.9.2 Primary sources of data

Creswell (2014) define the primary data source as the original data collected for the study. Both closed, and open-ended questions are included in the questionnaire to conduct the primary research. According to (Sekaran & Bougie, 2016) a questionnaire can be an efficient method for collecting data if the variables are already identified. The researcher considered the information from the literature review and other critical issues, such as the wording and the research objective, to design the questionnaire.

3.10 Research instrument

This “investigation utilized a survey comprising both closed and open-ended inquiries as a reliable research tool. A survey is a research tool that involves a pre-written set of queries to which respondents provide their responses (Sekaran & Bougie, 2016). Surveys are an effective way to gather data, particularly when the researcher has identified the variables of interest (Sekaran & Bougie, 2016). According to (M. N.

Saunders et al., 2015), a survey generally aims to collect three primary types of data variables: opinions, behaviors, and attributes". The design of the survey considered three crucial aspects:

- The alignment of objectives of the study, the research questions, and the hypothesis.
- The wording of the questionnaire (simple language was used in the questionnaire for the sake of understanding; also, the researcher defined all abbreviations)
- The last critical issues were the coverage (the researcher ensured that the questionnaire covered academic staff in the selected faculty.

(Sekaran & Bougie, 2016)state that a questionnaire can be distributed to the potential respondent by post, emailed as an online questionnaire, or face-to-face by hand. Due to the COVID restrictions, the researcher opted for the electronic questionnaire distribution. The questionnaire is divided into three sections.

- Section A is designed "to collect demographic information about respondents.
- Section B contains questions designed to collect information about the significant variables covered in the study of the relationship between readiness to adopt the fourth industrial revolution technologies and knowledge management in academic institutions. There are 3 parts in this section: B1 was developed to access perceived usefulness, and B2 was developed to test the perceived ease of use of technologies of the fourth industrial revolution. A 5-point Likert-type rating scale that an American psychologist created, Rensis Likert, will be used in this study, ranging from 1 (strongly disagree) to 5 (strongly agree) (Wilson, 2014a); Treiblmaier and Filzmoser (2011) state that a Likert rating scale has changed how attitude research is performed because it was easy to use and interpret. Moreover, Likert scales help control many questions' answers, enabling their measurement as a single construct; this makes the questionnaire more reliable (Wilson, 2014a)(Wilson, 2014).
- Section C contains open-ended contain open-ended questions (structured questions) that elicit non-numerical data.

3.10.1 Strengths and challenges of the research instrument utilized

The survey possesses notable advantages, such as safeguarding the confidentiality and anonymity of participants, employing straightforward language in its queries to ensure comprehension, aligning the survey's objectives, research inquiries, and hypotheses, and providing open-ended questions for respondents to express their viewpoints. Furthermore, the survey allows for results to be presented through tables, percentages, bar charts, histograms, and other mediums, ensuring precise interpretation of outcomes. Lastly, the survey is cost-effective and efficient in terms of time.

The significant challenges were to obtain permission from other academic institutions. Initially, the researcher was supposed to collect data from three academic institutions but ended up collecting data from only one institution.

3.11 Data analysis

- The primary data of the research under the first section was analyzed utilizing descriptive statistics such as frequency counts, means, and standard deviation presented in frequency distribution tables, pie charts, and different graphs.
- The information from the second section of the questionnaire was coded and analyzed using inferential statistics captured in the IBM Statistical Package for the Social Science (SPSS) version 28. In this study, the inferential statistics are Pearson's correlation coefficient and multiple regression.
- Information from the last section was non-numerical and analyzed using content analysis. Information from the last section was non-numerical and analyzed using content analysis. Content analysis focuses on the assessment of the contextual implications of a transcript (Krippendorff, 2013). It is a non-numerical method of data analysis commonly used by researchers to examine narrative information. Both the content and context of the transcripts under investigation are assessed (Spencer, Ritchie, & Connor, 2003). First the information was grouped into themes and sub-themes. The purpose of this section was to collect opinions and views of academics' staffs regarding the use of 4IR technologies in education. The following steps were utilised in analysing the non-numerical data collected under section 'C' of the research instrument. Firstly, all questionnaires were given a number. Then the questionnaires were sorted because not all respondents completed the non-numerical section of the

questionnaire. Next texts were extracted from the questionnaires and organised into themes in line with the structured questions, while the emerging subthemes were also extracted. Finally, the emerging themes and subthemes or sentences were interpreted as illustrated in chapter four.

3.12 Reliability

Sekaran and Bougie (2016)put forward the importance of pre-test the questionnaire to ensure that the respondents understood the question, there was no ambiguity, and that there was no problem associated with wording in the research instrument. According to Creswell (2014) reliability is the extent to which research findings would be the same if repeated later or with a different sample of subjects. In other words, reliability has to do with the consistency, stability, and dependability of the measuring instrument adopted for the study. Reliability helps to assess the goodness of measure and indicates accuracy in measurement (Sekaran & Bougie, 2016). There are many ways to measure the reliability of the measurement instrument, such as split-half reliability and Cronbach's Alpha (Sekaran & Bougie, 2016).

Other scholars in the management field, such as (Davis, 1985) have used Cronbach's Alpha in similar studies. The researcher decided to use Cronbach's alpha method since it is a better way to test questions of the technology acceptance model (TAM).

The closer the Cronbach's alpha coefficient is to 1, the higher the internal consistency of the research instrument. George and Mallery (2019) provide the following techniques:

- Cronbach’s Alpha >0.90 = Excellent
- Cronbach’s Alpha between 0.80 - 0.89 = Good
- Cronbach’s Alpha between 0.70 - 0.79 = Acceptable
- Cronbach’s Alpha between 0.60 - 0.69 = Questionable
- Cronbach’s Alpha between 0.50 - 0.59 = Poor
- Cronbach’s Alpha <0.50 = Unacceptable

Zikmund, Babin, Carr, and Griffin (2003) recommend a size of pre-testing group of 25 or 50 subjects. This study will be considered that.

3.13 Validity

Validity is the extent to which the data collected truly reflect the phenomenon being studied. It has been revealed that there are validity difficulties in measuring attitudes and behaviours (Ticehurst & Veal, 2000). Sekaran and Bougie (2016)suggest three types of validity tests: content validity, criterion-related validity, and construct validity. This study took cognizance of two types of internal validity: content and construct validity.

3.13.1 Content validity

face validity, which is also referred to as content validity, evaluates the consistency between the various components and the idea by collecting evaluations from experienced evaluators and conducting preliminary examinations with numerous subgroups or other techniques (Sekaran & Bougie, 2016). In this research, we will gauge the content validity of the tool by seeking the views of specialists and the intellectual knowledge of experts in the relevant field. Before administering the tool, we also received input from supervisors. Eventually, we carried out some minor modifications to the tool based on the recommendations. Aside from that, we will pre-test the tool with a group of diverse individuals to guarantee its pertinence and comprehensibility. Other than that, the instrument was be pre-tested- by a group of academic staff within the Commerce, Law, and Management faculty.

3.13.2 Construct validity

The second form of content validity, commonly referred to as sampling validity, is achieved by ensuring that the study's constructs and objectives are in line with the research instrument. In this study, construct validity was ensured by utilizing instruments that have been devised by experts in the relevant field of study. To determine construct validity, a variety of model fit indices were employed. Lastly, to establish external validity of the instrument employed in this study, the results will be compared to those of similar studies conducted in other nations.

3.14 Delimitations of the study

The study presents some limitations as it targets only academic staff within three schools in commerce, law, and management faculty at wits university Johannesburg,

South Africa. Therefore, the results of this study cannot be generalized to all universities in the country.

Another methodological limitation regarding data collection is the utilization of a cross-sectional approach instead of a longitudinal one. Studies show that cross-sectional data collection cannot make conclusions directly via a causal inference (Meyer & Morin, 2016). However, the researcher had to use cross-sectional data collection due to time constraints.

3.15 Ethical consideration

The "investigator adhered to the ethical principles established by the University of Witwatersrand to ensure the genuineness and reliability of this investigation. The University's Ethical Clearance Application Form was duly filled out, and a duplicate of the research tool was appended. Furthermore, the Humanities and Social Science Research Committee of the University of the Witwatersrand authorized the ethical clearance (protocol number: H21/04/01)".

CHAPTER 4: DATA ANALYSIS AND INTERPRETATION OF RESULT

4.1 Introduction

This chapter presents the results and the interpretation of data based on the responses that were collected. This study made a use of IBM SPSS (Statistical Package for the Social Sciences) version 28 for analysis.

4.2 Response rate

This study target sample size was hundred and thirteen (113) academic staff in the faculty of commerce law and management at the university of Witwatersrand. Ninety (90) participants completed the online questionnaire, and one questionnaire was not correctly completed and was rejected. The remaining 89 questionnaires represent a 78,7 % response rate.

Johnson and Wislar (2012) suggests a minimum of 60% response rate in research. So, the response rate of 78.5% is in the acceptable range. This was achieved because the respondents were reminded to complete the questionnaire. Consent to participate in the study was obtained from all participants.

4.3 Reliability of the instrument

Table 4. 1: Reliability

Construct	Cronbach's alpha	items
optimism	0,77	4
Innovativeness	0,70	4
Discomfort	0,56	3
Insecurity	0,71	3
PU	0,71	4
PEU	0,69	4
IU	0,65	6

A reliability test was conducted on all questions in the questionnaire except for section one of the questionnaire on demographic information and the section on open ended

question. Table 4.1 "shows the majority of construct, five out of seven, have a Cronbach alpha statistic of above 0.7. The five constructs had a Cronbach alpha value that ranged from 0.70 to 0.78. A Cronbach's alpha value of 0.7 to 0.8 is generally accepted as an indicator of reliability (Baruch, 1999). The rest of the construct is lower than 0.7 (0,56, 0,69, and 0,65)." These values are below the recommended value 0,7 however, researchers such as Heale and Twycross (2015) argue that a Cronbach alpha value of 0.5 is sufficient in research.

4.4 Analysis of demographic data

There are three different types of demographic data in this study: gender, age group, and academic title of respondents.

Table 4. 2: Overall demographic statistics

		Gender	Age group	Academic title
N	Valid	89	89	87
	Missing	0	0	2
Mean		1.66	1.58	3.00
Median		2.00	1.00	3.00

The statistics shows that the majority of demographics data (gender and age group) have been answered. Only the academic title has two missing variables and are eligible for data analysis.

4.3.1 Gender

As depicted in Table 4.3 the frequency distribution of respondents based on their gender reveals that 44.9% of participants were male (n=40) and 43.8% were females (n=39). 11.2 % representing 10 respondents decided not to reveal their gender.

Table 4. 3: Frequency distribution of participant by gender

		Frequency	Percentage	Valid Percent	Cumulative Percent
Valid	Male	40	44.9	44.9	44.9
	Female	39	43.8	43.8	88.8
	I prefer not to say	10	11.2	11.2	100.0
	Total	100	100.0	100.0	

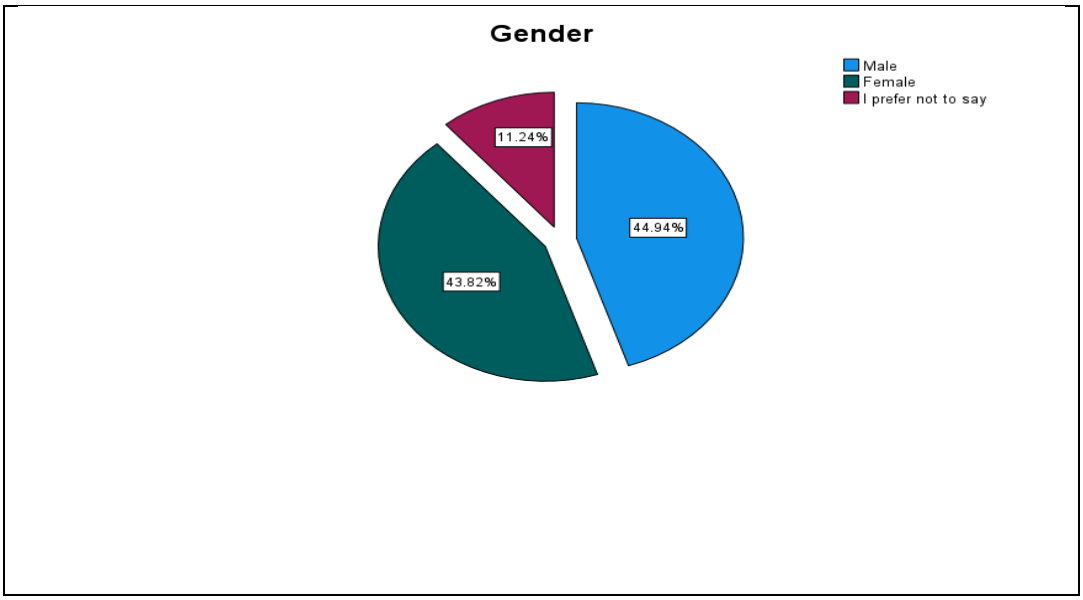


Figure 4. 1: Gender

Figure 4.1 presents the approximate percentage distribution of respondents based on their gender.

4.3.2 Age group

Figure 4.2 Is a pictorial representation of the distribution of respondents based on their age group.

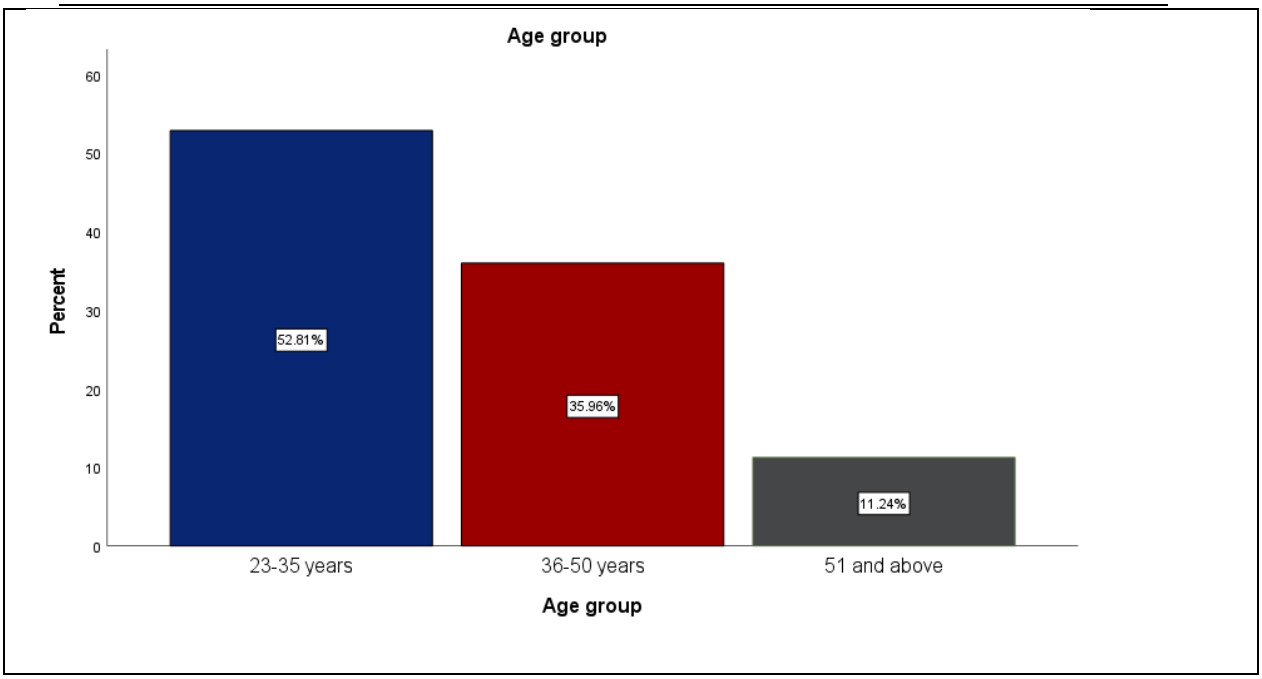


Figure 4. 2: Age group of respondents

Figure 4.2 shows that the majority of respondents (52.81%) are between the ages of 23 and 35. The 36-50 years old category represents (35,96%). The 51 and above category has the least respondent rate.

4.3.3 Academic title

Figure 4.3 presents the distribution of respondents based of their academic title.

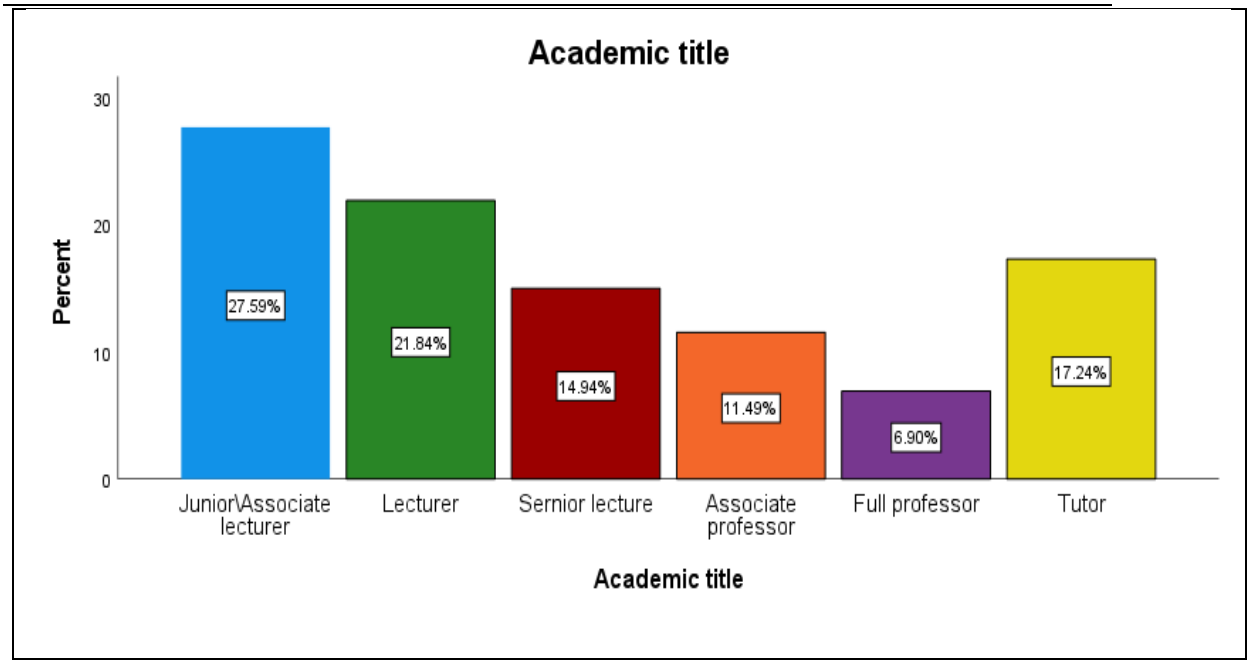


Figure 4. 3: Academic title of respondents

As presented in Figure 4.3, the majority of respondents, 24 (27,59%), were junior\associate lecturers, while 19 (21,84%) were lecturers. The number of respondents who were senior lecturers, associate professors, and tutors was 13(14.94%), 10(11.49%), and 15(17,24%), respectively. In the category with the least respondents, 6(6.9%) are full professors.

4.5 Analysis of research questions

4.4.1. Technology readiness index

4.4.1.1 Optimism

Optimism factors are presented in Table 4.4 below, indicating that positivism is a motivator of technology readiness, as showed by the high percentages of respondents who agreed and strongly agreed with the four questions.

Table 4. 4: Mean, standard deviation for OPTI construct

Optimism	Frequency Distribution						Descriptive statistics		Latent factor components)
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient

Q1.1 Technology contribute to a better quality of life	Count	1	3	20	44	20	62.7%	3.90	0.83	0.886
	%	1.1%	3.4%	22.7%	40%	22.7%				
Q1.2 Technology gives me more freedom of mobility	Count	1	12	19	38	18	63.7%	3.68	0.98	0.731
	%	1.1%	13.6%	21.6%	43.2%	20.5%				
Q1.3 Technology gives me more control over my daily life	Count	1	16	22	40	10	56.1%	3.47	0.95	0.813
	%	1.1%	18%	24.7%	44.9%	11.2%				
Q1.4 Technology makes me more productive in my personal life	Count	1	6	29	40	12	59.1%	3.64	0.84	0.683
	%	1.1%	6.8%	33%	45.5%	13.6%				
		Cronbach's Alpha					0.78			
		% Of total variation accounted for by latent factor					61.173%			

As indicated in Table 4.4 above, the highest indicator of positivism is from (question 1.2) technology gives them more freedom of mobility, as indicated by the highest percentage (63.7%) of respondents who agree and strongly agree. The response on the item produces a mean and standard deviation of 3.68 and 0.98, respectively. (Question 1.3) produced the lowest percentage (56.1%). The item's mean score and standard deviation were 3.47 and 0.95, respectively.

The last column of the table calculates the summary of all item of positivism using principal component or latent factors. The weights indicate that question 1.1, technology contributes to a better quality of life, has the highest (0.886) weight.

4.4.1.2 Innovativeness

Table 4.5 presents innovative factors. The table indicate the majority of respondents are innovative, as indicated by the high percentages of respondents who agreed and strongly agreed with the four questions that were asked.

Table 4. 5: Mean, standard deviation for INNO construct

Innovativeness		Frequency Distribution						Descriptive statistics		Latent factor components)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient
Q2.1 people come to me for advice on new technology	Count	1	19	31	35	3	42.7%	3.24	0.86	0.810
	%	1.1%	21.3%	34.8%	39.3%	3.4%				
Q2.2 I am among the first in my department/faculty to acquire new technology	Count	3	19	47	19	1	22.4%	2.97	0.78	0.782
	%	3.4%	21.3%	52.8%	21.3%	1.1%				
Q2.3 I can figure out new high-tech product and services without help from others	Count	0	20	26	39	4	48.3%	3.31	0.87	0.721
	%	0%	22.5%	29.2%	43.8%	4.5%				
Q2.4 I keep up with the latest technological developments in my areas of interest	Count	0	8	22	54	3	65.5%	3.60	0.70	0.596
	%	0%	9.2%	25.3%	62.1%	3.4%				
		Cronbach's Alpha					0.70			
		% Of total variation accounted for by latent factor					53.576%			

As indicated in table 4.5 above (question 2.4) I keep up with the latest technological developments in my areas of interest yield the highest percentage (65.5%) with a mean mean and standard deviation of 3.60 and 0.70, respectively. (Question 2.2) on the other hand yield the lowest percentage (22.4%) with a mean score and standard deviation of 2.97 and 0.78, respectively.

The last column of the table calculates the summary of all item of INNO using principal component or latent factors. The weights indicate that question 2.1, people who come to me for advice on new technology, has the highest (0.810) weight.

4.4.1.3 Discomfort

Table 4.6 below presents discomfort factors. The table shows that some respondents manifested a feeling of being overwhelmed by technology.

Table 4. 6: Mean, standard deviation for DISCOM construct

Discomfort		Frequency Distribution						Descriptive statistics		Latent factor components)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient
Q3.1 I sometimes feels as if I am being taken advantage of by someone who knows more than I do	Count	5	46	18	19	1	22.4%	2.61	0.92	0.621
	%	5.6%	51.7%	20.2%	21.3%	1.1%				
Q3.2 There should be caution in replacing important people tasks with technology because new technology is not dependable	Count	1	9	31	46	2	53.9 %	3.44	0.75	0.790
	%	1,1%	10.1%	34.8%	51.7%	2.2%				
Q3.3 Technology always seems to fail at the worst possible time	Count	3	23	38	22	3	28.1%	2.99	0.88	0.787
	%	3.4%	25.8%	42.7%	24.7%	3.4%				
		Cronbach's Alpha					0.56			
		% Of total variation accounted for by latent factor					54.275%			

As indicated in table 4.6 above, (question 3.2) produced the highest percentage (53.9%) of respondents who agreed and strongly agreed to the statement. The response on the item produces a mean and standard deviation of 3.44 and 0.75, respectively.

The lowest scoring item of discomfort came from (Question 3.1) This statement produced the lowest percentage (22.4%) of academic staff who agreed and strongly agreed with the statement with a mean score and standard deviation of 2.61 and 0.92, respectively.

An "overall measure of discomfort was calculated as a summary of the three items in Table 4.6. This summary variable is calculated using principal components (or latent factors), which have weights in the table's last column. The weights indicate that (question 3.2) has the highest (0.790) weight, indicating that it is an essential component of discomfort."

4.4.1.4 Insecurity

Table 4.7 below shows INSEC factors. It indicates that technology is a source of insecurity among academic staff, as indicated by the high percentage of academic staff who agreed and strongly agreed with the three questions.

Table 4. 7: Mean, standard deviation for INSEC construct

Insecurity		Frequency Distribution						Descriptive statistics		Latent factor components)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient
Q4.1 people are too dependent on technology to do things for them	Count	1	12	28	40	8	53.9%	3.47	0.88	0.768
	%	1.1%	13.5%	31.5%	44.9%	9%				
Q4.2 Too much technology distracts people to a point that is harmful	Count	4	9	19	42	15	64.1%	3.62	1.03	0.804
	%	4.5%	10.1%	21.3%	47.2%	16.9%				
Q4.3 Technology lowers the quality of relationships by reducing personal interaction	Count	1	9	30	28	19	54%	3.63	0.97	0.828
	%	1.1%	10.3%	34.5%	32.2%	21.8%				
		Cronbach's Alpha					0.71			
		% Of total variation accounted for by latent factor					64.104%			

As indicated in table 4.7 above, academic staff believe too much technology can distract people to the point that it is harmful (question 4.2), as indicated by the highest percentage (64.1%) of respondents who agreed and strongly agreed with the statement. The response on the item produces a mean and standard deviation of 3.62 and 1.03, respectively.

An overall measure of insecurity was calculated as a summary of the three items in Table 4.5. This summary variable is calculated using principal components (or latent factors), which have weights in the table's last column. The weights indicate that (question 4.3) has the highest (0.828) weight.

4.4.5 Technology acceptance model

4.4.5.1 Perceived usefulness

Table 4.8 below present PU factors. The table indicates a high PU of technologies of the fourth industrial revolution among academic staff. It is indicated by the high percentage of academic staff who agreed and strongly agreed with the four questions**.**

Table 4. 8: Mean, standard deviation for PU construct

Perceived usefulness		Frequency Distribution						Descriptive statistics		Latent factor components)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient
Q5.1 using 4IR technologies will enable me to accomplish my job quickly	Count	0	9	18	49	13	69.7%	3.74	0.83	0.602
	%	0%	10.1%	20.2%	55.1%	14.6%				
Q5.2 using 4IR technologies in my job will increase my productivity	Count	0	3	24	45	17	69.7%	3.85	0.76	0.775
	%	0%	3.4%	27%	50.6%	19.1%				
Q5.3 4IR technologies would make it easier to do my job	Count	0	2	21	50	16	74.2%	3.90	0.70	0.805
	%	0%	2.2%	23.6%	56.2%	18%				
Q5.4 4IR technologies would be useful for me as an academic staff	Count	0	1	13	56	19	84.2%	4.04	0.63	0.766
	%	0%	1.1%	14.6%	62.9%	21.3%				
		Cronbach's Alpha					0.71			
		% Of total variation accounted for by latent factor					54.968%			

As indicated in table 4.8 above, respondents believe that technologies of the fourth industrial revolution will be helpful for them as academic staff (question 5.4), as indicated by the highest percentage (84.2%) of respondents who agreed and strongly agreed to the statement. The response on the item produces a mean and standard deviation of 4.04 and 0.63, respectively.

An overall measure of perceived usefulness was calculated as a summary of the four items in Table 4.8. This summary variable is calculated using principal components (or latent factors), which have weights in the table's last column. The weights indicate that (question 5.3) has the highest (0.805) weight, indicating that it is the most critical component of perceived usefulness.

4.4.5.2 Perceived ease of use

Table 4.9 below present PEOU factors. The table shows the high PEOU of technology of the fourth industrial revolution among academic staff. Proved by the high percentage of academic staff who agreed and strongly agreed with the three questions that were asked

Table 4. 9: Mean, standard deviation for PEOU construct

Perceived ease of use		Frequency Distribution						Descriptive statistics		Latent factor components)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient
Q6.1 learning to operate 4IR technologies would be ease for me	Count	0	3		31	49	5			
	%	0%	3.4%		35.2%	55.7%	5.7%	61.4%	3.64 0.64	0.721
Q6.2 I would find it easy to get 4IR technologies to do what I want to do	Count	0	6		25	53	3			
	%	0%	6.9%		28.7%	60.9%	3.4%	64.3%	3.61 0.67	0.738
Q6.3 My interaction with 4IR technologies would be clear and understandable	Count	0	3		34	49	2			
	%	0%	3.4%		38.6%	55.7%	2.3%	58%	3.57 0.60	0.786
Q6.4 It would be easy for me to become skilful at using 4IR technologies	Count	0	4		25	52	8			
	%	0%	4.5%		28.1%	58.4%	9%	67.4%	3.72 0.69	0.653
		Cronbach's Alpha					0.69			

	% Of total variation accounted for by latent factor	52.706%

As indicated in table 4.9 above, respondents believe it would be easy to become skilful at using technologies of the fourth industrial revolution (question 6.4), as indicated by the highest percentage (67.4%) of respondents who agreed and strongly agreed to the statement. The response on the item produces a mean and standard deviation of 3.72 and 0.69, respectively.

"An overall measure of PEOU was calculated as a summary of the three items in Table 4.9. This summary variable is calculated using principal components (or latent factors), which have weights in the table's last column. The weights indicate that (question 6.3) has the highest (0.786) weight which indicates that it is the most crucial component of perceived ease of use".

4.4.5.3 Intention to use technology

Intention to use factors are presented in Table 4.10 below. The table shows that there is a high intention to use technology of the fourth industrial among academic staff. This is indicated by the high percentage of academic staff who agreed and strongly agreed to the three questions that were asked.

Table 4. 10: Mean, standard deviation for IU construct

Intention to use		Frequency Distribution						Descriptive statistics		Latent factor components)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient
Q7.1 I plan to use 4IR technologies in my job	Count	0	3	8	57	21	87.6%	4.08	0.678	0.823
	%	0%	3.4%	9%	64%	23.6%				
Q7.2 It is likely that I will use 4ir technologies in my job	Count	0	2	10	63	14	86.5%	4.00	0.603	0.838
	%	0%	2.2%	11.2%	70.8%	15.7%				
Q7.3 Assuming I have access to 4IR technologies, I intend to use them in knowledge management process	Count	0	0	20	58	11	77.6%	3.90	0.585	0.759
	%	0%	0%	22.5%	65.2%	12.4%				
Q7.4 codification and capturing of information can be further enhanced by adding a layer of AI and machine learning to data	Count	0	1	34	47	7	59.8%	3.67	0.636	0.719
	%	0%	1.1%	38.2%	52.8%	7%				

Intention to use		Frequency Distribution						Descriptive statistics		Latent factor components)
		Strongly disagree	Disagree	Neutral	Agree	Strongly agree	%Agree\ strongly agree	Mean	Standard dev	coefficient
Q7.5 an advanced KM platform with built in AI engine can bring contextual knowledge and help discover effective solution faster	Count	0	1	22	60	6	74.1%	3.80	0.568	0.691
	%	0%	1.1%	24.7%	67.4%	6.7%				
Q7.6 AI can improve searches drastically and give employees the information and knowledge most relevant to them	Count	0	1	17	57	14	79,7%	3.94	0.628	0.804
	%	0%	1.1%	19.1%	64%	15.7%				
		Cronbach's Alpha					0.73			
		% Of total variation accounted for by latent factor					65.162%			

As indicated in table 4.10 above, all three questions about the intention to use scored high percentages of respondents who agreed and strongly agreed, 87.6%, 86.5%, and 77.6% (question 7.1, question 7.2, question 7.3, question 7.4, question 7.5 and question

7.6), respectively. The response to (question 7.1) produces a mean and standard deviation of 4.08 and 0.678, respectively.

An overall measure of intention to use fourth industrial revolution technology was calculated as a summary of the three items presented in Table 4.9. This summary variable is calculated using principal components (or latent factors), which have weights in the table's last column. The weights indicate that (question 7.2) has the highest (0.838) weight, indicating that it is the most crucial component of intention to use.

4.6 Factor analysis

Watkins (2018) define Exploratory factor analysis (EFA) as " a statistical data reduction used to reduce data to a smaller set of summary variables and examine the phenomena' underlying theoretical structure." J.-O. Kim, Ahtola, Spector, Kim, and Mueller (1978) also states that Principal Component Analysis (PCA) is a dimension-reduction tool that can be used to reduce a large set of variables to a small set that still contains most of the information in the large set. A PCA and EFA were conducted on the 28 variables with orthogonal rotation (Varimax).

4.6.1 Test of sampling adequacy and presence of correlation

Table 4. 11: KMO and Bartlett's Test

"Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.602
	Approx. Chi-Square	467.097
	df	171
	Sig.	<.001"

The Kaiser-Meyer-Olkin (KMO) measures the adequacy of the sample. As indicated in Table 4.11, the KMO value is (0.602) significant and higher than 0.6. This indicates that factor is likely to factor well adequate sampling. Bartlett's Test of Sphericity demonstrated that statistical probability of significant correlations existed with these data ($X2 = 467.097$, $df = 171$; $p < .001$). hence, we can conclude data is suitable for factor analysis.

4.6.2 Communalities

Yong and Pearce (2013) describe communalities as "Communalities indicate the amount of variance in each variable that is accounted for "

Table 4. 12: Communalities

		Initial	Extraction
OPT1	Technology contributes to a better quality of life	1.00	.797
OPT2	Technology gives me more freedom of mobility	1.00	.602
OPT3	Technology gives me more freedom of mobility	1.00	.625
OPT4	Technology makes me more productive in my personal life	1.00	.472
INNO1	Other people come to me for advice on new technology	1.00	.706
INNO2	I am among the first in my department to acquire new technology	1.00	.553
INNO3	I can figure out new high-tech product and services without help	1.00	.564
INNO4	I keep up with the latest technological developments in my areas of interest	1.00	.681
DISCOM1	I sometimes feels as if I am being taken advantage of	1.00	.578
DISCOM2	New technology is not dependable	1.00	.498
DISCOM3	Technology always seems to fail at the worst possible time	1.00	.516
INSEC1	People are too dependent on technology to do things for them	1.00	.600
INSEC 2	Too much technology distracts people to a point that is harmful	1.00	.604
INSEC3	Technology lowers the quality of relationships by reducing personal interaction	1.00	.667
PU1	Using 4IR technologies will enable me to accomplish my job quickly	1.00	.602
PU2	Using 4IR technologies in my job will increase my productivity	1.00	.776
PU3	4IR Technologies would make it easier to do my job	1.00	.618
PU4	4IR Technologies would be useful for me as an academic staff	1.00	.496
PEOU1	Learning to operate 4IR technologies would be easy for me	1.00	.616
PEOU2	I would find it easy to get 4IR technologies to do what I want to do	1.00	.671
PEOU3	My interaction with 4IR technologies would be clear and understandable	1.00	.608
PEOU4	It would be easy for me to become skilful at using 4IR technologies	1.00	.523
IU1	I plan to use 4IR technologies in my job	1.00	.603
IU2	It is likely that I will use 4IR technologies in my job	1.00	.755
IU3	Assuming I have access to 4IR, I intend to use them in the Knowledge Management process	1.00	.629
IU4	Codification and capturing of information can be further enhanced by adding a layer of AI and machine learning to data	1.00	.445
IU5	n advanced KM platform with built in AI engine can bring contextual knowledge and help discover effective solutions faster	1.00	.689
IU6	AI can improve searches drastically and give employees the information and knowledge most relevant to them	1.00	.574"

As shown in Table 4.12, OPT4; DISCOM2; PU4; and IU4 had communalities less than 0.5 and the researcher decided to remove them from the data set. According to Osborne, Costello, and Kellow (2008) a communalities of 0.5 and above is acceptable.

Table 4. 13: Rotated components matrix

Rotated Component Matrix[a]							
	Component						
	1	2	3	4	5	6	7
OPT1	.874						
OPT2	.728						
OPT3	.643						
OPT4	.552						
PU2	.505	.413			.437		
IU4	.461						
PU1		.726					
IU6		.682					
PU3		.678					
PU4		.411					
IU2			.827				
IU1			.738				
IU3			.692				
INNO4				.744			
INNO2				.678			
INNO1	.422			.606			
PEOU1				.582			
INNO3				.479			
PEOU2					.784		
PEOU4					.694		

PEOU3					.638		
DISCOM1						.706	
DISCOM3						.647	
DISCOM2						.635	
INSEC1						.625	
IU5							.679
INSEC2							.668
INSEC3						.400	.650
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.							
a. Rotation converged in 12 iterations.							

Table 4.14 have factor loadings greater than 0.4. Osborne et al. (2008), suggest dropping all factor that are cross-loaded from the analysis. The study follows this suggestion and PU2, INNO1, INSEC3, were removed. After removing the items that were cross-loaded several times, we repeated the process of EFA, and these items (OPT4; PEOU1; IU1; IU2, and IU4) were also cross-loaded, and therefore they were removed.

The EFA was return with the following results

Table 4. 14: Communalities recalculated

		Initial	Extraction
OPT1	Technology contributes to a better quality of life	1.00	.872
OPT2	Technology gives me more freedom of mobility	1.00	.666
OPT3	Technology gives me more control over my daily life	1.00	.871
INNO2	I am among the first in my department to acquire new technology	1.00	.761
INNO4	I keep up with the latest technological developments in my areas of interest	1.00	.854
DISCOM2	New technology is not dependable	1.00	.882
DISCOM3	Technology always seems to fail at the worst possible time	1.00	.745
INSEC 2	Too much technology distracts people to a point that is harmful	1.00	.923
INSEC3	Technology lowers the quality of relationships by reducing personal interaction	1.00	.704
PU1	Using 4IR technologies will enable me to accomplish my job quickly	1.00	.841
PU3	4IR Technologies would make it easier to do my job	1.00	.750

PEOU2	I would find it easy to get 4IR technologies to do what I want to do	1.00	.806
PEOU3	My interaction with 4IR technologies would be clear and understandable	1.00	.710
PEOU4	It would be easy for me to become skilful at using 4IR technologies	1.00	.754
IU1	I plan to use 4IR technologies in my job	1.00	.842
IU2	It is likely that I will use 4IR technologies in my job	1.00	.830
IU3	Assuming I have access to 4IR, I intend to use them in the Knowledge Management process	1.00	.674

All factors in Table 4.15, are higher than 0.65 nearly 0.7 and there are no cross-loadings.

Table 4. 15: Total variance table

Total Variance Explained									
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.317	19.512	19.512	3.317	19.512	19.512	2.212	13.011	13.011
2	2.286	13.449	32.961	2.286	13.449	32.961	2.121	12.479	25.491
3	1.986	11.683	44.644	1.986	11.683	44.644	1.860	10.944	36.435
4	1.386	8.154	52.797	1.386	8.154	52.797	1.523	8.957	45.392
5	1.193	7.020	59.817	1.193	7.020	59.817	1.499	8.819	54.211
6	1.074	6.317	66.134	1.074	6.317	66.134	1.465	8.616	62.827
7	.892	5.250	71.384	.892	5.250	71.384	1.455	8.557	71.384
8	.812	4.776	76.159						
9	.723	4.253	80.413						
10	.670	3.939	84.352						
11	.573	3.371	87.723						
12	.503	2.957	90.680						
13	.453	2.662	93.342						
14	.387	2.275	95.618						
15	.295	1.737	97.355						

16	.228	1.344	98.699						
17	.221	1.301	100.000						
Extraction Method: Principal Component Analysis.									

Table 4.16 in the column labelled "Extraction Sums of Squared." The total column shows the Eigenvalues for each factor extracted. Kaiser (1960) states that this number should be greater than one. In table 4.15, all the numbers under this category are greater than one. The % of variance column indicates the variance explained by each factor. The cumulative % column shows the percentages of the total variance explained by factors. Table 4.16 shows that 71.384% of the total variances are explained by the seven factors that were extracted.

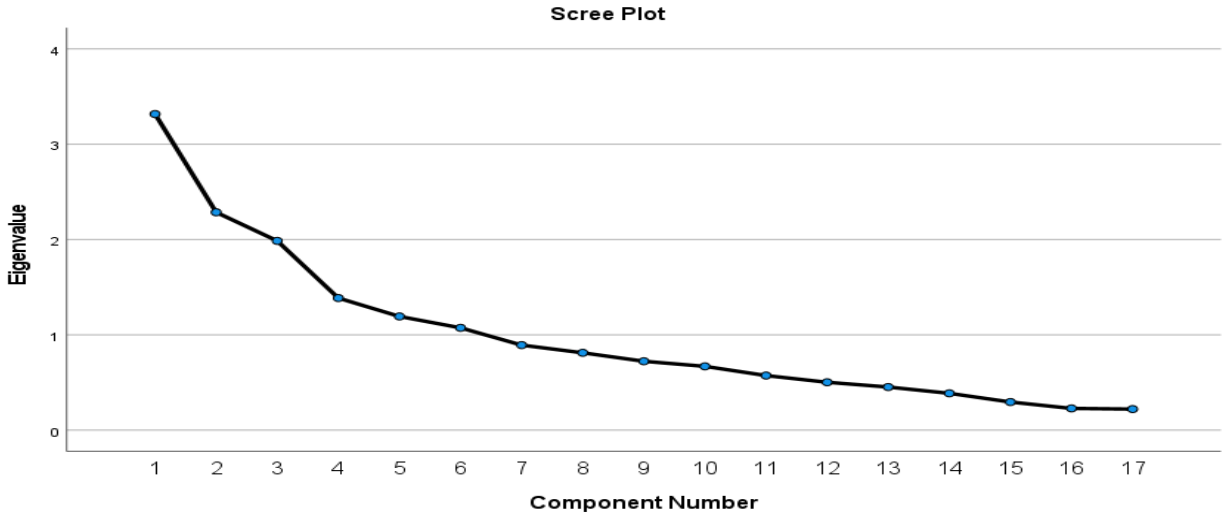


Figure 4. 4: Scree plot

Table 4. 16: Rotated component matrix

Rotated Component Matrix[a]							
	Component						
	1	2	3	4	5	6	7
OPTI1	.872						
OPTI2	.666						
OPTI3	.871						

INNO2						.761	
INNO4						.854	
INSEC2					.923		
INSEC3					.704		
PU3							.750
PU1							.841
PEOU2			.806				
PEOU3			.710				
PEOU4			.757				
IU2		.830					
IU1		.842					
IU3		.674					
DISCOM2				.882			
DISCOM3				.745			
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.							
a. Rotation converged in 6 iterations.							

Table 4.17 shows that all factor loadings have values of 0.6 and above. Furthermore they are not cross-loaded . Raubenheimer (2004) suggests a minimum of 3 items for each factor loaded. However, this study considered all factors that were loaded.

Factor1: optimism

Factor2: innovativeness

Factor3: insecurity

Factor4: discomfort

Factor5: perceived usefulness

Factor6: perceived ease of use

Factor7: intention to use

4.7 Correlation and Hypothesis testing

This study seeks to investigate the readiness of academic staff to adopt 4IR technologies to improve the KM process. In this section gives answer to the study questions, met the objectives of the study and met the hypotheses.

4.7.1 Technologies readiness and perceived usefulness

This section is design to respond to the first research question "Is there a relationship between the technology readiness index and the perceived usefulness of technologies of the 4IR?" The answer to this question will meet the first objective of the study and help make decision about the acceptance or the rejection of Hypothesis H1a; H2a; H3a; H4a.

Table 4. 17: Pearson correlation analysis between TRI and perceived usefulness

Correlations						
		PU	OPTI	INNO	DISCOM	INSEC
Pearson Correlation	PU	1.000				
	OPTI	.297 .002	1.000			
	INNO	-.074 .247	.025 .409	1.000		
	DISCOM	-.116 .139	-.153 .076	-.085 .214	1.000	
	INSEC	.089 .202	.042 .350	-.180 .046	.338 .001	1.000

Table 4.18 show the correlation coefficients among the dimension of the technology readiness index (OPTI, INNO, DISCOM, INSEC) and PU of the technology of the 4IR.

Among the four variables of technology readiness, only the correlation coefficient between OPTI and PU of 4IR technologies has a positive and significant relationship. Judging from the correlation coefficient of ($r=.297$, $p<0.05$).

Table 4. 18: Model summary INSEC, OPTI, INNO, DISCOM and PU

"Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.332[a]	.110	.068	.623
a. Predictors: (Constant), INSEC, OPTI, INNO, DISCOM"				

Table 4. 19: ANOVA INSEC, OPTI, INNO, DISCOM and PU

"ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.032	4	1.008	2.598	.042[b]
	Residual	32.591	84	.388		
	Total	36.624	88			
a. Dependent Variable: PU						
b. Predictors: (Constant), INSEC, OPTI, INNO, DISCOM"						

Table 4. 20: Coefficient INSEC, OPTI, INNO, DISCOM and PU

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.271	.648		5.051	<.001		
	OPTI	.232	.088	.277	2.643	.010	.966	1.035
	INNO	-.074	.109	-.071	-.683	.497	.966	1.035
	DISCOM	-.107	.103	-.115	-1.036	.303	.858	1.166
	INSEC	.077	.083	.104	.933	.354	.853	1.172
a. Dependent Variable: Perceived usefulness								

Perceived usefulness was regressed on predicting variables of TRI (OPTI, INNO, DISCOM and INSEC). The variables of TRI significantly predict the PU of 4IR technologies, $F(4, 84) = 2.598$, $p<0.05$, which indicates that the four factors under study significantly impact PU. Moreover, the R Square =0.110 depicts that the model explains 11% of the variation in PU.

Additionally, coefficients in table 4.21 were assessed to ascertain the influence of each of the factors of TRI on PU. Hypothesis H1a the effect of optimism on PU of 4IR technologies. The results reveal that OPTI significantly and positively impacts perceived usefulness (B=0.232, t=2.643; p=.010). Hence H1a was supported. H2a evaluated the effect of INNO on PU of 4IR technologies. The results reveal that INNO does not affect PU (B=.074, t=-.683; p=.497). Hence H2a was not supported. H3a evaluated the effect of DISCOM on the perceived usefulness of 4IR technologies. The results reveal that DISCOM does not affect perceived usefulness (B=.107, t=-1.036; p=.303). Hence H3a was not supported. Finally, H4a evaluated the effect of INSEC on PU of 4IR technologies. The results reveal that INSEC has no significance on PU (B=.077, t=.933; p=.354). Hence H4a was not supported

4.7.2 Technology readiness and perceived ease of use

This section is design to respond to the second research question "What type of relationship exists between the technology readiness index and the perceived ease of use of technology of the 4IR?

The answer to this question will meet the second objective of the study and help make decision about the acceptance or the rejection of Hypothesis H1b; H2b; H3b; H4b.

Table 4. 21: Pearson correlation analysis TRI and perceived ease of use

Correlations						
		PEOU	OPTI	INNO	DISCOM	INSEC
Pearson Correlation	PEOU	1.000				
	OPTI	-.002 .493	1.000 .493			
	INNO	.253 .008	.025 .409	1.000		

	DISCOM	-.025 408	-.153 .076	-.085 214	1.000	
	INSEC	-.039 .360	.042 .350	-.180 .046	.338 .001	1.000

The data in table 4.22 show the correlation coefficients among the dimension of the TRI (OPTI, INNO, DISCOM and INSEC) and PEOU of the technology of the 4IR.

The table suggests variables of TRI have no significant coefficient on perceived ease of use of 4IR technologies.

Table 4. 22: Model summary TRI and PEOU

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.253[a]	.064	.019	.494
a. Predictors: (Constant), INSEC, OPTI, INNO, DISCOM				

Table 4. 23: ANOVA table OPTI, INNO, DISCOM, INSEC and PEOU

"ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.404	4	.351	1.437	.229[b]
	Residual	20.516	84	.244		
	Total	21.920	88			
a. Dependent Variable: PEOU						
b. Predictors: (Constant), INSEC, OPTI, INNO, DISCOM"						

Table 4. 24: Coefficients

Coefficients[a]					
Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	Collinearity Statistics

		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.990	.514		5.818	<.001		
	OPTI	-.006	.070	-.010	-.091	.927	.966	1.035
	INNO	.204	.086	.254	2.367	.020	.966	1.035
	DISCOM	-.006	.082	-.008	-.074	.941	.858	1.166
	INSEC	.006	.066	.010	.091	.928	.853	1.172
a. Dependent Variable: Perceived ease of use								

PEOU regressed on predicting variables of TRI (OPTI, INNO, DISCOM and INSEC). The variables of TRI do not predict PEOU) of 4IR technologies, F (4, 84) = 1.437, p>0.05, which indicates that the four factors under study have no significant impact on PEOU. Moreover, the R Square =.064 depicted in table 4.23 indicates that the model explains only 6.4 % of the variation in PEOU.

Additionally, coefficients in table 4.25 were assessed to ascertain the influence of each of the factors of TRI on PEOU. H1b the effect of OPTI on PEOU of technologies of 4IR technologies. The results reveal that OPTI has no significant impact on PEOU (B=.204, t=-.091; p=.927). Hence H1b was not supported. H2b evaluated the effect of INNO on the PEOU of 4IR technologies. The results reveal that INNO positively affects PEOU (B=.074, t=2.367; p=.020). Hence H2b was supported. H3b evaluated the effect of DISCOM on PEOU of 4IR technologies. The results reveal that DISCOM has no significance on PEOU (B=-.006, t=-.074; p=.941). Hence H3b was not supported. Finally, H4b evaluated the effect of INSEC on PEOU. The results reveal that INSEC has no significant on PEOU (B=.006, t=.091; p=.928). Hence H4b was not supported.

4.8.3 Perceived usefulness and perceived ease of use

This section is design to respond to the third research question of this study "Is there a positive relationship between Perceived ease of use and perceived usefulness?

The answer to this question will meet the third objective of the study and help make decision about the acceptance or the rejection of Hypothesis H5.

Table 4. 25: Coefficiemts PU and PEOU

'Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	3.734	.509		7.342	<.001		
	PEOU	.024	.139	.018	.171	.864	1.000	1.000
a. Dependent Variable: PU'								

Coefficients in table 4.26 were assessed to ascertain the influence of PEOU on PU. The results reveal that PEOU of 4IR technologies does not impact PU of 4IR technologies B=.024, t=.171; p= .864). Hence H5 was not supported

4.8.4 Perceived usefulness, perceived ease of use and the intention to use

This section is design to respond to the fourth research question "Do perceived usefulness and perceived ease of use of technology lead to the adoption of technologies of the 4IR in KM practices? The answer to this question will meet the fourth objective of the study and help make decision about the acceptance or the rejection of Hypothesis H5 and H6.

Table 4. 26: Correlation between TAM items

Correlations				
		IU	PEOU	PU
Pearson Correlation	IU	1.000		
	PEOU	.216 .021	1.000	
	PU	.335 .001	.018 .432	1.000

The interplay between PU and IU produced a coefficient of (r=.335 p<0.05). Suggesting that the PU of the technology of the 4IR and IU are positively related and statically significant.

The interplay between PEOU and IU also produced a coefficient of (r=.216, p<0.05). This denotes that PEOU of 4IR technologies and IU are positively related and statistically significant.

Table 4. 27: Model summary PU, PEOU and IU

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.395[a]	.156	.136	.467
a. Predictors: (Constant), PU, PEOU				

Table 4. 28: ANOVA table PU, PEOU and IU

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.464	2	1.732	7.942	<.001[b]
	Residual	18.754	86	.218		
	Total	22.217	88			
a. Dependent Variable: IU						
b. Predictors: (Constant), PU, PEOU						

Table 4. 29: Coefficient PU, PEOU and IU

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	2.241	.466		4.810	<.001		
	PEOU	.211	.100	.210	2.114	.037	1.000	1.000
	PU	.258	.077	.331	3.339	.001	1.000	1.000
a. Dependent Variable: IU								

IU was regressed on PU and PEOU. Table 4.29 indicates that PU and PEOU predict IU 4IR technologies, F (2, 86) =7.942, p<0.01, which indicates that PU and PEOU factors significantly impact intention to use. Moreover, the R Square = .156 in table 4.27 indicates that the model explains 15.6% of the variation in intention to use.

Additionally, coefficients in table 4.29 were assessed to ascertain the influence of each TAM factor on IU. H6 the effect of PU on IU the intention to use 4IR technologies. The results reveal that PU significantly impacts intention to use 4IR technologies (B=.258., t=3.339; p=.039). Hence H6 was supported. H7 evaluated the effect of PEOU on IU 4IR technologies. The results reveal that PEOU significantly affects IU the 4IR technologies (B=.211, t=2.114; p=.001). Hence H7 was supported.

4.8 Qualitative insights

This section is design to respond to the firth research question the open-ended question "How will the technologies of the 4IR contribute to the improvement of KM practices?" The answer to this question will meet the firth objective of the study. This section was analysed using content analysis in excel.

The respondents were not restricted to a set of options in closed-ended form. The open-ended questions showcased the respondents' points of view on how technologies of the 4IR contribute to improve KM. The different themes and sub-themes that emerged from responses on this question are presented and interpreted below.

Figure 4.5 below depicts the sub-themes that emerged from the open-ended questions.

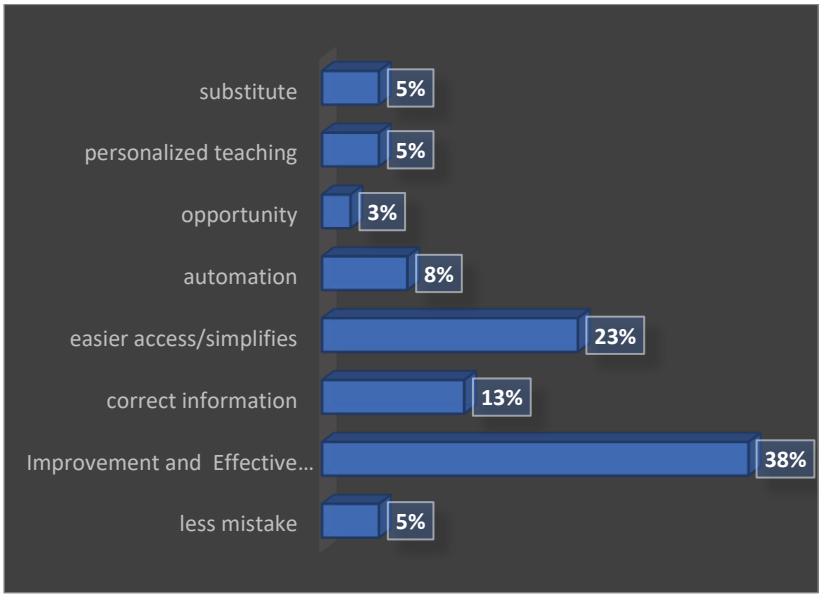


Figure 4. 5: Themes from open ended questions

4.7.1 Easy access

Most respondents (23%) believe that 4IR technologies will be helpful in KM because they will allow easier and simplified access to information in the education sector.

Technology plays a vital role in the knowledge sharing and storing of information. The right knowledge-sharing platform within the organization allows easy access to knowledge.

The following are other comments from the respondents:

- *"I don't need to think - experience has shown me that I have the world of knowledge at my fingertips due to the development of technology - I am more excited than ever with what I have access to and what I am learning."*
- *"I think it definitely can, as it can automate and improve on the ability to store information and allow for easier access."*
- *"New technology makes it easier for companies to automate routine tasks and could disrupt the balance between job responsibilities completed by humans and those completed by machines and algorithms"*
- *"One of the main effects of the Fourth Industrial Revolution is increased human productivity. With technologies like A.I. and automation augmenting our professional lives, we can make smart choices faster than ever before."*
- *"Yes, because technology makes things easier, and with the fourth industrial revolution it's easy to share and store information."*

4.7.2 Improvement productivity and Effective management

Effective management is needed in universities to further the academic mission. 36% of respondents believe that through 4IR technologies universities can achieve effective knowledge management. The followings are some comments from respondents:

- *"Knowledge Management not only offers competitive advantages but also provides a means for organizational survival, by improvising core capabilities or generating new ones that can drive people in the Fourth Industrial Revolution (4IR) era."*
- *"Due to the availability of appropriate application programs."*
- *"Cloud computing is essential for proper management, analysis, and dissemination of research data."*
- *"K.M. not only offers competitive advantages but also provides a means for organizational survival, by improvising core capabilities or generating new ones that can drive people in the Fourth Industrial Revolution (4IR) era".*

- *"Knowledge Management can play a crucial role in their adoption by mitigating knowledge loss during its implementation, supporting knowledge creation, and assisting decision making. Hence, organizational performance can be improved by better decisions".*
- *"I am not sure what Knowledge Management practices are, but I think technology will be able to improve whatever."*
- *"With any technological advancement, there is always a trade-off. For example, the Internet of Things (IoT) is the cornerstone of 4IR, as it enables the monitoring and management of non-digital objects/devices over the internet".*
- *"Increased productivity, efficiency and quality in processes, greater safety for workers by reducing jobs in dangerous environments, enhanced decision making with data-based tools, improved competitiveness by developing customized products that satisfy consumers' needs."*
- *"It can be used to track and record progress made by all individuals within a team."*
- *"The Fourth Industrial Revolution would increase human productivity."*
- *"It can be used to track and record progress made by all individuals within a team."*

4.7.3 Correct information

K.M. provides not only competitive advantage not employees but also to the organization. Furthermore, the data and information which come with proper management of knowledge through 4IR technologies can help organizations make an informed decision. 13% of respondents believe that 4IR technologies will help make informed decisions. The followings are some comments from respondents:

- *"Depending on the extent of information, an overload of information needs to be analyzed and the usefulness thereof established. This is a timeous process."*
- *"For example, technologies of the 4th I.R. has contributed through the knowledge management during this pandemic by providing the correct information at the right time."*

- *"Industry 4.0 technologies give you a greater knowledge of the manufacturing process, supply chains, distribution chains, and business performance".*
- *"Information at your fingertips"*
- *"Knowledge bases have multiplied into several components, and technology is useful in keeping track and remaining up to date with things."*

4.7.4 Automation

KM automation is the relationship between KM systems and AI. It enables organizations to store information and ensure its availability, relevance, and feasibility to help stakeholder customers find the correct information at the right time. 8% of respondents believe that through 4IR technologies, organizations can achieve KM automation. The followings are some comments from respondents:

- *"It will automate processes."*
- *"The Fourth Industrial Revolution (4IR) offers optimum productivity and efficiency via automation, expert systems, and artificial intelligence."*
- *"With the digitization of work processes, the fourth industrial revolution enables organizations to optimize their production operations and increase their competitiveness and productivity as manufacturing becomes more automated, more flexible, and cheaper."*

4.7.5 Personalized teaching

4IR has a substantial impact on education. Among the impact of 4IR technologies in education is the personalization of learning. The term personalized learning/teaching refers to the customization of learning for each student need, strength, interest and cultural background. .5% of respondents believe that 4IR technologies can help achieve personalize teaching. The followings are some comments from respondents:

- "*Technologies are converging in education to support: Increased access, Engagement*
- *Skill building, Personalized teaching."*
- *"The 4th Industrial Revolution is pushing teachers to evolve teaching strategies, so they support personalized learning for creativity, innovation, and problem-solving and have more time for individual instruction."*

4.7.6 Substitute human work

One of the worries about 4IR technologies is that they might substitute human work. 5% of respondents expressed their worries about 4IR technologies. The followings are some comments from respondents:

- *"Technology of the Fourth Industrial Revolution is very crucial in terms of competition and productivity, especially in a working environment. However, the practice is very problematic because more jobs will be replaced by artificial intelligence. Thus, many people will be jobless, and many families will be economically deprived.*
- *"With any new technology, there is always the concern that it will eventually substitute human workers."*

4.7.7 Opportunity

One respondent, representing 3% of respondents, believes that 4IR technologies will create new opportunities *"Offering new opportunities to create and use knowledge."*

CHAPTER 5: DISCUSSION OF FINDINGS

5.1 Introduction

This chapter elaborates on results outlines in chapter 4. It elucidates the research aims, questions and the hypotheses that were formulated. Furthermore, the chapter corroborates the findings with previous literature and theories.

The discussion of results gives answers to the study questions are answered and fulfill the research aims. Additionally, clarifications are given to determine whether the research hypothesis corroborate or contradict previous studies and theories.

5.2 Discussions regarding the research objectives, questions and hypotheses

This study's research questions, hypotheses, and objectives are linked. In other words, when research question one is answered, objective one of the studies is met, and hypotheses H1a, H2a, H3a, and H4a are met at the same time.

When research question two is answered, objective two of the study is met, and hypotheses H1b, H2b, H3b, and H4b are met. When research question three is answered, objective three of the study is met, and H5 is met. When a research question four are answered, objective four of the study is met, and H6 and H7 are met. Finally, research objective five is met when research question five is answered.

5.2.1 Effect of TRI on perceived usefulness

The investigation of how TRI variables influence PU was intended to provide a response to the first research question. To determine whether the hypotheses H1a; H2a; H3a; H4a were accepted or rejected, a multiple regression analysis was conducted.

The research results indicate that TRI variables have a negligible positive significant effect on the perceived usefulness of the fourth industrial revolution technologies.

Hypothesis H1a states that optimism positively influences academic staff PU of 4IR technologies. It was found that optimism has a significant positive effect on perceived usefulness. This suggests that the more optimistic the academics are, the more they perceive technologies of the fourth industrial revolution as applicable. The results agree

with previous research(Chen & Lin, 2018; Gestiardi, Sarwanto, Chumdari, & Maryani, 2021), Hence Hypothesis (H1a) was supported.

Hypothesis H2a states that INNO positively influences academic staff' PU of 4IR. The results suggest that INNO has no significant effect on PU of 4IR technologies. The outcomes of the relationship between INNO and PU are in agreement with prior research (Esen & Erdogmus, 2014; Kwon, Choi, & Kim, 2007). Individuals who enjoy trying new technology tend to use new technologies even when the potential benefits are still inexplicable(Agarwal & Prasad, 1999).

Hypothesis H3a states DISCOM negatively influences academic staff PU of 4IR technologies. The findings of the relationship between DISCOM and PU indicate a lack of substantial correlation. These results are consistent with prior research. (Saragih, Nafa Sari, Nurtjahyo Moch, & Muslim, 2020; Venkatesh & Bala, 2008) . Academic staff who feel uncomfortable with 4IR technologies may be unaccustomed to them, resulting in their inability to use them with ease. This could clarify why DISCOM factor did not have noteworthy influence on perceived usefulness. Therefore, it has been determined that Hypothesis (H3a) is not supported.

Hypotheses H4a states Insecurity negatively influences academic staff PU of 4IR technologies. The research results indicate that INSEC has no significant effect PU. The results are consistent with the work of (Igbaria, Schiffman, & Wieckowski, 1994). 4IR is predicted to bring many opportunities and social challenges. Some of the concerns among people include income inequalities and low-skilled workers concerned about the competition with robots (Acemoglu, 2002; Benioff; Huber & Stephens, 2014). Another major problem that may become more severe due to the 4IR is climate change (Zervoudi, 2020). Academic staff may be concerned about these social challenges that come with 4IR technologies. As a result, whether 4IR technologies are helpful, 4IR technologies may not be a priority to academic staff. Having established that Hypothesis (H4a) is not supported.

5.2.2 Effect of TRI on perceived ease of use

The investigation of how TRI variables influence PEOU was intended to provide a response to the second research question. To determine whether the hypotheses HIb; H2b; H3b; H4b were accepted or rejected, a multiple regression analysis was conducted.

The research results indicate that TRI variables have no significant relationship with PEOU of 4IR technologies.

Hypothesis H1b states that optimism positively influences academic staff PEOU of 4IR technologies. Results suggest no significant effect of OPTI on PEOU. These outcomes contrast with the earlier discoveries that indicated that OPTI has a positive effect on the PEOU(Musyaffi, Mulyani, Suraida, & Sukmadilaga, 2021). Hence H1a was not supported.

Hypothesis H2b states INNO positively influences academic staff PEOU of 4IR technologies. The research results indicate that INNO significantly affects PEOU perceived ease of use. This suggests that the more innovative the academic staff are, the more they perceive 4IR technologies as easy to use. The results of the relationship between innovativeness and perceived ease of use are consistent with previous studies (Esen & Erdogmus, 2014; Kwon et al., 2007). Individuals who enjoy trying new technology have the tendency to adopt new technological advancements, even in situations where the advantages are not yet fully comprehensible (Agarwal & Prasad, 1999). Hence hypothesis H2b is supported.

H3b states that discomfort negatively influences academic staff PEOU of 4IR technologies. The research results indicate that discomfort does not significantly affect perceived ease of use. Such results agree with previous studies (Saragih et al., 2020; Venkatesh & Bala, 2008) . H3b is not supported in this study.

H4b states that insecurity negatively influences academic staff PEOU of 4IR technologies. The findings of the study suggest that DISCOM does not have a considerable impact on PEOU. These findings do not align with prior research, which suggests that feelings of insecurity have a negative impact on PEOU. (Igbaria et al., 1994). H4b is not supported.

5.2.3 Effect of perceived ease of use on perceived usefulness

The investigation of how PEOU variable influence PU was intended to provide a response to the third research question. To determine whether the hypotheses H5 was accepted or rejected, a multiple regression analysis was conducted.

Hypothesis H5 states that academic staff PEOU of 4IR technologies positively influences their PU of 4IR technologies. The findings of this research indicate that there is no significant relationship between PEOU and PU. Nevertheless, these findings vary from earlier research, which proposes a significant positive impact of PEOU on PU. (Holden, Brown, Scanlon, & Karsh, 2012; Kuo, Liu, & Ma, 2013; Seong & Hong, 2022; Walczuch et al., 2007). It implies that even when academic staff perceives 4IR technologies as easy to use, they will still see them as useless. Having established H5 is not supported.

5.2.4 Effect of perceived usefulness and perceived ease of use on intention to use 4th industrial technologies in the knowledge management process

The investigation of how PU and PEOU variable influence IU was intended to provide a response to the fourth research question. To determine whether the hypotheses H6 and H7was accepted or rejected, a multiple regression analysis was conducted.

Hypothesis H6 states that academic's staff PEU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process. Hypothesis H7 states that academic's staff PEOU of 4IR technology positively influences their behavioral intention to use 4IR technologies in the KM process.

The findings of the study suggest that both Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) play a crucial role in shaping the intention to adopt 4IR technologies in KM. This outcome aligns with the outcomes of earlier researches (Compernolle et al., 2018; Esen & Erdogmus, 2014; Kuo et al., 2013). Having established that Hypothesis H6 and H7 are supported.

Table 5. 1: Summary of hypothesis result

"Hypothesis	P value	Results
H1a: OPTI-PU	.010*	supported
H1b: OPTI-PEOU	.927	Not supported
H2a: INNO-PU	.497	Not supported
H2b: INNO-PEOU	.020*	supported
H3a: DISCOM-PU	.303	Not supported
H3b: INSEC-PEOU	.941	Not supported
H4a: INSEC-PU	.354	Not supported
H4b: DISCOM-PEOU	.928	Not supported
H5: PEOU-PU	.864	Not supported

H6: PU-IU	.037*	supported
H7: PEOU-IU	.001**	supported

*Correlation is significant at the 0.05 level(2-tailed)

**correlation is significant at the 0.01 level(2-tailed)"

5.2.5 Perceived benefits of adopting technologies of the 4IR in KM practices

The fifth research question aimed to determine the advantages perceived in the implementation 4IR in KM procedure. It was an open-ended question and the answers obtained from this section were analysed through thematic analysis in Microsoft Excel.

Seven themes emerged from the answers on question five regarding the perceived advantages of integrating 4IR technologies in KM processes. They include easy access; improvement of productivity and effective management; correct information; automation; personalized teaching; and opportunity are some of benefits academic's staff perceive by adopting technologies of the fourth industrial revolution in the knowledge management practice.

These themes aligned with preceding studies showing the benefits of worldwide technology usage in the KM process in all sectors. The emergence of IT has led to remarkable swiftness, flexibility, information exchange, teamwork, and effectiveness in managing knowledge (Holsapple & Singh, 2001; Sharma & Deb, 2019; Von Zedtwitz & Gassmann, 2002). If technology is not integrated into the knowledge management system, organizations will face difficulties in operating efficiently and managing intellectual capital(Bollinger & Smith, 2001).

5.2.6 Chapter summary

In this chapter, the outcomes of the investigations were examined in line with the research questions, objectives, and hypotheses. The results were discussed based on the outcome of the statistical investigation in the previous chapter.

The results of the research a statistical significance between OPTI and PU of technologies of the fourth industrial revolution and between INNO and PEOU of 4IR technologies. This study also established that PU and PEOU are statistically related to the IU technologies of the 4IR in KM process. The following section will concentrate on the suggestions and ultimate decision of this investigation.

CHAPTER 6: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

In this section, we will provide an overview of the conclusions and recommendations drawn from the previous chapters. The primary aim of this study was to explore the preparedness of academic staff to adopt 4IR technologies into the KM process. The TRAM model was utilized to evaluate their willingness to adopt such technologies. This chapter will highlight the key findings from the literature review and quantitative data analysis. Additionally, the study's constraints will be discussed, and suggestions for future research will be provided. Lastly, we will outline the contribution this research has made to the field of management. Our conclusions are based on the following objectives:

- To establish whether the technology readiness index effect the perceived usefulness of technologies of the 4IR
- To explore the relationship between the technology readiness index and the perceived ease of use of technologies of the 4IR
- To establish whether perceived ease of use affects the perceived usefulness of technologies of the 4IR in KM practices.
- To examine if perceived usefulness and ease of use affect the adoption of technologies of the 4IR in KM practices.
- To ascertain the perceived benefits of adopting technologies of the 4IR on KM practices.

6.2 Summary of findings and contribution of this study

This research was carried out at the University of the Witwatersrand Johannesburg, specifically in the School of Management. The objective was to examine the preparedness of academic staff for technology and to investigate whether the four

personality traits associated with technology readiness (OPTI, INNO, DISCOM, and INSEC) were linked to how useful and easy-to-use the technologies of the Fourth Industrial Revolution were perceived to be by academic staff. Ultimately, the study aimed to determine whether these factors influenced academic staff's intention to utilize 4IR technologies in knowledge management processes.

6.2.1 Summary of findings from closed-ended questions

The primary research findings from the tested hypotheses provided reliable answers to the research questions through which all the study's objectives were met.

The first research findings of this study show that among the four-personality threat of TRI, only OPTI is positively associated with PU of 4IR technology of the fourth industrial revolution. This implies that optimistic academic staff perceives 4IR technologies as useful; secondly, this study finds that only INNO is positively associated with PEOU. This means that innovative academic staff perceives 4IR technologies as easy to use.

The relationship between PEOU is not associated with PU. This implies that academic staff who perceive technologies of the fourth industrial revolution as easy to use perceive do not see technologies as applicable.

Finally, the research findings of this study proved that both PU and PEOU positively affect the intention to use technologies of the fourth industrial revolution in the knowledge management process.

6.2.2 Summary of finding from open ended questions

The following themes emerged from the open-ended questions: Easy access; improvement of productivity and Effective management; correct information; automation; personalized teaching; opportunity, and fewer mistake.

6.3 Summary of each chapter

The first chapter of this investigation provides an overview of the study's main objective, which is to examine academic staff's preparedness to accept fourth industrial revolution technologies. This chapter includes a discussion of the study's background, problem statement, research questions, objectives, and hypotheses. To achieve the research objective, five research questions, objectives, and hypotheses were formulated.

The second chapter is a literature review that is divided into three sections. The first section reviews the previous industrial revolution and its impact on the education sector, describes the 4IR, and examines how emerging technologies affect the education sector. The second section reviews the literature on knowledge and knowledge management and its application in the education sector. Finally, the last section of this chapter reviews the theoretical framework and the connection between the Technology Acceptance and Readiness Model (TRAM).

Chapter three outlines the research methods employed in this study. The research philosophy and guiding principles were considered to select the most appropriate method to answer the research questions, achieve the research goals, and test the hypotheses. This study adopted the pragmatism research philosophy and the deductive research approach. The research was both descriptive and exploratory. A cross-sectional data collection approach was adopted, using a questionnaire with both open and closed-ended questions as the primary instrument for data collection.

In the fourth chapter, the outcomes obtained from the participants' data were exhibited and examined using IBM SPSS version 28, which facilitated the execution of descriptive and inferential statistics such as correlation and multiple regression analysis, Cronbach's alpha, and exploratory factor analysis among the variables scrutinized. The findings were presented in Tables, pie charts, and bar graphs.

Chapter five deliberates on the conclusions derived from the empirical evidence put forth in chapter four. The discussion was presented in conjunction with the research questions, objectives, and hypotheses.

Ultimately, chapter six summarizes all the preceding chapters. Furthermore, it provides recommendations and discusses the study's contribution to the management field's knowledge. Lastly, the chapter concludes with the limitations' outlines.

6.4 Recommendations

Based on the conclusion from the tested hypotheses, the researcher proposed the following recommendations to academic’s institutions in South Africa:

- Considering that some academic staff responded they do not know what knowledge management is, Academic leaders should continue refining and

communicating the value of knowledge management in education by fostering continuous training programs for academic staff.

- Schools should help and educate their academic staff about the benefits of technologies of the fourth industrial revolution. This can help them reduce stress and discomfort about 4IR technologies. They should inform them that adopting 4ir technologies will change their work but will not still change their work.
- It is essential for both educators and students to establish a culture that promotes the exchange of knowledge, as they seem hesitant to do so. The utilization of information and communication technology (ICT) and the cultivation of advanced competencies among educators are insufficient in terms of their ability to contribute, communicate, document, and disseminate knowledge. A suitable policy should be developed to govern the capture and sharing of information and knowledge among academic staff. This can be achieved by utilizing an intranet or extranet for a collection of branches operating under the same management but located in different areas. The assistance of ICT and network managers is crucial for all academic staff, and the necessary infrastructure and technical support must be provided.

6.5 Contributions to the body of knowledge

The findings of this research have several implications for scholars and academic organizations. To begin with, this study has advanced the knowledge base on the application of TAM in forecasting academic faculty's inclination towards new technology use. As expected, both PU and PEOU demonstrated significance in elucidating academic staff's behavioral intentions towards the adoption of technologies for KM. Furthermore, this research expanded on previous works on technology acceptance and provided a deeper understanding of 4IR technologies adoption based on individual traits of technology readiness. Lastly, this study authenticated the TRI's measuring scale in an academic environment and enhanced its applicability to other contexts.

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6.6 Limitations and future research

Merging TRI and TAM is the initial step towards attaining an enhanced comprehension of technology acceptance among with diverse characteristics. Although several findings were significant, it is essential to acknowledge certain limitations present in the study:

1. The study's sample was obtained solely from one university in one country, which may reduce the study's generalizability to other institutions of higher education. Furthermore, the respondents' representativeness may also be restricted.

2. The study was carried out from a cross-sectional perspective, which may present a snapshot of the current study. Therefore, it would be beneficial to the proposed model if longitudinal studies were implemented.

3. While the present study emphasized the academic staff's personality traits towards the acceptance of fourth industrial revolution technologies in KM, forthcoming studies could investigate different staff members, such as librarians, to acquire an improved understanding of the impact of personal tendencies. Future research could also examine new constructs, such as perceived trust and perceived risk, which could enhance the explained variance of the proposed model.

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APPENDICES

APPENDIX A ETHICAL CLEARANCE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Research Office

HUMAN RESEARCH ETHICS COMMITTEE (NON-MEDICAL)
R14/49 Akonkwa

CLEARANCE CERTIFICATE	**PROTOCOL NUMBER: H21/04/01**
PROJECT TITLE	Assessing the readiness to adopt tecnologies of the fourth industrial revolution as a mean to improve knowledge management practices in academic institutions
INVESTIGATOR(S)	Ms J Akonkwa
SCHOOL/DEPARTMENT	Business Sciences/
DATE CONSIDERED	16 April 2021
DECISION OF THE COMMITTEE	Conditionally Approved Permission letters required before data collection can commence Risk Level: Minimal
EXPIRY DATE	07 June 2024

DATE 08 June 2021 **CHAIRPERSON** _____
(Professor J Knight)

cc: Supervisor : Professor A Moodley

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10004, 10th Floor, Senate House, University. Unreported changes to the application may invalidate the clearance given by the HREC (Non-Medical)

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to submit an amendment of the protocol to the Committee. **I agree to completion of a regular progress report. For Minimal and Low studies, this is due annually on 31 December. For Medium and High Risk studies, this is due twice annually on 30 June and 31 December.**

_____ _____/_____/_____
Signature **Date**

PLEASE QUOTE THE PROTOCOL NUMBER ON ALL ENQUIRIES

APPENDIX B QUESTIONNAIRE



SCHOOL OF BUSINESS SCIENCES

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

ASSESSING THE READINESS TO ADOPT TECHNOLOGIES OF THE FOURTH INDUSTRIAL REVOLUTION AS A MEAN TO IMPROVE KNOWLEDGE MANAGEMENT PRACTICES IN ACADEMIC INSTITUTIONS

Master of Business Science Research Project

Researcher: Judith Akonkwa Bahagarhe (2367616)

Supervisor: Althea Jansen

Dear Respondent,

Thank you for taking the time to take part in this study.

This questionnaire was created to assess the readiness of academic's staff to adopt the technologies of the Fourth Industrial Revolution as a mean to improve knowledge Management (KM) practices.

Throughout this questionnaire there are questions that seek to understand academics standpoint with the use of the technologies of the Fourth Industrial Revolution. The questions do not request any personal data or identity but the perception and the countermeasure that the academics staff have in place regarding the emerging of the technologies of the Fourth Industrial Revolution. Kindly provide your answer to the question by selecting the options provided. And a short and concise sentence where you are required.

By taking part in this questionnaire, you are contributing to the study that seek to understand the readiness to adopt technologies of the Fourth Industrial Revolution to improve knowledge management practices. By agreeing to submit your responses, you are providing consent to be part of this study and have your responses used for analysis. Furthermore, all personal information will be kept private, and you will be afforded complete anonymity.

Should you require more information on the study, you can contact the researchers as follows:

Researcher – Judith Akonkwa Bahagarhe (2367616@students.wits.ac.za)
Supervisor – Althea Moodle(althea.moodley@wits.ac.za)

You may also contact the Wits Human Ethics Research Committee (Non-Medical) for further grievances, or to elevate any concerns or complaints.

Telephone +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

Once again, thank you for taking the time to lend your interpretations to this study!

Judith Akonkwa Bahagarhe
*Required

QUESTIONNAIRE

SECTION A- Demographic Data

Instruction: Mark the most appropriate answer with an X

1. **Gender**

Male	**Female**	**Prefer not to say**

2. **Age group**

23-35 years	36-50 years	51 and above

3. **Academic Title**

Junior/Associate Lecturer	Lecturer	Senior lecturer	Associate professor	Full professor	Tutor

SECTION B

Technology readiness index

Definition

Fourth Industrial Revolution (4IR) is a fusion of technologies that is blurring the lines between the physical, digital, and biological spheres. These technologies include: artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing**.**

S/N	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly disagree
1.1	Like the revolutions that preceded , the Fourth Industrial Revolution has the potential to raise global income levels and improve the quality of life for populations around the world.With Disruptions and changes brought on by technologies of the Fourth Industrial Revolution, such as machine learning, artificial intelligence and robotics , it is imperative that new framework are adopted to better education					
1.2	Smart Technology will improve knowledge management					
1.3	Technology gives people more control over their lives					
1.4	Technology makes me more productive in my personal life					
1.5	Technology makes me more efficient in my occupation					
1.6	Product and services that uses the newest					

	technologies are much more convenient to use					
1.7	I rely on technology to keep up to date in my academic job					
1.8	Technologies of the Fourth Industrial Revolution will help people build stronger relationships					

S/N	**ITEM**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly disagree**
2.1	Other people come to me for advice on new technology					
2.2	In general, I am among the first in my department/faculty to acquire new technology when it appears					
2.3	I can usually figure out new high-tech product and services without help from others					
2.4	I keep up with the latest technological developments in my areas of interest					
2.5	I enjoy the challenge of figuring out high-tech gadgets					
2.6	I find I have fewer problems than other people in making technology work for me					

S/N	**ITEM**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly disagree**
3.1	When I get technical support from a provider of a high-tech product or service , I sometimes feels as if I am being taken advantage of by someone who knows more than I do					

3.2	Technical support lines are not helpful because they don't explain things in terms I understand					
3.3	Sometimes, I think that technology systems are not designed for use by ordinary people					
3.4	There is no such thing as a manual for a high-tech product or service that's written in plain language					
3.5	There should be caution in replacing important people tasks with technology because new technology is not dependable					
3.6	Technology always seems to fail at the worst possible time					
3.7	Many new technologies have health or safety risks that are not discovered until after people have use them					

S/N	**ITEM**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly disagree**
4.1	With Disruptions and changes that are expected from the technologies of the Fourth Industrial Revolution , I do not consider it safe to provide personal information over the internet					
4.2	Fourth Industrial Revolution and its technologies will					

	exacerbate existing social, economic and political inequalities in south Africa					
4.3	Disruption and changes of the technologies of the Fourth Industrial Revolution will lowers the quality of relationships by reducing personal interaction					
4.4	Economies are being disrupted by new technologies in the Fourth Industrial Revolution, I am scared that I might lose my job as a result of robotics and other technologies of the Fourth Industrial Revolution					
4.5	Technologies of the Fourth Industrial Revolution such as the Internet of Things(IOT) presents previously unforeseen risks to the organization and its knowledge assets					
4.6	With the uncertainty brought on by technologies of the Fourth Industrial Revolution , I worry that information I make available over the internet may be misused by others					
4.7	Whenever something is automated, you need to check carefully that the system is not making mistakes					

Technology acceptance

S/N	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly disagree
5.1	Using technologies such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing, in my job would increase the efficiency of my daily work					
5.2	using technologies such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing would improve my job performance					
5.3	using technologies such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing would increase my productivity					
5.4	technologies such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing would make it easier to do my job					
5.5	Technologies such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing would be useful for me as an academic staff					

S/N	ITEM	Strongly Disagree	Disagree	Neutral	Agree	Strongly disagree
6.1	Learning to operate technologies such as					

	Internet of things (IOT), Artificial Intelligence (AI), cloud computing would be easy for me					
6.2	I would find it easy to get technologies such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing to do what I want to do					
6.3	My interaction with technologies such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing would be clear and understandable					
6.4	It would be easy for me to become skillful at using technologies of the 4IR such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing					
6.5	I would find technology of the Fourth Industrial Revolution such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing easy to use					

S/N	**ITEM**	**Strongly Disagree**	**Disagree**	**Neutral**	**Agree**	**Strongly disagree**
7.1	I plan to use the technology of the Fourth Industrial Revolution such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing in my job					
7.2	It is likely that I will use the technology of the Fourth Industrial Revolution such					

	as Internet of things (IOT), Artificial Intelligence (AI), cloud computing in my job.					
7.3	Assuming I have access to the technologies of the Fourth Industrial Revolution4IR such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing I intend to use them in the Knowledge Management process					
7.4	Given that I have access to the technology of the Fourth Industrial Revolution such as Internet of things (IOT), Artificial Intelligence (AI), cloud computing I predict that I would use them in the Knowledge Management process					

In your Opinion do you think technologies of the Fourth Industrial Revolution will improve the Knowledge Management practices?

Yes	**No**

Please justify your response to the previous question

……

……

WE THANK YOU FOR YOUR PARTICIPATION AND TIME