Sudan University of Science and Technology

College of Graduate Studies

The interpretation role of innovation capabilities in the relationship between knowledge management processes and competitive advantage: the moderating effect of information technology in Sudanese industrial sector

الدور المفسر للقدرات الابداعية فى العلاقة بين عمليات ادارة المعرفة والميزة التنافسية.

الأثر المعدل لتكنولوجيا المعلومات فى القطاع الصناعي السودانى

Thesis Submitted in Fulfilment to the Requirements of the Philosophy of Doctorate Degree in Business Administration

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Khartoum

2019

Dedication

Special thanks to the most important people in my world to whom i dedicate this thesis .

To the meaning of love, life and mystery of existence **mother** words cannot express how grateful I am, your prayer for me was what sustained me thus far.

To my **father**, who taught me to give without waiting for thanks, to whom I bear his name proudly, I had experienced your existence and guidance each and every day, dad you are the one who enable me finish my degree.

My beloved **wife** and **Brothers**, Thank you for supporting me for everything, and I can't thank you enough for encouraging me throughout this experience

To whoever might find this dissertation is interesting.

My love to all of you can never be quantified.

God bless you all.

Acknowledgements

In the beginning, I would like to thanks Allah for guiding me through all the difficulties and in completing this thesis.

Second I would likes to thanks Sudan University of Science and Technology for accepting my proposal and be one of the universities PhD. Researcher.

Next special mentions go to my enthusiastic supervisor professor Siddig Balal Ibrahim Balal; you have been a tremendous mentor for me. I would like to thank you for your brilliant comments, suggestions and faithfully guided me step by step for more than three years so that I was talented to finish my work and obtain this doctoral degree.

Besides my supervisor, I would like to thanks Dr, Abdulsalaam Adam for his valuable comments.

I would like also to express my profound gratitude to my colleague from PhD Candidates Adam Yagoob and Alamin Mohamed for their practical support, and advice

Finally, I'm grateful to my colleagues, who share me the time, funny and love, thanks for your valuable comments.

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LIST OF ABBREVIATIONS:

KM	knowledge management
CA	Competitive advantage
INC	innovation capability
IT	information technology
CMIN/DF	Normal Chi-Square Fit Index
AGFI	Adjusted Goodness-of-Fit Index
RMSEA	Root Mean Square Error of Approximation

NFI	Normed Fit Index or Bentler Bonett Index
NNFI	Tucker Lewis Index or Non-Normed Fit Index
CFI	Comparative Fit Index″
GFI	Goodness-of-Fit Index
CMIN/DF	Normal Chi-Square Fit Index
Std	standard deviation
EFA	exploratory factor analysis
CFA	Confirmatory Factor Analysis
SFL	Standardized factor loadings
AVE	Average Variance Extracted
CR	Composite Reliability
RMR	Root Mean Square Residual
KMP	knowledge management process
SEM	structural equation model
RBV	resource-based view
KBV	Knowledge-based view
KMPC	knowledge management process capability

Abstract

Today's firms are facing rapid changes in the business environment. One of the biggest global challenges that faced industrial firms is how to win and create competitive advantage. The purpose of this study is to investigate the effect of knowledge management processes on competitive advantage through innovation capabilities in the industrial firms operating in Khartoum State. Based on literature review, RBV theory and knowledge-based theory the model study were built, the study used descriptive methods, primary data were obtained through a questionnaire survey distributed 300 and returned 207questionnaire rate with 70%. The study used equation structural modeling (ESM). The study results showed that a positive and partial relationship between knowledge management processes and innovation capabilities on competitive advantage, innovation capabilities partial mediate the relationship between knowledge management processes and competitive advantage, while information technology is moderate the relationship between knowledge management processes and innovation capabilities. Based on study's results, the discussion of the findings, the theoretical and practical implications for study.

Keywords: knowledge management, innovation capabilities, information technology, competitive advantage

المستخلص:

تواجه الشركات اليوم تغيرات متسارعه في بيئه الاعمال التى تتسم بالتغيير السريع فكان من أكبر التحديات العالمية التي يواجهها الشركات الصناعية فى كيفية كسب وخلق الميزة التنافسية. لذا هدفت هذه الدراسة لأختبار الدور الوسيط للقدرات الإبداعية فى العلاقة بين ادارة المعرفة و الميزة التنافسية فى الشركات الصناعية العاملة بولاية الخرطوم. إستنادا علي النظرية القائمة على الموارد ونظرية المعرفة وادبيات الدراسات السابقة تم بناء نموذج الدراسة, أستخدمت الدراسة المنهج الوصفي التحليلي, لتحقيق اهداف الدراسة تم تصميم إستبانة كأداة رئيسية لجمع البيانات الأولية عن طريق إستخدام عينة غير إحتمالية, حيث وزعت 300 إستبانة للمدراء استرد منها 207 إستبانة بنسبة 70%,إستخدمت الدراسة نمذجة المعادلة البنائية . و توصلت الدراسة الي مجموعة من النتائج. هنالك علاقة إيجابيه جزئية بين إدارة المعرفة والقدرات الإبداعية على الميزة التنافسية, وان القدرات الإبداعية تتوسط العلاقة جزئيا بين ادارة المعرفة والميزة التنافسية, وان تكنولوجيا المعلومات تعدل العلاقة بين ادارة المعرفة والقدرات الإبداعية, واستنادا علي نتائج الدراسة تم مناقشتها وتقديم التاثيرات النظرية والعملية

الكلمات المفتاحية: ادارة المعرفة, القدرات الابداعية, تكنولوجيا المعلومات, الميزة التنافسية

CHAPTER I:

INTRODUCTION

CHAPTER I:

1.0. Introduction

The purpose of this chapter is to provide an overview of this study and its organization. It begins with Background of the study. Followed by the problem statement, research questions, research objectives and the significance of the study, In addition the chapter contains a section on operational definitions of the key variables used in this study as well as the outlines of the study organization.

1.1: Background of the study

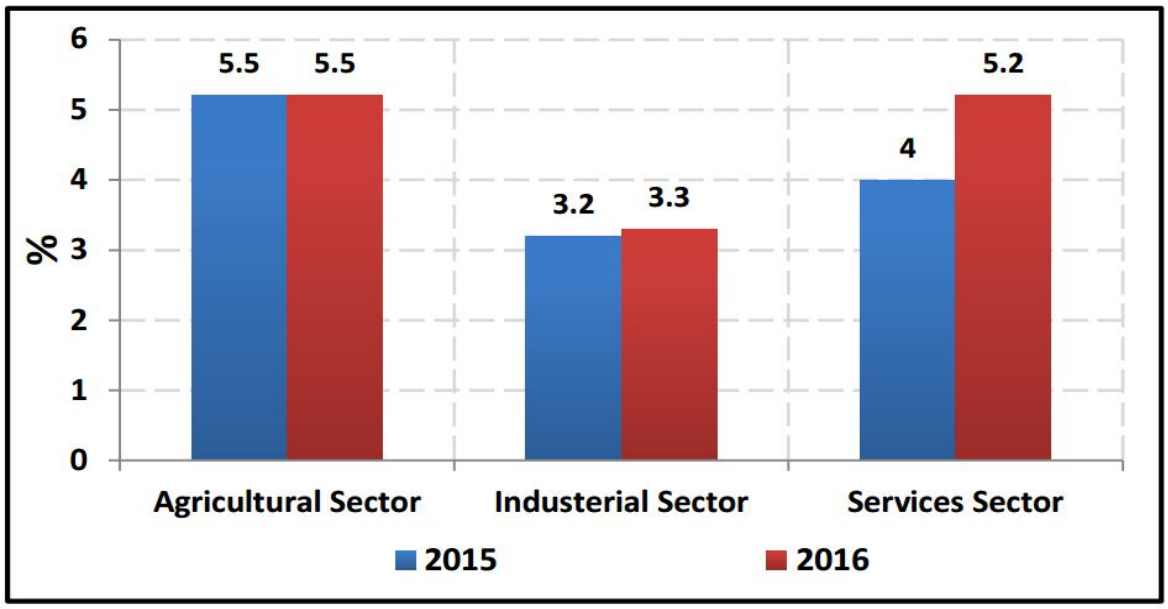
As the globalization has created challenges to the organizations, there are many organizations competing each other in order to defeat that competition and win the customers. The organizations have to face the high risks of competition and the possibilities of losing customers. One of the main reasons which cause this problem is that organizations have difficulties in responding to the rapid changes of market trends (Sixue, 2017).The current business competition is increasingly tight. Businesses or companies are required continuously to find ways and strategies to be best in order to survive in global competition. One way that can be taken by the company to be the best is to have a good company strategy in order to gain competitive advantage(Afriapollo 2016).

This instability of environment, characterized by the ever increasing rate of change, necessitates change in the way organisations conduct their business Change in terms of the way business is conducted means there is a corresponding change in business models and the business processes that support these models. As the change is a global phenomenon comes in different manners, so Sudan it became a country with a new reality after 2011. Challenges and unclear economic future, this resulted reality has economic crisis situation that may continue because of many reasons.(Hamid, 2018). After years of continuous growth contribution of industry in Sudan GDP but in the last five years the contribution of industry has decreased(CBOS, 2015)along side with that problem more than (40%) of Manufacturing companies were closed due to different reasons related to economy and policies (Ministry of industry,2016).

The Industrial Sector comprises: petroleum, mining, quarrying, processing industries, handicrafts, water and electricity. The contribution of the industrial sector to the Gross Domestic Product rose slightly from 26.1% in 2016.

Figure (1-1)

Sectors Growth Rate for 2015 and 2016



Source: manual report (CBOS, 2016)

According to figure (1-1) GDP growth rate at constant prices witnesses a considerable increase from 4.3% in 2015 to 4.9% in 2016 due to the increase in some sectors such as the industrial sector in which the growth rate increased to some extent from 3.2% in 2015 to 3.3% in 2016,

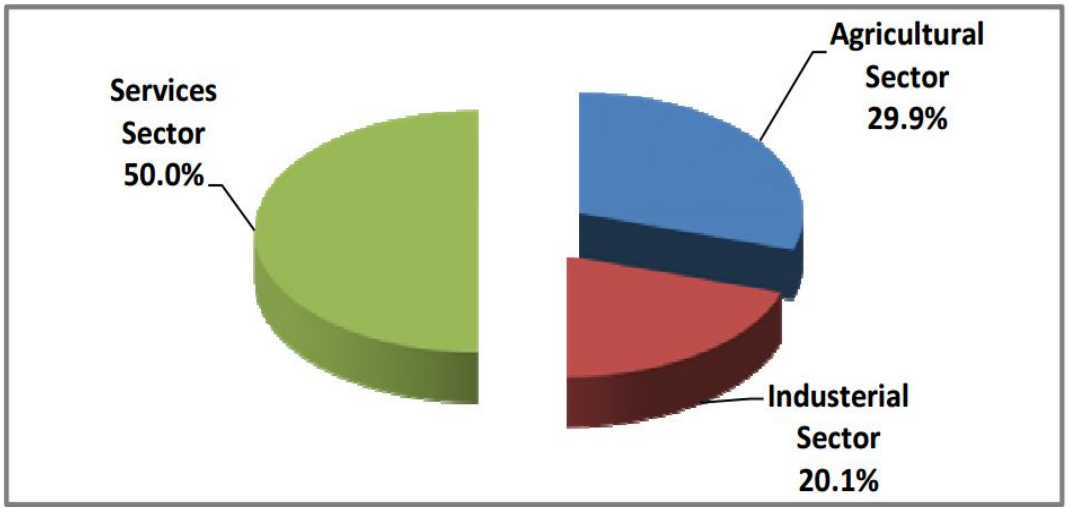
The increase in the industrial sector growth rate can be attributed mostly to the boost in the growth rate of some of its sub sectors, such as the handcraft and processing, which grew significantly from 4.1% in 2015 to 5.1% in 2016, Building and construction also show a significant growth rate from 5.0% in 2015 to 5.5% in 2016, never the less, growth rate of mining and quarrying sub sector decreased from minus 10.8% in 2015 to minus 13.6% in 2016, and the electricity and water growth rate decreased from 10.9% in 2015 to 5.8% in 2016.

1.2. Contribution of Economic Sectors in GDP

Figures (1-2) (A) and (1-2) (B) exemplify the contribution of various economic sectors in GDP for 2015 and 2016.

Figure (1-2) (A)

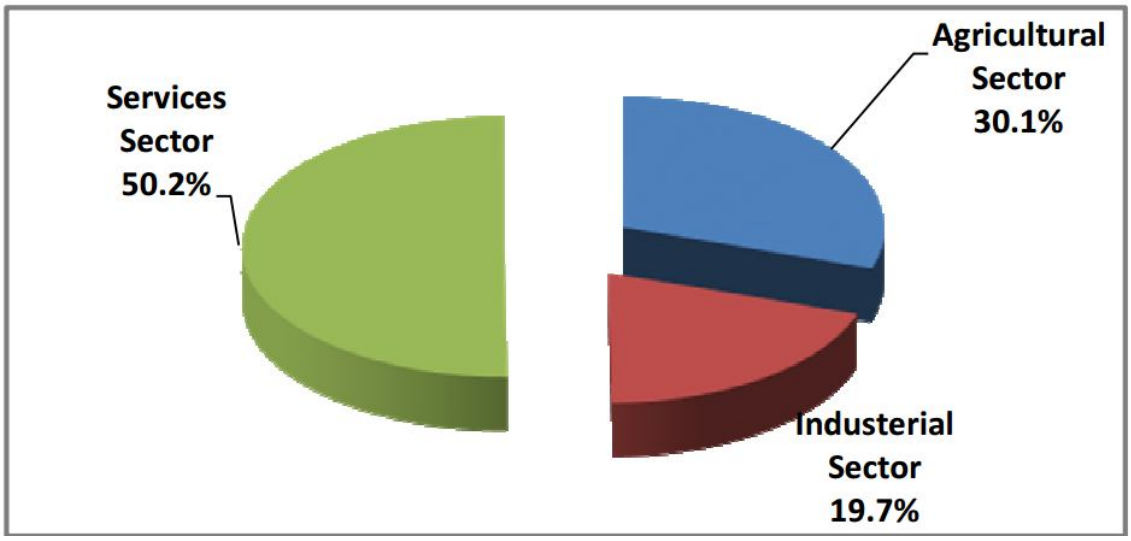
Economic Sectors Contribution to the GDP for 2015



Source: manual report (CBOS, 2016)

Figure (1-2) (B)

Economic Sectors Contribution to the GDP for 2016



Source: manual report (CBOS, 2016)

However, the contribution of the industrial sector to GDP in real terms decreased from 20.1% in 2015 to 19.7% in 2016 by 0.4%, due to the decrease in the contribution of its some sub sectors. The contribution of mining and quarrying decreased from 2.1% in 2015 to 1.8% in 2016, while the contributions of some of its subsectors such as processing and manufacturing, electricity and water, building

and construction remained without change at 13.4%, 2.8% and 1.8% respectively in 2015 and 2016 manual report (CBOS,2016).

Therefore, it is difficult to overestimate the necessity of knowledge management (KM) in organizations. Efficient knowledge management creates the capability, which becomes the basis for the future competitive advantage of any company. Companies in different sectors of economy and various industries face an increasing flow of information, which need to be managed and analyzed in order to create knowledge and remain competitive on their markets (Tcarev, 2018).

1.3. Statement of the problem:

Knowledge management is purported to be essential to sustained competitive advantage and continued business success(Ambula et al,2017),nowadays knowledge management has become important due to increased awareness of the importance of knowledge for organizations prosperity and survival (Eugenie&John,2016),knowledge currently and in the future represents a power source that achieves progress and the competitive advantage ,because it considers the most important source for the organizations ,societies and individuals it helps enhancing skills and experiences ,accelerates the innovation and creative distinguish activities which adds value and a achieves customers desires ,it also makes the organization at the excellence stage (AL-Hayaly&ALnajjar, 2016).

The arguments of researcher for conducting this research is that previous studies are done in other economics, so the implication of those studies cannot be generalized for a developing country like Sudan where the knowledge management is still emerging in Sudan. There is a lack of empirical studies that explore even the mere existence of knowledge management in the country .This study will explore the relationship between knowledge management and competitive advantage. The existing empirical work concentrates mainly on the knowledge management and related constructs independent variables and innovation capability as mediator variables, information technology as moderator variables and competitive advantage as dependent variables .the results of these studies still mixed. previous studies showed a positive relationship between knowledge management and competitive advantage (Burren,2017; Sixue,2017;AL-Hayaly&ALnajjar,2016; Guzman et al ,2017; Ali et al,2017; Nwaiwu&Imafidon ,2017; Jyoti et al,2015; Munene et al,2016; Kiseli et al,2016).All these studies used knowledge management in different dimensions,

Some of these studies used knowledge management as three components (Ambula,et al, 2017; Buuren, 2017), while others used knowledge management as four dimensions (Malek et al, 2016), furthermore, AL-Hayaly&ALnajjar (2016)used knowledge management as five dimensional construct. However few of the scholars (Udin&Baluch, 2017) used knowledge management multidimensional construct. This study were examined the relationship between knowledge management and competitive advantage the main reason for using knowledge management dimensions with four components it was more holistic and core elements for knowledge management processes. Despite the importance of acknowledging the concept of knowledge management and its implications on competitive advantage, it emerges that empirical studies on the relationship between competitive advantage and knowledge management are unduly under-represented, and remain inconclusive.

Besides exploring the relationship between knowledge management and competitive advantage this study investigates the relationships between knowledge management and innovation capabilities. Previous research as shown that successful application of knowledge management for example (Ambula et al,2017; Mohammed et al,2017; Nawab et al ,2015).In contrast ,there are limited studies which addressed the knowledge management and relationship innovation capabilities (Byukusen et al, 2016; Ebrahim et al, 2017;Marianne &Danny , 2017; Dinesh et al, 2017; Shahid &Alvi,2016), the previous studies used innovation capabilities as two dimensions (Ebrahim ,2017,Vafaeid et al, 2017) and others researchers used three dimensions (e.g., Kising et al, 2017; Sameeni&Alvi , 2016). In this study used innovation capabilities as two dimensions namely: radical innovation and incremental innovation. In contrast and to some extent there is no any study that explicitly addressed the innovation capabilities related to knowledge management in Sudanese environment.

As regards the impact of innovation capability on competitive advantage, the theoretical and empirical literature reflects the importance of firms innovating to achieve enhanced performance (Laith et al, 2015). However**,** many studies have explored the impact of innovation capabilities on competitive advantage (Karanja et al, 2018; Perin et al, 2016; Coccia, 2016; Hahmidi& Gharneh,2017; Alrubaiee et al,2015; Samsir et al,2017; Wanjiku, 2018; Nawab et al,2015). Companies that have had a positive performance through innovations invest in more activities regarding innovations that have succeeded in order to achieve more. It's important to note that no

company can exist and survive without innovating despite their activities of size (Sipos & Ionescu, 2018).

Thus, examining this relationship is important because they are rarely studied together in the obtainable literature. Moreover, the previous studies have mostly ignored the relationship between innovation capabilities and competitive advantage with knowledge management process

Researchers do not take in to account the impact of relationship innovation capabilities in mediating the relationship between knowledge management and competitive advantage. Previous studies showed that the mediating role of the innovation capabilities between knowledge management and competitive advantage for instance (Laith et al, 2015; Nursanti, 2017; Bugenie&John, 2016; Durmus& Kharmorz, 2017) .in this research test the relationship between knowledge management and competitive advantage, innovation capabilities as mediator.

Besides investigating the mediating effect of relationship innovation capabilities on the relationship between knowledge management and competitive advantage, this study investigates the moderating effect of information technology on the relationship between knowledge management and innovation capabilities.

Previous study indicated that, Sumo et al (2017) explore information technology plays an important role in student's participation in knowledge management activities for learning, Khalieghi (2017) considering the necessity of attention to information technologies and their impact on organizational agility, knowing various effective factors affecting it is also of paramount importance

information technology capability reflects the ability of a firm to deploy IT –based resources in support of business strategies and work processes, this ability primary considered critical factor that enables firms to acquire and apply knowledge as well as information during collaboration (Cai, Huang, Liu and Liang, 2018).Finally, past studies examine how such information technology interacts with other variables (Zhaocai&Hefuliu, 2016; Tarekengn, 2017;Allamah,2017; Miller, 2018; Abubaker et al, 2017). Therefore, this study investigates the moderating role of information technology between knowledge management and innovation capability

Specifically, the main problem of the research is to examine the interpretation role of innovation capability dimensions (radical innovation and incremental innovation) in the relationship between knowledge management dimensions (knowledge acquisition, knowledge sharing, knowledge storing and knowledge application) and competitive

advantage dimensions (cost,quality,delivery and flexibility) of the manufacturing firms in Sudan, beside the moderating effect of information technology in the relationship between knowledge management and innovation capabilities.

1.4. Research questions

1. What is the relationship between knowledge management and competitive advantage?

2. What is the impact of knowledge management on relationship innovation capabilities in Sudanese organizations?

3. What is the relationship between innovation capabilities and competitive advantage?

4. Does innovation capabilities mediate the relationship between knowledge management and competitive advantage?

5. Does information technology moderate the relationship between knowledge management and innovation capabilities?

1.5. Objectives of the study:

This study attempt to achieve the following objectives:

1. To explain the relationship between knowledge management components and competitive advantage.
2. To investigate the relationship between knowledge management components and relationship innovation.
3. To determine the relationship between relationship innovation capabilities and competitive advantage.
4. To test the effect of relationship innovation capabilities as mediator variable between knowledge management and competitive advantage.
5. To investigate the moderating effect of information technology on the relationship between knowledge management and innovation capabilities.

1.6. Significance of the study:

1.6.1. Theoretical significance: This study is expected to add to the following areas of knowledge about competitive advantage:

1. The study identifies the knowledge management process adopted by industrial firms in Sudan. In general, knowledge about existence of knowledge management process in Sudan and developing countries is still lacking. Thus, the study can add considerable knowledge in this area and provide a base for future researches on this issue.

2. The study contribute to fill the gaps knowledge in the previous studies specialized in Sudan industries

3. The study will provide scientific advices and guidelines through which the Sudanese firms can achieve the competitive advantage.

4. The study will examine mediating effect of innovation capabilities on the relationship between knowledge management process and competitive advantage, information technology as moderator variable between knowledge management process and innovation capabilities

The study also valued the theory by using RBV theory and KBV theory

1.6.2. Practical significance: from a practical contribution perspective, the study is expected to enhance the knowledge of competitive advantage in Sudanese firms in the following ways:

1. The study can advance manager's understanding about the importance of of knowledge management process to competitive advantage.

2. The adoption of knowledge management process among Sudanese industries will contribute to establishing innovation capability and enhancing competitive advantage.

3. Managers can emphasize the importance of intangible resources in enhancing and sustainable competitive advantage.

4. This study may encourage managers to play a greater role in activities related to the development of innovation capabilities.

1.7. Operational Definitions:

Knowledge management process: Defined as activities of acquiring, creating, storing, sharing, diffusing, developing and deploying knowledge by individuals and groups (Ran& Vangala, 2017)

Knowledge Acquisition: defined as the process of creating knowledge, deriving it and forming it within the institution, and transforming knowledge into a phenomenon (Musa, 2013)

Knowledge sharing: defined as business process that requires collective knowledge skills expertise and dissemination of knowledge across the organizational units (Musa, 2013).

Knowledge storage: codifying, storing, refining, indexing, evaluating and updating the knowledge in organization repository (Ram &Hire math, 2017).

Knowledge application: defined as organization response of knowledge that reflect the organization ability to respond to different types of information that has access to it (Lee, & Ooil 2013).

Innovation capabilities: defined as the adoption of an idea or behavior that is new to the organization, the innovation can be a new product or new service or new technology, innovation is related to change, which can be radical or incremental (Herkema, 2003).

Radical innovation: radical innovation refers to the important of the changes made in new products and services offered by the company (Regient et al, 2016).

Incremental innovation: is defined as cumulative and gradual nature of technological changes in organization to create services (Regient et al, 2016).

Competitive advantage: is defined as the organizations ability to perform its task in a way that is difficult for its competitors to imitate. (Alghamdi 2016)

Cost: defined as a competitive priority focus on lowering cost, improving productivity, maximum capacity utilization, reducing inventory (Sani, 2014).

Quality: Quality is ability to satisfy the need and expectations of customer (Sachitra&Chong 2017),

Flexibility: the abilities of organization to response to environment change and extent to which services match consumer satisfaction (Khalifa, 2016).

Delivery: Delivery is a competitive priority because customers are interested in satisfying their needs and wants in the right quantity at the right time (Pong& Himanshu, 2017).

Information technology: defined a company to require deploy information technology is tools and methods used in different ways to collect, store, retriever process analyze and distribute data (Tarekengn, 2017).

1.8. Research organization

This thesis consists of six chapter's .chapter one introduction construct from (background of the study, statement of the problem, research questions, research objectives, significance of the study). Chapter two provides a structured literature review of general this review classifies and analyses literature published on knowledge management, innovation capabilities, information technology and competitive advantage. Chapter three reviews will present the research framework, theories and the hypotheses development that will test. Chapter four contains research methodology, Population and sample of the study, designing questionnaire, pre-test and variables measurement. Chapter five data analysis and findings**:** including an analysis of the collected data and testing the hypotheses.

Chapter six, discussion and conclusions**:** including presentations of the results, that provides discussion of research implications, the limitations, and directions for future research.

CHAPTER II:

LITERATURE REVIEW

CHAPTER TWO
LITERATURE REVIEW

2.0. Introduction

The literature review sheds light on the areas of knowledge management, innovation capability, information technology and competitive advantage. The discussion of each is conducted by the review of relevant literature that will be used to explain the relationship between knowledge management processes, innovation capability and competitive advantage. It will also explain the mediating role of innovation capability on the relationship between the knowledge management processes and competitive advantage. This in addition to testing the moderating effect of information technology on the relationship between knowledge management processes and innovation capability

2.1. The concept of Knowledge

Many of intellectuals and researchers have called the current era as the knowledge era or the knowledge revolution era after knowledge has entered the types and areas of knowledge in all aspects of contemporary life. Knowledge is viewed as main supplier in organizations and as an anchor for the organizations activities, such as making smart decisions, prediction and strategic planning (Al-Zoubi&Nsor, 2016).

(Alrubaiee et al, 2015) identifies knowledge as a mixture of concepts, ideas, rules and procedures that guide actions and decision. It also defined as the integrative systematic process to coordinate the organizations' activities in light of identifying cognitive needs and acquiring, transferring, storing, sharing and applying the knowledge to achieve the organizational goals which help the organization to be able to achieve better value and benefit from the knowledge.

(Iram et al, 2015)In organizational terms, knowledge is generally thought of as being know-how, applied information, information with judgment, or the capacity for effective action, Knowledge maybe tacit, explicit, individual and or collective. It is intrinsically linked to people. Knowledge is result of learning and the process of

identifying, creating, storing, sharing, and using it to enhance performance. It has always occupied man. Knowledge is something which only humans can possess. People know things; computers can't know thing.

Sixue (2017) considered as one of the most important and highly valued asset and commodity. Ebrahim et al, (2017) defined knowledge as information in context with understanding to applying that knowledge. Knowledge consists of truths and beliefs, perspectives and concepts judgments and expectations, methodologies and know-how. Knowledge is justified personal beliefs that increase an individual's capacity to take effective action. Mercelo, (2016) it contains information that is ready and can be used in making decision and actions. The main purpose to share the knowledge is to make the knowledge visible and to show the role of knowledge in organizations and encourage employees to foster behaviour such as knowledge sharing and build the knowledge infrastructure.

Akram et al, (2011) identified the duality of the knowledge. He divided knowledge into two types:

Tacit knowledge: defined are the abilities, expertise and conceptual thinking. Further, he argued that tacit knowledge is not only attributed to the, what is known but it is also attributed to the knower as well. Because sometimes knower's knowledge level is soaring but he could not explain in efficient way or sometimes knower does not have adequate sources to disseminate his knowledge to the person who actually needs this. Tacit knowledge is very difficult to acquire because it is embedded in the form of capabilities, skills and ideas which individuals carry in their minds. Tacit knowledge can only be seen through the application that is why tacit knowledge is difficult to capture exploit and diffuse among the organizational members (Akram et al, 2011).

Explicit knowledge: explicit knowledge can be disseminated and shared data, well defined procedures and standardized principles. Nonaka&Takeuchi defined explicit knowledge as knowledge of rationality. Explicit knowledge is easy to capture, manage, share and disseminate to the people (Akram et al 2011).

In contrast, tacit knowledge is personal and hard to formalize – it is rooted in actions, procedures, commitments, values and emotions. Tacit knowledge is the less familiar unconventional form of knowledge. It is the knowledge which we are not conscious of. Tacit knowledge is not codified, it is not communicated in a "language", and it is acquired by sharing experiences, by observation and imitation (Agbin et al, 2017).

According to Sharafuddin, (2017) Knowledge can be separated into two different types, tacit and explicit knowledge. Explicit knowledge is the type of knowledge which can be documented while tacit knowledge is the experience, behaviour and perception that have been gained inside the human. On the other hand, tacit or explicit knowledge is the extreme private knowledge that is not easy to verbalize, articulate and transfer it also cannot be grasping by official training or education and may even be subconscious but it can be documented to become explicit knowledge.

2.1. 1. Knowledge management Concept:

The concept of KM is relatively new and highlights how the management of knowledge is just as important as managing resources. It is a new area of management in the era of the knowledge economy. KM is the management of information and knowledge, and their usage in organizational business processes within the organization. It indicates strategies and processes designed to identify, capture, structure, value, leverage, and share an organization's intellectual assets to enhance its performance and competitiveness. KM is about applying the collective knowledge of the entire workforce to achieve specific organizational goals. It involves people, technology and processes. To understand KM we need to know the process and how that differs from information and information management (Mohajan, 2017).

The definition of KM various authors are provided as follows:

Knowledge management has been defined in different ways and from different aspects; interestingly, no sole definition can explain the whole picture, as different authors viewed knowledge management from several perspectives, which dictates the way they define it. However the study of knowledge dates back to ancient Greece. Even before that, knowledge was at least implicitly at managed as people performed work. Early hunters, for example learned the best skills and practices for successful hunt. The skills and techniques transferred from one generation to the next. This illustrates the transfer of knowledge, knowledge management activity (Tarekengn, 2017).

Knowledge management can be defined as a combination of border experience, contextual information, norms and values that give a base for investigating and integrating new information and experiences. It prevails in the mind of individuals but from organization perspective it not only exists in the repositories but also in the daily routine activities of the organization practices (Butt, 2017).

Knowledge management (KM) diffusion is timely dissemination of needed knowledge to the relevant decision makers. KM capability turns to a source of competitive advantage because that is usually difficult to copy. Companies utilize external information systematically to develop creative options that enhance productivity and leads to new ideas (Sameeni & Alvi, 2016).

Knowledge management represents the methodological way that enhances the company's capability to improve the capability on making the decision, and the process formulating the strategy (AL-Hayaly&ALnajjar, 2016)

Knowledge management approach is a self-conscious combination of personnel process and technology that are involved in design attract, and execution of rational infrastructures in an organization and it not only consists of design and execution of information systems, but includes the necessary changes in administrative attitudes and organizational behaviour and policy that the present personnel in the organization may developed the ability for information collection and sharing of what they know and this leads to activity that improves services and results (Mirza,2016).Knowledge management is defined as helping the organization to detect, select, organize, distribute and transfer of knowledge and experience successfully for activities such as problem solving, strategic planning and decision making (Mobaraki, 2017).

KM envisages capturing, creating, using, reusing, sharing, disseminating and managing of knowledge, which comprises of three components as: I) people who create, share and use knowledge as part of their daily work and help shape a knowledge sharing organizational culture, ii) processes which include methods to acquire, create, organize, share and transfer knowledge to fit different situations, and iii) the technology including the mechanisms to store and provide access to data, information, and knowledge are created by people in various locations within a country or in different countries that must be integrated with the way people work, and address their real needs(Mohajan,2017).The purpose of knowledge management is to enhance and improve the operation of a company to achieve profitability, competitiveness, and increase profit. The concept of knowledge management in a company also aims to improve performance by growing the culture of sharing knowledge, where knowledge is an asset that can be managed, so that it can be communicated and used together (Samsir, Nursanti, Zulfadil, 2017)

AL-Hayaly&ALnajjar, (2016) considered knowledge management strategy helps the organizations to face the competition, globalization, economy and the rapid

technological development through creating the effective knowledge that contributes the raising the organizational intellectual capabilities and achieving competitive advantage. American Productivity & Quality Centre (APQC) defines KM as “an emerging set of strategies and approaches to create, safeguard, and use knowledge assets (including people and information), which allows knowledge to flow to the right people at the right time so that they can apply these assets to create more value for the enterprise,
(Vangala, 2017)

Mirza et al, (2016)Knowledge management refers to systematic and coherent process of harmonization of wide activities including the acquisition, creation, and storage, sharing and applying knowledge by individuals and groups in order to a achieve organizational goals. Therefore, the level of interest of KM from enterprises, especially SMEs, is based on the development of computing, networks and data management services by which knowledge can be shared and transferred among different people (Guzman et al, 2017).

(Kiseli&Eng, 2016) Were among the first scholars in the field of KM to provide a comprehensive model of KM capability dimensions from the perspective of organizational capabilities, According to this model, the KM capability of a firm includes two key components: knowledge management infrastructure capabilities (KMIC) and knowledge management process capabilities (KMPC). KMIC includes technology, structure and culture, while KMPC is comprised of acquisition, conversion, application and protection processes. Taken together, these resources determine the KM capability of an organization.

Nwaiwu & Huldah (2017) identified the following five processes as constituting knowledge management:

1) Understanding knowledge requirements; searching for knowledge from different sources; finding existing knowledge; and fusing it;
2) Creating new knowledge;
3) Integrating knowledge created externally;
4) Applying existing knowledge; and
5) Re-using knowledge.

According to Aramburu (2014) Knowledge management is about managing knowledge processes, i.e. the acquisition, creation, distribution, storing and retrieval of knowledge in an organization. With the aim of increasing the efficiency in the use and exploitation of knowledge, although, there are many classifications of KM, this study

prefer the viewpoints of knowledge management processes because industrial sector is knowledge based, it uses knowledge management processes for continuous innovation in business products, and processes for achieving competitive advantage

2.1.1.2. Knowledge management process:

Most of the concepts and the management schools see that knowledge management represents processes, and knowledge information come from internal and external sources do not mean anything without these processes. Knowledge management processes define as the degree to which the company creates in them the knowledge and participate in it, distribute and benefit from it in the job limits (AL-Hayaly&ALnajjar, 2016).KM processes includes the creation of knowledge, organizing, storage, sharing and utilization of knowledge while the KM Strategies are codification and personalization. The modern society is moving towards knowledge society with a very fast pace; therefore knowledge is one of the ultimate sources of competitive edge for most of the companies (Nawab et al, 2015)

Lai and Choi (2013) emphasized that knowledge management consists of processes to manage knowledge and enablers (or capabilities) to support these processes. They also argue that knowledge management enablers consist of organizational culture, structure, people, and information technology support.Valio&Martins, **(**2017**)** indicate that the KM process consists of four stages: acquisition, storage, distribution, and use of knowledge.

Parhizgar & Kiarazm (2015) Knowledge management is a process to capture, acquire, organize, and disseminate employees' knowledge for tacit and explicit knowledge. It is a conscious effort to get the right knowledge to the right person at the right time so that staff in the organization can share and put information into action in ways that improve organizational performance. Ram et al, (2017) addressed the knowledge management process; they divided the knowledge management into many process. KM process includes activities of acquiring, creating, storing, sharing, diffusing, developing and deploying knowledge by individuals and groups.

Samsir, (2017) is an integrated process relating to the creation, dissemination and utility of knowledge to realize the objectives of the company? Knowledge management is also a series of actions to show the design of the organization along with the principles of management and business, procedures and applied technique. This can help employees to show their ability and creativity with extraordinary efficiency to

create values for the business itself. In other words, the timeliness in receiving and transmitting the right information to the right employees will result in a competitive advantage for the company.

Sharafuddin, (2015) defined knowledge management process is the process of converting data into right information and delivery it to the right person in the right time. It's the process of putting information into action in ways that will improve the company performance. Thus, KM must be considered as a sequence of activities and events (i.e. creation, storage, transfer or application of knowledge) that ultimately lead to KM outcomes (Chiu &Chen, 2016).

Azimi (2016) deemed KM as a process thereby the organizations are enabled to convert data into information and information into knowledge and at the same time they will be able to employ the acquired knowledge effectively in their decision making. On the other side, Tubigi and Alshawi (2015) addressed the processes of the knowledge management as some other researchers relied on characteristics to distinguish between every process where to start and where to end. However, there are common processes between those researchers.

The main perspectives of study on the KM process, the first, referred to in this article as flow based on organizational development, focuses on increasing the knowledge storage and reuse of the knowledge repository (Gonzalez et al., 2014). In this perspective, KM refers to the development of methods, tools, techniques and organizational values that promote the flow of knowledge between individuals and the retrieval, processing, and use of this knowledge in improving and innovating activities, The second important area, called process-based flow, has as its main interest the study of the contribution of Information Technology (IT) as a mechanism to stimulate the creativity of individuals to develop new values to the business (Gonzalez& Martins, 2017)

According to (Ran& Vangala, 2017) this study examines four processes: knowledge acquiring, knowledge sharing, knowledge storing and knowledge application. Hence these processes depend on each other; therefore, based on the previous studies, this study addressed knowledge management processes within the following four dimensions

Table(2.1) Dimensions of knowledge management process

No	Authors	Dimensions
1	Mahdi et al (2019)	**1.** Knowledge identification.2.sharing.3. Storing. 4.generating.5.application
2	Mohammed et al(2017)	1. Creation 2. Dissemination 3. Application
3	Colinting (2017)	1. Creation 2.Storage 3.Transfer 4. Application
4	Ran Naresh (2017)	1. Acquisition 2. Storing 3. Sharing 4. Applying
5	Lemlem (2017)	1. Sharing 2. Utilization 3. Creation
6	Joy Chidiebere(2017)	1. Acquisition 2. Transfer 3. Application
7	Esther et al (2017)	1. Acquisition 2. Protection 3. Conversation. 4. Application
8	Nada (2017)	1.Creation 2.sharing
9	Bader et al (2016)	1. Acquisition, 2.Transfer, 3. Storage, 4. application
10	Tyebeh &Maryam(2016)	1.Creation,2.Acquisition, 3.Sharing 4. Application, 5. Transfer
11	Mustafa (2016)	1. Creation, 2. Storing, 3.Sharing, 4.Application
12	Abdallah,& Alfalah (2016)	1.Creation, 2.Storage, 3.sharing
13	Mohmoud & Asad (2016)	1.Acquisition,2.Conversation,3.Sharing,4.Application 5.protection
14	Suliman (2015)	1. Capturing, 2. Sharing, 3. Storing, 4. Applying
15	Ahmed (2015	1.Knowledge creation, 2.knowledge sharing
16	Mohammed (2015)	1.Creation, 2.Acquisition, 3.Storage

Source: prepared by researcher (2018)

2.1.1.2.1. Knowledge Acquisition:

Knowledge acquisition: When the organization determines the needed level of knowledge, it determines the cognitive gap that should be reached that requires the look inside, and the organization some time demands help from external companies in developing its capabilities to attain the needed knowledge, or buys the advanced technology from the market, also can cooperate through combining its resources by the

emerging processes or unification, this can help the organization attains its need of knowledge (AL-Hayaly&ALnajjar, 2016).

In terms of processes, knowledge acquiring and creating is where members in the organization gain, collect, create and obtain required and useful knowledge to perform their job activities. It is a complex, multidimensional and dynamic process. KAC involves developing new content and updating existing content with the organization's tacit and explicit knowledge (Vangala et al, 2017).

Knowledge acquisition can be organizational as well as individual. Defined organizational knowledge acquisition as gathering knowledge from external environment and moulding it to be useful for the organization. Thus it involves extraction, interpretation, and transfer of knowledge for enhancement of knowledge that already resides with organization. However, the individual knowledge acquisition comprises three different ways to gather knowledge: obtaining from the knowledge repository within the organization, learning from other individuals, and learning from experience, Knowledge within an organization usually resides within the individual's memory (Rabbi et al, 2015).

Knowledge acquisition can be possessed through two perspectives: first the ability to generate new knowledge through the application of existing knowledge. Second, the ability to improve the existing knowledge and the effect acquiring and using new acquired knowledge (Mahmoud &Abu Rumman, 2016).This process involves new implementation of knowledge or replacing the current content within the organization explicit and tacit knowledge. It requires the organizations to search for new knowledge and information, both inside and outside of the organizations (Sixue, 2017).

According to Agbin et al (2014) knowledge acquisition relates to the location, creation or discovery of knowledge. Knowledge which is new to an organization has to either be invented internally or acquired from external sources. There are many sources of knowledge both internal and external for an organization to tap from. Knowledge acquisition is the creation of knowledge within the organization through a learning process, and also the acquisition of external knowledge, originated in associative action with other organizations, business consulting, and universities (Valio&Martins, 2017).

Nwaiwu&Huldah(2017)argues that other ways in which organisations learn is by means of congenital learning, whereby the knowledge which is possessed by founding fathers of organisations is passed on to other members of the organisation. When

individuals work in teams, members influence one another through knowledge exchange. Accordingly, knowledge acquisition takes place at all levels of the organisation and if adequately articulated

Therefore, this study assumes that acquisition is the creation of knowledge within the organization through a learning process, and also the acquisition of external knowledge, originated in associative action with other organizations (Guzmanet al, 2017)

2.1.1.2.2. Knowledge Sharing

Knowledge sharing techniques have been a subject of interest for many scholars of strategy with majority of companies analyzed indicating that beneficial consequences of their use had been realized (Nzongi, 2018). Knowledge sharing is the process of mutually exchanging knowledge and jointly creating new knowledge (Mohajan, 2017). It is an activity by which knowledge is exchanged among individuals and organizations, and also to collect shared knowledge through information and technology. It promotes the professional skill and competence among employees (Semradova &Hubackova, 2014)

Knowledge sharing is exchange of employee's knowledge, experience, and skills across the whole organization. Employees share knowledge by talking to their colleagues, by helping one another and by seeking the way to get something done better, more quickly and efficiently (Byukusen, 2016).

There are many definitions for the knowledge sharing some named it as knowledge dissemination, knowledge transfer or knowledge distribution among employees. Knowledge transfer requires a group or individuals desire to work with others, and share knowledge is mutual interest, thus if there was not involved in the knowledge sharing it is almost impossible for the knowledge that passed from one person to another person. So knowledge participation is essential condition of knowledge building (Malkawi&Abu Rumman, 2016).

In many situations, organizational factors such as job involvement and job satisfaction, performance evaluation and recognition act as stimuli for increasing knowledge sharing behaviour among employees. In addition, organizational culture, top management support and organizational communication influence knowledge sharing behaviour (Mirza et al, 2016)

Azimi (2016) described in a way that when we say someone shares his knowledge we mean that person guides another person with his knowledge insight and thoughts to help him see his status better. According to (Masa ‘deh, Gharaibeh, Tarhini &Obeidat, 2015),rapid changes due to globalization in the business environment caused by intense competition creates competitive business environment, thus knowledge becomes the key component of competitive advantage and the main factor to enhance productivity and improved organizations. Indeed, knowledge sharing is considered as a basic facilitator for knowledge management which helps in achieving organization goals although knowledge sharing barriers can obstruct the effectiveness of KM.

Wang &Noe (2010) the concept of knowledge sharing describes task-based information, via know-how technique to assist and cooperate with others to resolve problems, build up new ideas and put procedures and policies into practice. There are many definitions for the knowledge sharing some named it as knowledge dissemination, knowledge transfer or knowledge distribution among employees. Knowledge Transfer requires a group or individual's desire to work with others, and share knowledge is mutual interest, thus if there was not involved in the knowledge sharing it is almost impossible for the knowledge that passed from one person to another person. So knowledge participation is essential condition of knowledge building (As ‘ad H& Abu Rumman, 2016).

It indicates the diffusion of knowledge to improve the work of the system and decision making processes. It can be characterized by the transfer of a total of knowledge from one person to another, It is the process by which knowledge held by an individual is converted into a form that can be understood, absorbed and used by other individuals through channels or networks between knowledge providers and seekers (Hong et al, 2011).

The definition by Chigada& Patrick (2015) illustrates that organisations should have systems in place that help the process of knowledge sharing. A good example of such systems would be computer-based systems because of its speed, ability to store large volumes of information and retrieval capabilities. Knowledge sharing enables organisations such as banks to converge towards ‘…knowledge portals rather than separate silos of knowledge’ (Money web 2013). Knowledge must be shared with co-workers, group team. Knowledge sharing and transforming is very important to the company, it is because companies face difficulties with knowledge loss which is because of employee turnover or retirement.

The workers at all levels of the company should make a structured attempt to use the knowledge which is available at different points of their activities. This will defiantly improve the operations efficiency; improve the innovations quality and quantity, and improving competitiveness (Sharafuddin, 2017)

This study assumes that Knowledge sharing as business process that requires collective knowledge skills expertise and dissemination of knowledge across the organizational units (Rita (, 2013).

2.1.1.2.3. Knowledge Storing

The knowledge storage refers to the organizational memory formation process, in which knowledge is formally stored in physical memory systems and in formally retained as values, rules and beliefs that are associated to culture and organizational structure (Rodrigo&Manoel,2017). Knowledge storage both explicit and tacit knowledge obtained by individuals within organizations should be stored. The organizations should arrange and manage the knowledge thus it can be accessed easier. When the knowledge is integrated, it helps to reduce the redundancy thus enhances efficiency (Sixue, 2016).

The creation of new knowledge is not efficient, having mechanism to store and retrieve the knowledge when needed is more important. This give rise to organization memory concept, which simply means the existence of knowledge in various structures and formats (i.e., electronic databases written documentations, individual and team tacit knowledge and codified knowledge (Abubaker et al, 2017)The organizational memory's influence has been neglected many times in the past by numerous organizations. As a result, the increasing rate of employee turnover and outsourcing measures typically led to a decrease in the knowledge of an organization. In the future, knowledge needs to be saved and secured on an organization's various data carriers as well as given the right mechanisms for indexing in order to retrieve and access it (Mahdi, et al, 2019).

Knowledge storage means the process of keeping the knowledge in the organizational knowledge based and it’s measured by the extent of the availability of database and information system to store information and take necessary procedures to protect this knowledge from misuse or theft (Alrubaiee et al, 2015). Store knowledge codification of tacit and explicit knowledge helps in making the knowledge understand able and which can be used later on (Ebrahim &Vafaei, 2017).

Allamah, Zare davoodi (2017) claimed that knowledge creating new knowledge is not enough and mechanisms are needed to store acquired knowledge and to retrieve it

when needed. The concept of organizational memory is a great solution in this regard. Organizational memory includes knowledge residing in various component forms that may include written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organization procedures and processes, and tacit knowledge acquired by individuals and networks of individuals.

Intimated that organizational knowledge should be stored in a proper way it includes knowledge in various forms like written documentation, codified human knowledge stored in an expert system, structured information stored in electronic database, documented organizational procedures and process and tacit knowledge acquired by individuals or network of individuals. While explicit knowledge should also be stored properly and it resides in structured documents in the form of memos, notes, meeting minutes etc (Nawab et al, 2015). Knowledge created and knowledge acquired must be stored within the organization databases to be used by workers in various organizations departments. This knowledge from the substance and the whole organization memory: so this knowledge has to be meaningful and useful, it should be coded, classified, configured and stored properly, only then this knowledge can be used and re-used by the right person, at the right time in the right way, when it is needed, this knowledge becomes the property of the organization as a whole and must be preserved (AsdH, & Abu Rumman, 2016).

Several studies indicated that there is close association between knowledge, storage, and stimulate creativity in the organization where (AsdH,& Abu Rumman) found that the greater the storage and accumulation of knowledge in the organization the more creativity Organizational, and the stored knowledge retain, sustain and this will lead to facilitate the dissemination of knowledge among employees by enabling them to access and deal with it at the right time and in an effective way, which contributes to reduce the time and cost incurred by the organization(Lee,Leong, Hew&Ooi,2013)

According to (Ram Naresh&Hiremath, 2017) this process consists of codifying, storing, refining, indexing, evaluating and updating the knowledge in organization repository

2.1.1.2.4. Knowledge application

Knowledge application includes applying knowledge action, problem solving and for decision-making protection which can ultimately result in knowledge creation. The created knowledge needs to be captured, shared and applied; hence, the cycle ensues (Abubaker et al, 2017).This process involves the usage of knowledge in adjusting the strategic direction, solving the problems, making decision, improving the efficiency and reducing costs. The individual can make use of the knowledge possessed by other individuals without actually learning that knowledge, if the organization wants to capitalize the knowledge they should know how the knowledge is created, disseminated and used as these processes are the basic for an effective organizational knowledge management (Sixue, 2017).

The application of knowledge means the creation of more active and more connected knowledge with the activities of the company to create value. An organization requires operational knowledge to create value for its products and services through various methods such as create available packages, training and motivation of staff to have a creative idea, and using workers knowledge in the process, products and services enterprise of organization (Parhizgar&Kiarazm, 2015). Knowledge application's purpose is to apply and represent information to knowledge seekers in appropriate matter. Also, knowledge application is the solution to wrapping knowledge to guarantee widespread usage. Moreover, knowledge application translates information into practical tools and applying the knowledge into real world. Knowledge application presents the knowledge in more clear and storable way

(Karadsheh et al, 2014)

While another pointed out that the knowledge application is the ability to retrieve and use of knowledge to support the decisions and actions, problem solving and automating routine business and provide measures to facilitate business (Malkawi&Abu Rumman, 2016).Knowledge application includes application for decision-making protection, action and problem solving which can finally lead to knowledge creation. The created knowledge needs to be captured, shared and applied and therefore the cycle continuous (Allamah et al, 2011).

According to (Vangala, et al, 2017) Knowledge application includes the application of decision – making protection, action and problem solving which final lead to knowledge creation.ApplicationRefers to the process of the actual use of knowledge.

This study assumes that the application of knowledge enables organizations to continuously translate their organizational expertise into embodied products (AL-Jaafreh &Fayoumi, 2017)

2.1.1.3. The Concept of Innovation capabilities

The concept of innovation is central to economic growth, and it can lead to sustained competitive advantage, which is something that firms should strive to achieve. Innovation is intentional and it requires that individuals are motivated (Moretro, 2017).innovative capacity, as defined the internal potential to generate new ideas, identify new market opportunities and implement marketable innovations through exploration of the company's existing resources and capacities(Mello et al, 2017).Innovation capability can be described as the ability to continuously transform knowledge and ideas into new products, processes and systems for the benefit of the firm and its stakeholders. Innovation capability not only refers to the ability to be successful in managing a business new stream, but is also concerned with the ability to synthesize operating paradigms (Omer et al, 2017).

Innovation is integrating capacity of a firm about bringing out new implementations from current knowledge. At the same time innovation capacity is the capability to develop new versions and make necessary changes in the direction of market demand. Innovation capacity is factor that can be the improved by working. Innovation capacity is the method and capacity of a firm to produce innovative output (Sozbilir, 2018).

Innovation as the successful implementation of creative ideas within the company, It is a mechanism to adapt the company in a dynamic environment. Therefore the company is required to create the assessment as well as new ideas and offer innovative products (Afriapollo, 2016). Innovation is a complex process related to changes in production functions and process whereby firms seek to acquire and build upon their distinctive technological competence. Understood as the set of resources a firm possesses and the way in which these are transformed by innovative capabilities.

Innovation at firm level refers to a firm" receptivity and propensity to adopt new ideas that leads to development and launch of new products (Rubera&Kirca, 2012).

Defined Innovation as an idea, practice or object perceived as new by an individual or other adoption units. Classifying an idea as new or not (newness) has been vastly discussed, but newness is a relative term. (Moretro, 2017), Innovation is essentially about converting ideas into something profitable, encourage to supply ideas needs to be substantial in order to channel the creative ability of the employees to convert ideas into innovations, therefore, organizations need to facilitate innovation by creating and maintaining an environment that support idea generation and creative (Rodriguez et al, 2013).

Innovation as a knowledge process aimed at creating new knowledge geared towards the development of commercial and viable solutions. Innovation is a process where in knowledge is acquired. Shared and assimilated with the aim to create new knowledge, which embodies products and services. Innovation is the adoption of an idea or behaviour that is new to the firm. The innovation can be a new product a new service or a new technology. Innovation is related to change, which can be radical, or incremental (Plessis &Littleton, 2015).

Innovation as the process of equipping in new, improved capabilities or increased utility. Innovation as the generation, acceptance, and implementation of new ideas, process, products or services, innovation can be viewed as the application of better solutions that meet new requirements in articulated needs, or existing market needs (Ebrahim et al, 2017).

Innovation is a complex process related to changes in production functions and processes whereby firms seeks to acquire and build upon their distinctive technological competence, understood as the set of resources a firm possesses and the way in which these are transformed by innovative capabilities. Innovative at firm level refers to a firm’s receptivity and propensity to adopt new ideas that lead to development and launch of new products (Atalay et al, 2013).

Innovation in general the implementation of a novel or drastically improved product, process, marketing or organizational methods in workplace organization, business practices, or external relations, Innovation is recognized as one of growth strategies to enter new markets, to increase market share and to provide the company with competitive edge.(Seyed et al, 2018). Believe that innovation capability is not only

an ability to be successful at running a business new stream, or to manage mainstream capabilities but synthesizing these two operating paradigms (Hahmidi &Gharneh, 2017)

Innovation has been conceptualized in a variety of ways, define it as the adoption of an idea or behaviour-regarding a system, policy, program, device, process, product or service-that is new to the adopting organization. It can be understood as the implementation of a new or significantly improved product (good or service) or process, a new market method, or a new organizational method in business practices workplace organization or external relations (Costa &Raquel2014).

According to Regient et al(2016), this study examine innovation capabilities as two dimension namely radical innovation and incremental innovation

Table (2.2) Dimensions of innovation capabilities

No	Authors	Dimensions
1	Smismans & Elen (2018)	1. Radical innovation. 2. Incremental innovation
2	Damanpour (2018)	1. Administrative innovation.2. Technical. 3. Product &process. 4.radical &incremental
3	Vafaeid et al (2017)	1. Product innovation, 2. Services innovation
4	Christian et al (2017)	1. Product innovation. 2. Process innovation
5	Tabias Moretro (2017)	1. Radical innovation. 2. Incremental innovation
6	Titus& Fred (2017)	1. Product innovation. 2. Process innovation 3. Administration
7	Nsor etal (2016)	1. Radical innovation.2. Process innovation
8	Mario Coccia (2016)	1. Radical innovation. 2. Incremental innovation
9	Mehrez chacher et al (2015)	1.Exploitative.(incremental)innovation 2.Exploratory(radical)innovation
10	Jalili et al (2015)	1. Incremental innovation.2. Radical innovation 3. Product innovation. 4. Process innovation 5. Administrative innovation
11	Regient et al(2016)	1. Radical innovation. 2. Incremental innovation

Source prepared by researcher (2018)

2.1.1.3.1. Radical innovation

Radical innovation is ground breaking, frame breaking, discontinuous, disruptive change in technology, product or process. These cause profound organizational and

market changes. Radical innovation is seen my many as critical future success of organizations (Wash, 2018).Radical innovation is expected to imply more fundamental changes for the company's activities, and it's often related to high risks during both the development and commercialization in comparison to incremental innovation. radical innovation as products that have a high impact on existing markets or create wholly new markets by offering totally new benefits, significant improvements in known benefits, or significant reduction in cost (Perin et al, 2016).

Radical innovation is a product, service and process with entirely unique or significant improvements in existing features which improve the cost and performance, radical innovation is a highly risky for the business because radical innovated products are more difficult to commercialize. But on the other hand, radical innovation in product, service or process is crucial for the business because it involves the development and application of new technology. Important aspect of radical innovation is that to what extent new technology is more sophisticated and advance as compared to current technology (Akram et al, 2011).Radical innovation defined as process of reorientation wherein patterns of consistency are fundamentally reordered. Although there are other definitions of the concept, the common feature is the effect of the change on the resources or technology in the organization (Engen&Holen, 2014).

Radical innovations involve creation of new markets (Rubera & Kirca, 2012)or making deeper changes that destroy existing positions on the market today, and make obsolete current products(Beck,Lopes-Bento, & Schenker-Wicki, 2016). However, the result of radical innovation is uncertain to assume greater levels of risk (Perin et al, 2016). Moreover, radical product innovations facilitate customer loyalty and faster market penetration while reducing costs, volatility and vulnerability of cash flows (Boso et al., 2016).

Radical innovation is offering of new-to-the-world performance features, or significant improvements in known ones. Radical innovation provides substantially higher customer benefits compared to previous products in the industry. Based off the model, radical innovation provides the highest degree of newness technology and the highest degree of customer fulfilment (Moretro, 2017).Radical innovations enable organizations to achieve sustainable competitive advantages in the long term by generating economic rents; these innovations offer greater customer benefits, cost reductions, or capabilities to create new businesses, any of which should lead to higher organizational performance (Slater et al., 2014)

Radical innovation seeks to meet the needs of emerging customers or markets; the magnitude of change in radical innovation is bigger than in incremental innovation. Based on an aggressive long-term strategy, organizations attempt to disrupt the prevailing technological trajectory and create new designs technologies and distribution channels for new markets. Accordingly radical innovation projects build on knowledge resources that a firm does not yet have or that differs from existing resources, Put differently, the success of a radical innovation project depends on the ability to make prevailing technologies obsolete by transforming the old knowledge into new knowledge, thereby producing fundamental changes in an organization (Lee, 2011). Therefore, this study assumes Radical innovations that produce fundamental changes in the activities of an organization and represent clear departures from existing practice (Damanpour, 2018).

2.1.1.3.2. Incremental innovation

Incremental innovations are minor improvements or simple adjustments in current technology, and that improve price/or performance advance at a rate consistent with existing technical trajectories (Patrick et al, 2018).Incremental innovation attempts to meet the needs of current customers of markets at a rate consistent with current technological trajectory. The strategic focus of incremental innovation is market dominated growth with diversification by improving and expanding current products and services within a short time, Incremental innovation projects call for the ability to reinforce, recombine, and take advantage of existing knowledge resources (Lee, 2011).

Incremental innovations can easily be defined as products that provide new features, benefits, or improvements to the existing technology in the existing market. An incremental new product involves the adaptation, refinement and enhancement of existing products and /or production and delivery system (Garcia& Calantone, 2018).

Incremental innovation is the most common type of innovation in most companies in general companies spends around 80precent of their total innovation investment. Incremental innovation usually causes changes in one or two levers of the business model or technology change. It’s the way to obtain much value from the products or services that the firm already has without making hug changes of important or strong investment (Boris, 2013).

Incremental innovation is basically a modification in product which also called line extension or market pull innovation. Incremental innovation does not need to

significantly diversify from current business. That is why this type of innovation enhances the skills and competencies of the organizational employees (Plessis (2007). Exploitative innovations are based on the existing companies' resources and are represented by small improvements in methods, technologies or products. This type feed on best practices and routines generated in the past. This type of innovation is called incremental innovation which is designed for existing customers or markets (Jansen et al, 2006).

2.1.1.4. The concept of Competitive advantage

Concept of Competitive advantage has a long tradition in the strategic management literature. Defined it thusly characteristics of unique opportunities within the field defined by the product-market scope and growth vector this is the competitive advantage. It seeks to identify particular properties of individual product-market which will give the firm a strong competitive position (Meihami& Hussein 2013).Competitive advantage represents a factor or a combination of factors that have a direct or an indirect impact on the stability or the growth of the organization in the market which includes an active participation in the economic impact and increase the stability of the profits through the optimal utilization of available resources (ALnajjar, 2016).

Competitive advantage or edge is a strategic objective of firms which is difficult to achieve due to the competitive challenges in the knowledge economy. Competitive advantage helps in achieving the added value of the organisation and also guarantees its survival and sustainability. Some characteristics that include uncommonness, invaluable and indispensable human resources, cordial customer relationships and system, are what gives an organisation a competitive advantage that results in a sustainable competitive position (Chahal, 2015)

The Competitive advantage considering one of the components of the organization marketing strategy which consist from a mixture of things tangible and non-tangible, Any organization can be owned a competitive advantage if it used the resources available and its capabilities in the right investment opportunities in the market. Competitive advantage means: organization ability to attract customers and build prestige for the organization or its products and increase perceived value by customers and achieve their satisfaction, which is also the ability to provide variety value to the customers. The competitive advantage is not fixed, but its need continuous developing

to keep in touch with the various developments, economic, political, social and technological (Diab, 2014).

Competitive advantage implies the creation of a system that has a unique advantage over competitors. The idea is to create customer value in an efficient and sustainable way, so that it can be interpreted as building competitive advantage where companies are advised to form a unique system and have advantages over the other competitors to provide more value to consumers efficiently to be maintained. Good value in the eyes of consumers is where the company can meet the needs of consumers well and well-served consumer (Afriapollo 2016).

Competitive advantage (CA) as the capability of the organization to carry out its activities in ways others cannot imitate. features of sustainable companies comprise creating long term financial value, know how activities influence environment and act towards reducing negative impacts, care about their stakeholders as well as to understand employees, community and customers that are related to each other (Ch&ROhana,2016).

Competitive advantage occurs when an attribute or combination of attributes in an organization are acquired or developed that allows the organization to outperform its competitors. In a service oriented business, competitive edge is well achieved through innovation strategies which are value creating and their implementation is simultaneous by any current or potential player (Wanyoike, 2016)

Competitive advantage basically grows from the values or benefits created by the company for its buyers. Customers generally prefer to buy products that have more value than they desired or expected. However, the value will also be compared with the price offered. Purchasing the product will occur if customers price consider the price of the products is appropriate with the value offered (Samsir 2017)

(Awwad, Abdulkareem, Al Khattab, Adel and Anchor, 2010) considers that quality and productivity can be used as strategic weapons for achieving competitive advantage. He argues that organizations must be aware of what increases quality or supports production as strategic weapons, otherwise they will lose market share. Competitive advantage is seen as the ability which is gained from attributes and resources and allows the firm to perform at a better level than others in the same industries. Competitive advantage or edge is a strategic objective of firms which is difficult to achieve due to the competitive challenges in the knowledge economy. Competitive advantage helps in achieving the added value of the organization and also

is guarantees its survival and sustainability. Some characteristics that include uncommonness, invaluable and indispensable human resources, cordial customer relationships and system, are what give organization competitive advantage that result in sustainable competitive position (Tarek et al, 2017).

Competitive advantage is a relative positional superiority in the marketplace that ensures a Firm outperforms its competitors by putting in place unique strategies that are inimitable. Competitive advantage is something driven from a valuable, rare, non-sustainable and imitable resources that came as a result of integrating unique resources and capabilities (Ngwenya, 2017).Competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firm cost of creating it. A firm's ability to outperform its competitors lay in its ability to translate its competitive strategy into a competitive advantage. Competitive strategy entails positioning the firm favourably in and industry relative to competitors (Meihami& Hussein, 2014).

According to (Chavez et al,2015), research has indicated that successful organizations engage in multiple performance objectives with companies more interested in aggregate performance measures. In this study, examine competitive advantage as four dimensions, namely quality, delivery, flexibility and cost.

Table (2.3) Dimensions of competitive advantage

No	Authors	Dimensions
1	Titus&Fred(2017)	Organizational excellence, Organizational effectiveness, Organizational responsiveness.
2	Nada (2017)	Cost, Differentiation, Innovation
3	Urbancova (2017)	Price, Quality, Delivery Product innovation. Time to market
4	Satria (2016)	Price. Quality. Delivery. Dependability Product innovation. Time to market
5	Joma&Al –Najjar (2016)	Cost. Quality. Differentiation, Creativity. Flexibility
6	Abdulraheem (2016)	Cost. Quality. Delivery. innovation
7	Reihaneh (2016)	Quality. Flexibility. Response time. Cost
8	Diab (2014)	Cost. Quality. Delivery. Flexibility
9	Lei& Hanh (2017)	Differentiation. Low cost
10	Mohsen (2015)	Cost. Quality. Delivery. product innovation time to market
11	Mugdadi (2015)	Innovation. Flexibility. Value creation Branding
12	Fayez (2016)	Cost. Quality. Differentiation. Creativity Flexibility
13	Mugdadi, (2015)	1. Innovation. 2. Flexibility. 3. Value Creation. Brand

Source: prepared from data analysis (2018)

2.1.1.4.1. Cost

Cost is one of the important variables in achieving competitive advantage by reducing the cost of production in a percentage that achieves the desires of a wide range of customers by reducing the total cost of service products, with the need to realize that the strategic goal of reducing cost is not absolute, but according to the governed conditions and regulations. Therefore, the organization that adopts the least cost should focus on the production process, starting from the supplier and the ending with the arrival of the product to customers and control overall products and costs associated with production and provide new value-inexpensive services (Al-Najjar, 2016).

Cost is one of the most basic dimensions for competition and that many organization tried to rely on reducing their product cost to achieve competitive advantage, which means that the organization carry on the product and marketing of products at the lowest possible cost compared to its competitors enabling it to sell at a lower price (Alhayali et al, 2013).Phusavat&Kanchana, (2007) competing on cost focuses on the ability to effective manage production cost, including its related aspects such as overhead, inventory and value-added. Zho et al, (2002) further describe this as the ability to reduce product cost by reducing overheads, labour, raw materials costs and production cycle time.

Competitive advantage, as argued by (Abdulkareem, Awwad, Adel Al Khattab& John ,2013)can be achieved by adopting one or more of the following generic competitive strategies: 1) cost leadership in which the features of this strategy are: low cost relative to competitors, related and standardized products, and economies of scale. A cost leadership strategy requires intense supervision of labour, tight cost control, frequent and detailed control reports and structured firm and responsibility; 2) differentiation: this strategy is described in terms of product uniqueness, an emphasis on marketing and research, and a flexible structure; and 3) focus: this strategy implies a focus on a narrow strategic target (buyer group, product line or geographic market) through differentiation, low cost or both.

Cost is one of the most basic dimensions for competition and that many organizations tried to rely on reducing their product cost to achieve competitive advantage, which means that the organization carries on the production and marketing of products at the lowest possible cost compared to its competitors, enabling it to sell at a lower price(Alghamdi, 2016**)**

2.1.1.4.2. Quality

The ability to offer products and services at the lowest cost and free of defects, and to ensure the achievement of discrimination to the organization under the existing competition in the market and represent the overall attributes and characteristics of the product and the service that meets the needs of customers, quality is known as one of the most important factors for the survival and growth of the organization and to maintain its competitiveness (Gupta, Garg& Kumar, 2014,).

Quality is the degree of excellence of a particular product or service with the global auto maker embracing this idea with the corporate slogan quality is job1. Quality is also concerned with product longevity and strength; as well consumer satisfaction in the after-sales service process and through advertisement through word-of-mouth (Wawmayura et al, 2017).Quality is a competitive weapon in the marketplace. It engenders competitive advantage by providing products that meet or exceed customer needs and expectations. Quality defined using different perspectives, as it is a subjective goal that has indefinable characteristics. Quality as fitness for use Juran's definitions employs the customers perspective in defining quality, it is the customer who decided what goods or services best satisfy his/her needs (Awwad, 2010).

A similar approach is taken by (Abdulkareem et al, 2013) who define quality as excellence, value, conformance to specifications and meeting or exceeding customers' expectations. Quality means what the customer really wants, In the other words, a product is of high quality when it is in agreement with customers' needs and demands(Hosseini et al, 2018).Defines fitness more holistically as "value to some person" Quality can be achieved by adding unique attributes to products to enhance their competitive attractiveness so as to benefit customers in the final stage Reference (Abou-Moghli,**Al** Abdallah, &Al Muala, 2012).Quality has received substantial attention in the literature. Traditionally, quality in manufacturing has been regarded as conformance quality, which is described as the degree to which products meet manufacturing specifications. However, there are other important characteristics of quality that go beyond product specifications(e.g. performance, reliability and durability) such as service quality, and thus quality is not solely related to the product itself but also to the service that comes with it(Chavez et al, 2015).

Quality is a critical factor for the success of many organizations; industrial or service, public or private, as it is a main pillar to achieve the competitive advantage (Alghamdi, 2016**)**

2.1.1.4.3. Flexibility

Flexibility is the company ability to offer a variety of products in a timely manner and the company ability to develop existing products and improve its operations to offer new products that meet the needs and desires of customers, Flexibility is the ability of the organization to responds quickly to changes on the characteristics of the products design or changes related to the size of customers' orders and the multiplicity of their desires (Al-Najjar, 2016).Flexibility also encompasses product flexibility in the first place which is defined as the ability of the organization to trace changes in consumers' needs, tastes and expectations so as to carry out changes in product designs. The second flexibility has to do with volume which stands for the organization's capability to respond to changes in consumer demand (Abou-Moghli et al, 2012)

Flexibility is essential for a firm to be able to respond to changing demand resources, and competitive condition in international market. Flexibility can be used both as an adaptive response to environment uncertainty, and to proactively create market uncertainties for competition, There are two interdependent dimensions of flexibility: time dimension that focuses on speed of response to customer needs, and arrange dimension that focuses on the ability to meet customization, and volume requirement defined by customer in efficient and cost-effective manner (Mugdadi, 2015).

Diab (2014) Confirms flexibility; is adjust services to respond to customers' requirements and to avoid their complaints and then to achieve high levels of customer satisfaction. In addition to that, the organization's owned a largest market share than other competitors, in order to reduce the overall costs. Flexibility as a quick response to change production volume, change of product mix, customization of product (e.g. provide each customers with what they want), introduction of new products and adoption of new technology, Flexibility as the ability to change or react with little penalty in time effort, cost, or performance (Awwad et al 2010).Flexibility is another important operational performance measure, which is described as the ability of the company to adapt and respond to diversity or change, to give customers individual treatment, or to introduce new products/services it (Chavez et al, 2015).

Defines flexibility as a quick response to changed production volume, changed product mix, customisation of product (i.e. providing each customer with what she wants), introduction of new products and adoption of new technology (Abdulkareem S. Awwad, Adel A. Al Khattab, John& Anchor,2013)

2.1.1.4.4. Delivery:

Delivery is a competitive priority because customers are interested in satisfying their needs and wants in the right quantity at the right time (Awwad et al, 2013). The delivery or time dimension is considered as the basic rule of competition between companies in the market by focusing on reducing the time and increasing the speed of the design of new products and presenting them to customers in the shortest possible time (Altaweel& Ragheed, 2008).The delivery or time dimension is considered as the basic rule of competition between companies in the market by focusing on reducing the time and increasing the speed of design of new products and presenting them to customers in the shortest possible time

(Alghamdi, 2016**)**

Delivery is a competitive priority via which customer are interested in satisfying their needs and wants in the right quality at the right time. In this context, state that delivery of the required function means ensuring that the right product (meeting the requirements of quality, reliability and maintainability) is delivered in the right quantity, at the right time in the right place, from the right source (a vendor who is reliable and will meet commitments in a timely fashion), with the right service (both before and after sale), and finally at the right price (Awwad et al, 2010).

"Delivery of the required function means ensuring that the right product (meeting the requirements of quality, reliability and maintainability) is delivered in the right quantity, at the right time, in the right place, from the right source (a vendor who is reliable and will meet commitments in a timely fashion), with the right service (both before and after sale), and, finally, at the right price. Diab, (2014) the speed of service and response to customer demand has become one of the factors of competitions between organizations; this is linked to the customer's willingness to pay higher cost for the services or products he/she needs in the timely. Whenever the organization able to respond to the needs and requirements of the customer quickly and shortest time over competitors whenever organization received a larger market share and charging higher prices for their services at least until the arrival of competitors to the market

According to (Awwad et al, 2010) Delivery: this is considered as a time-based issue. Delivery addresses how quickly a product or a service is delivered to customers. It also incorporates the time-to market for a new product

2.1.1.5. Information technology:

Today information technology industry is one of the most dynamic industries in world economy. Information technology in industrial countries has been continuously taken into account by the managers in recent years. Information technology not only facilitates and guarantees the validity of operation via elimination of repetitive operations in various units rather in supports top managers in their planning and appropriate and timely decision making via providing them with classified and analytical information (Khalieghi, 2017). Information technology a set of technology that creates, saves, acquires, transmits, reconfigures, analyzes and communicates data and information. They understand hardware, software and telecommunications as its key components (Lidija 2012).

It supports communication, collaboration, knowledge seeking and enables collaborative learning, ICT tools help in capturing knowledge and expertise created by knowledge workers and making it available to the large community. Information technology is widely used in an organization, and thus qualifies as a natural medium for the flow of knowledge in the organization (Vangala et al, 2017).Information technology (IT) is the application of computers to store, study, retrieve, transmit and manipulate data (Daintith, John et al, 2009).

Information technology describes a firms computing and telecommunications hardware and software technologies that provide automatic means of handling and communicating information (Richard&Alemayehu, 2004).Information technology is computer software may contain details for the programmed in structure, which control and coordinate the contents of computer information system (Sharafuddin, 2017). Information technology is defined a company to require deploy information technology is tools and methods used in different ways to collect, store, retriever process analyze and distribute data (Kamal &Abdel, 2016).

According to Righa (2014) In order to create sustainable competitive advantage using information technology, we must first understand the influence of technology on organizational activities and processes and know how to create value using it.

The idea that information technology can contribute to the optimization of enterprise resources, strengthen enable and enhance business performance (Shaqiri, 2015)

(Tarekengn, 2017) Technology is an important aspect to successfully organize and share knowledge. With the help of technology, organization can build the infrastructure and tools to support the expansion of KM. IT facilitate organizations to used knowledge for organizational efficiency and effectiveness. Furthermore, IT provides suitable environment for learning and interaction among the employees of an organization. Systems like expert systems are used in organizations to capture and manage knowledge

2.1.1.6. The Relationship between Knowledge management process and innovation capabilities:

Basing on the knowledge –based theory (Bahram& Hussein 2014) associated knowledge resources to innovation and argued that these resources determine the capacity of the firm to innovate. Similarly, (Byukusen et al, 2016) revealed that only knowledge sharing was found positive and significant predictor of innovation. This implies that effective knowledge management through sharing may lead to innovation.

Githii, (2014) shows that there is overwhelming support that knowledge management practices lead to innovation. This study provides insights on the most important knowledge management practices that management need to cultivated in order to foster innovation. It's evident that knowledge management practices play a significant role in innovation. find that different components of Knowledge Management as Knowledge activities, Knowledge types, transformation of knowledge and technology have a significant positive effect in bringing innovation through transformation of knowledge into knowledge assets in organizations (Akram et al,2011)

Ebrahim et al (2017) emphasizes the importance of knowledge management and links it with innovation. Has shown there is a clear Link between knowledge management and innovation, Furthermore knowledge activities like knowledge gathering, managing, sharing, learning, reuse and retrieval play important role in bringing innovation.

Sameeni & Alvi(2016) Knowledge management acquisition has positive impact on product service and marketing innovation, also knowledge management diffusion is found to have a positive significant impact on innovation there is a significant positive

relationship between knowledge management and innovation Shahraki&Keshtegar(2016)Knowledge management had positive and significant effect on product innovation (Samira 2017; Nawab et al, 2015) the implementation of knowledge management practices and in strengthening their role as an innovation catalyst for companies, Also confirmed the importance of knowledge management practices and as a factor strengthening the ability of business to generate both exploitative and explorative innovation.

Malkawi&Abu Rumman (2016) emerged that the dimensions of knowledge (acquisition, sharing, application and protection were found to be positively associated with products innovation, and it shows the importance of knowledge management in it companies which lead to produce new products and applications in a short time frame with high quality and low cost. Albroz& Mohammedreza (2016) the impact of the application of knowledge on the innovation performance was confirmed. Also access to relevant information and key knowledge and use of scientific knowledge used and integration of different groups can lead to innovation performance.

Gloet&Samson (2017) revealed knowledge management practices can contribute to innovation; Also indicate that knowledge management activities through fostering continuous improvement which in turn encouraged a stronger focus on incremental rather than radical forms of innovation. Alrubaiee et al,(2015) confirm that a positive and strong effect of Knowledge Management Processes on Organizational Innovation and Organizational Performance. Kor& Maden, (2013**)** show that knowledge management processes (acquisition, sharing and application) relate positively to innovativeness, which in turn increases innovations in organizations.

2.1.1.7. The Relationship between Knowledge management and competitive advantage:

Sixue (2017) knowledge management has successfully helped to generate values which have become an imperative for the organizations in new economy. Competitive advantage has become a core of the organizations in today's fast changing business world. Organization is able to achieve competitive advantage and stay competitive in business environment when they practice a combination of knowledge management. Forogh (2016) indicates that a positive and significant relationship between knowledge management and competitive advantage. Shahraki& Keshtegar, (2016) it was shown that there is a positive relationship between knowledge management and employees

performance, there is a positive relationship between five dimensions of knowledge management including absorbing, storing, organizing, distribution and deployment.

Jyoti et al (2015) there is significant impact of knowledge management practices on competitive advantage. Knowledge acquisition highly influences to competitive advantage because a service provider organization remains in competition only if it has full information about its competitors, polices of governments, customers etc. the get all these information from the process of knowledge acquisition where as knowledge protection process also plays an important role in organization to gain competitive advantage by protecting the acquired information from illegal use.

Ambula et al (2017) revealed that knowledge management have a direct and significant influence on firm performance also suggest that manufacturing firms can achieve competitive advantage through knowledge management. -Guzman al (2017) revealed that sharing experience, skills and knowledge between the executive and workers with new workers, it create an ideal working environment for the creation and development of knowledge which can turn improve of better services or in the creation of products with a high-quality standard which will in turn improve substantially the level of growth and competitiveness of SMEs. Show that manufacturing SMEs have good knowledge management which can be regarded as a competitive advantage.

Gavrikova et al, (2016) Knowledge management can help to gain competitive advantage in different ways. The firms can increase productivity if knowledge management is applied effectively. Knowledge management is able to let the employees share and apply the desired knowledge rapidly. It also helps to transform the methods of meetings and increase productivity thus creates a value advantage. Nzongi,(2018)inferred that knowledge management has benefited the firm and not only enhances efficiency leading to competitive edge but also delivers expertise to the firm by giving the firm s agents, the opportunity to focus on its key competencies,

Ali et al, (2017) show that external knowledge management and talent management both contributes positively to the performance of manufacturing firms. Malek et al (2016) show a positive and significant casual relationship between knowledge management and competitive advantage.AL-Hayaly&ALnajjar, (2016) identify the knowledge management processes and their impact on the organizational performance, showed significant impact of knowledge management processes (exploration, acquisition, Knowledge evaluation, Applying knowledge and Knowledge accumulation) on the

organizational performance. Kiseli, (2016) established that organization has processes for absorbing knowledge from individuals into the organization concerning competitive advantage

2.1.1.8. The Relationship between Innovation capabilities and competitive advantage:

Jyoti et al (2015) revealed that innovation has a positive and significant impact on competitive advantage. Technological innovation is essential for creating and sustaining competitive advantage in the market. (Wanyoike, 2016) show that innovation strategies influence competitive advantage in logistic firms, product innovation strategy had a positive and significant effect on competitive advantage since one unit increase innovation strategy increased competitive advantage. Product innovation is critical in enhancing competitive advantage. (Hana, 2013) Innovation contributes to achieving a competitive advantaged in several aspects such as maintain market shares, improve profitability; growth by non-price factors; producing less costly products of better quality as compared to competitors .

(Asli et al, 2013) mentioned that innovation must be understood in the largest possible sense of the notion: the new products manufacture, the new production technologies, the new equipment acquisitions, the improved management of financing methods, the improved performance and qualification of the labour force, the improved informational system and so on. In the strategic enterprises 'option must be inserted. The innovation implementation methodology that is the main source and tool to gain the competitive advantage, (Marcelo et al, 2016) the study brings a proper understanding that radical innovation play a crucial role for organizational performance in emerging economics.

Karanja et al, (2018) showed that process innovation has the highest positive influence on organizational performance. Process innovation assist companies to improve on quality of their product and services through better use of technologies, equipments resulting to operational efficiency, effectiveness, brand image improvement, sales growth and market rank performance. Kising et al, (2016) revealed that organizational innovation, product innovation, administrative innovation, and process innovation plays significant role in sustainable competitive advantage of universities in Kenya.

2.1.1.9. The mediating role of innovation capabilities in the relationship between knowledge management and competitive advantage:

Özdemir&Kharmorz, (2017) states that knowledge management process affects all innovation components and direct effects of the knowledge management process on firm performance, marketing product and process innovation are mediator in the relationship between the knowledge management process and performance. Byukusen et al, (2016) emphasizes that innovation had a positive effect on business performance; there was no direct effect of knowledge management on business performance. Except through the full mediation of innovation, this implies that without innovation SMEs may not achieve an improved business performance.

Jyoti et al, (2015) supports the fully mediated model as compared to other two models, revealed the mediating effect of innovation between knowledge management and competitive advantage.

Samir (2017) states that product innovation as mediates the effect of knowledge management on the competitive advantage. It indicates that the higher the knowledge management will lead the higher competitive advantage, if mediate product innovation were also higher.

Mahdi & Abdolali (2016) showed that innovation has a positive mediating role between knowledge management and competitive advantage. Nawab et al (2015) investigates that knowledge management processes which are knowledge creation, knowledge organizing, knowledge storing, knowledge sharing and knowledge utilization have significant but indirect impact on industry, and showed that these processes are contributing to the enhancement of innovation. According to the findings of these authors, innovation capability of a firm is a resource that leads to improved firm performance.

Alrubaiee et al, (2015) provide evidence of the mediating effect of organizational innovation on the relationship between Knowledge Management Processes and Organizational Performance.

2.1.2. The moderating role of information technology in the relationship between knowledge management and innovation capabilities

According to the resource based view (RBV), Barney (1991) drew attention to all assets, capabilities, organizational process, firm attributes, information knowledge. Control by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness. Ultimately firms that is able to leverage resources to implement a value creating strategy not simultaneously being implemented by any current or potential competitor. Qi et al (2006) indicate that in order to obtain competitive information technology resources. It takes a considerable amount of time and effort to learn and accumulate.

Information technology resources are derived from (RBV) of the firm, which suggests that information technology resources and argued that the heterogeneous information technology resources of firms are the basis of gain competitive advantage (Mata et al, 1990). Information will play a critical role in the future information-enhanced accelerated radical innovation process. New software tools and methods will be needed to gather necessary information for participants to make decisions at key points about the feasibility of continuing a project. In addition, this same software will provide the initial momentum for a new radical innovation by locating and collecting necessary ideas and information about relevant current and past innovations
(Miller, 2018)

IT has been found to be a key element for effective and efficient knowledge process, because it expedites swift collection, storage, and exchange of knowledge on a magnitude not feasible in the past, IT integrate fragmented knowledge, thus, it eliminates barriers to communication within the organization, in doing so supports knowledge processes such as generating, facilitating, expending and transferring (Abubaker et al, 2017).information technology positively moderates the relationship between supply chain collaboration and organizational responsiveness.

Information technology refers to the infrastructure and its capabilities supporting the knowledge management architecture. There is an ongoing debate on the role that information technology can play in knowledge management. On the one hand, information technology is pervasively used in the organization and qualifies as a natural medium for the flow of knowledge in the organization (Allamah, 2017).Information technology provides effective search and retrieval of knowledge and information within

the organization and facilitates collaboration, coordination, and telecommunication among functional areas or department, thereby leading to effective knowledge transfer (Al-Jaafreh& Fayoumi, 2017).IT capability as significant boundary factor that moderates the relationship between SCC and organizational responsiveness, In addition IT moderating effects of the three IT capability types vary; both outside-in and spanning IT capability enhance the positive relationship between SCC and organizational responsiveness(Zhaocai&Hefuliu,2016).

Hongyi,Shan,Jinlon&Zhaohua,(2018) indicates that three types of information technology resources (i.e., IT infrastructure, IT human and IT relationship) positively affect knowledge management capability (KMC), which is positively related to competitive advantage. The value that knowledge management adds lays in increasing individual, team and organizational efficiency through the use of knowledge management tools, that is, information technology. Information technology component of the knowledge management by and large means: a) Capturing knowledge: the higher the level of capturing knowledge (explicit or tacit) with information technology tools, the better the KM result; and b) Usage of IT tools: the higher the quality of tools, quality of information, user satisfaction, usage and accessibility, the greater the KM effect on organizational performance (Tarekengn, 2017)

2.2. Summary of the chapter

A structured literature review of the research construct in general was undertaken in this chapter to define the study variables. Which's represents of knowledge management (acquisition, sharing, storing and application). Also, the chapter illustrates the competitive advantage (cost, quality, flexibility and delivery). The conceptualization of innovation capabilities (radical innovation and incremental innovation) has also been present to reflect the concept. The chapter illustrates the relationship between study variables. In the final part, the chapter illustrates the moderating role of information technology interaction between knowledge management and innovation capabilities. The next chapter will focus on theory, conceptual framework, and hypotheses development

CHAPTER III:
THEORETICAL FRAMEWORK AND HYPOTHESIS DEVELOPMENT

CHAPTER: III

THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

3.0. Introduction:

This chapter presents the theoretical framework of the study which describes the relationship between the variables, (independent, dependent, mediating and moderating variables). Beside the hypotheses development, and theories of the study

Underpinning theories:

3.1. Resource-based view (RBV):

The resource-based view of the firm (RBV) draws attention to the firm's internal environment a driver for competitive advantage and emphasises the resources that firms have developed to compete in the environment (Hoskisson et al. 1999), the focus was on the internal factors of the firm. The origins of the RBV go back to Penrose (1959), who suggested that the resources possessed, deployed and used by the organisation are really more important than industry structure. The term 'resource based view' was coined much later by Wernerfelt (1984), who viewed the firm as a bundle of assets or resources which are tied semi-permanently to the firm (Wernerfelt 1984). Prahalad and Hamel (1990) established the notion of core competencies, which focus attention on a critical category of resource – a firm's capabilities. Barney (1991) also argued that the resources of a firm are its primary source of competitive advantage. According to Ramos-Rodríguez and Ruíz-Navarro's (2004) bibliometric study of the Strategic Management Journal over the years 1980–2000, the most prominent contribution to the discipline of strategic management was the Resource-Based View of strategy. In addition, the papers written by Wernerfelt (1984) and Barney (1991) are the two most influential articles in strategic management research (Ramos-Rodríguez & Ruíz-Navarro 2004).Early researchers simply classified firms' resources into three categories: physical, monetary, and human (Ansoff, 1965). These evolved into more detailed descriptions of organisational resources (skills and knowledge) and technology (technical know-how) (Hofer & Schendel 1978). Amit and Shoemaker (1993) proposed an alternative taxonomy involving physical, human and technological resources and

capabilities. Lee et al. (2001) argued for a distinction between individual-level and firm-level resources. Miller and Shamsie (1996) classified resources into two categories: property-based and knowledge-based. Barney (1991) suggested that other than the general resources of a firm, there are additional resources, such as physical capital resources, human capital resource and organisational capital resources. Later, Barney and Wright (1998) add human resource management-related resources to this list of additional resources of a firm. These resources can be tangible or intangible (Ray et al. 2004). Wenerfelt (1984) also discussed that resources might be tied semi-permanently to the firm. Barney (1991) drew attention to 'all assets, capabilities, organizational processes, firm attributes, information, knowledge etc., controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness'. Ultimately, firms that are able to leverage resources to implement a 'value creating strategy not simultaneously being implemented by any current or potential competitor' (Barney 1991) can achieve competitive advantage. Researchers subscribing to the RBV argue that only strategically important and useful resources and competencies should be viewed as sources of competitive advantage (Barney 1991). They have used terms like core competencies (Barney 1991; Prahalad & Hamel 1994), distinctive competencies (Papp & Luftman 1995) and strategic assets (Amit & Shoemaker 1993; Markides &Williamson 1994) to indicate the strategically important resources and competencies, which provide a firm with a potential competitive edge. Strategic assets are, 'the set of difficult to trade and imitate, scarce, appropriable and specialized resources and capabilities that bestow the firm's competitive advantage' (Amit & Shoemaker 1993).

3.2. Knowledge-based view (KBV):

The Knowledge-Based View (KBV) states that the success of an organization that is involved in producing, integrating and distributing knowledge is measured by the organization's ability to develop new knowledge based on its own resources. Thus, the core resource of the organization is knowledge (Grant, 1996).

Previous researches (Bierly & Chakrabati, 1996; Davenport & Prusak, 1998) suggest that knowledge-based organizations are more creative, efficient and effective than any other organizations. This therefore implies that knowledge is the only source of sustainable competitive advantage. To achieve superior performance, with the necessary resources and superior capabilities (Davenport & Prusak, 1998), the

organization needs tacit knowledge to integrate and coordinate other resources and capabilities (Grant, 1996).

Organizational knowledge has an important position as a major source of organizational competence. This is because knowledge is contextual information, experiences, values and opinions of experts (Davenport & Prusak, 1998). There is a debate about what "knowledge as resource" means. One strand argued that "knowledge as resource" focuses on knowledge per se, meaning that knowledge is something that can be transferred, recombined, licensed, codified and put into a computer-based knowledge repository, and used to create value for a firm (Carlsson, 2004). Carlsson further stated that another strand argued that it is not knowledge per se that should be in focus, but "knowing". This means an emphasis on the context where knowledge is created, shared, integrated and put to use. The later view has primarily a process and flow view, which means that the design, structuring of knowledge processes and flows form the basis for achieving competitive advantage.

Furthermore, since competitive advantage is based on knowledge and the ability to continually develop new knowledge; this knowledge element is an important factor and resource in the success of the organization (Bierly & Chakrabati, 1996).This approach be seen in Figure (3.1) Two sources the organization assets and capabilities based on knowledge is directly on the strategy and directly - indirectly have a significant impact on the organization competitive advantage

Organization assets: The same unique resources, which will lead to the creation or development of a sustainable competitive advantage. Sometimes performance of these sources is direct effect on strategy and of these through is indirect effect on competitive advantage (Georgios et al, 2009)

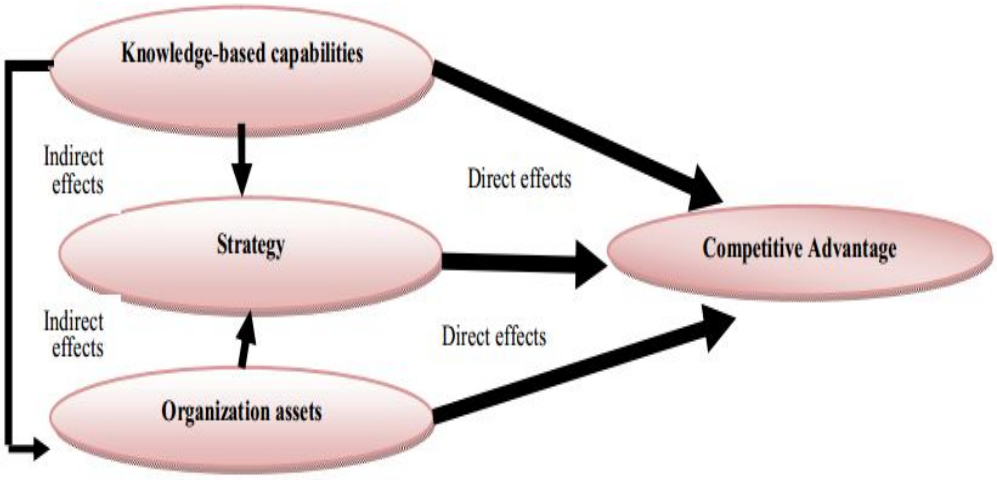


Figure 3.1 Conceptual Frameworks for Competitive Advantage

Knowledge-based capabilities: This capability involves stages acquisition of knowledge, creation, recording and the transmission ability of the individual to the group and eventually converting into organizational knowledge. It is this point that this capability leads to modernization and also continuous improvement of the performance other assets of organization (Georgios et al, 2009).

The aim of this study is to examine the impact of knowledge management process (knowledge acquisition, knowledge sharing, knowledge storing and knowledge applying) on competitive advantage (cost, quality, flexibility and delivery) on the one hand beside relationship innovation (radical and incremental) as mediator. The integrative model presented in figure (3.1) considers the influence of independent variables on competitive advantage through mediating variables innovation and information technology as moderator.

Based on previous studies on knowledge management and competitive advantage, which showed a gap in this respect, hence this conceptual framework is thought to develop a model to fill such a gap. The integrative model displayed in figure (3.1) considers the influence of the knowledge management on competitive advantage through mediating variable and moderator variable.

So in this study, developed an integrative model that knowledge management variable competitive advantage variable, relationship innovation capabilities variable and information technology, the variables of this study are:

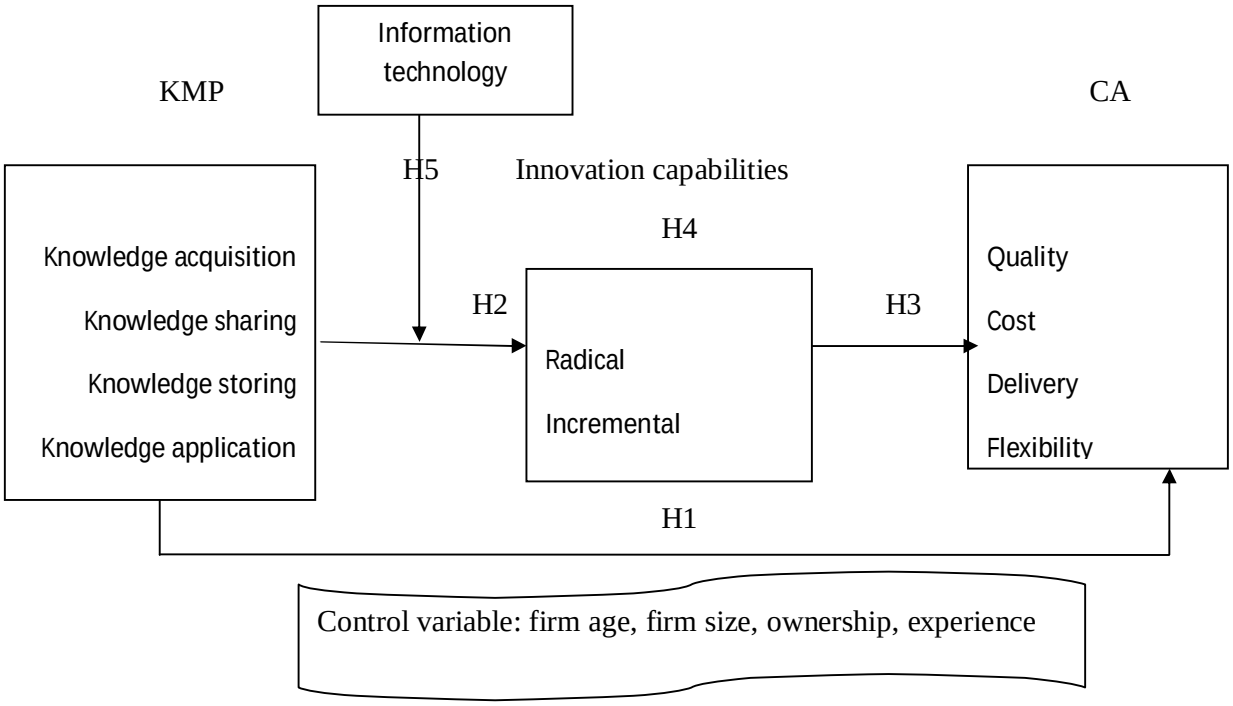
Independent variable is the KM which is consisting of four constructs (namely: acquisition, sharing, storing, and applying).

Mediating variable is the relationship innovation capabilities dimensions (namely: radical and incremental).

Moderator variable are the information technology

Dependent variable is the competitive advantage which is consisting of (cost, quality, flexibility and delivery)

Figure (3.2) Conceptual framework:



3.3. Research Hypothesis:

In this study ,there are five main hypotheses developed to test the relationship between knowledge management and competitive advantage and with the innovation capabilities dimension (incremental and radical innovation) Moreover, testing the relationship between innovation dimension with competitive advantage .Alongside ,tests innovation capabilities as a mediator variable between knowledge management and competitive advantage .finally test the moderating role of information technology as a moderate variable between knowledge management and innovation .

3.3.1. H1/ the relationship between knowledge management (acquisition, storage, sharing and application) and competitive advantage (cost, flexibility, delivery, and quality).

In accordance with the findings in literature knowledge management was posited to have significant and positive relationship with innovation in competitive advantage,(Gronzalo et al,2017) the results obtained show that manufacturing SMEs have good knowledge management which can be regarded as a competitive advantage ,(Muhammed et al,2017) states that external knowledge management (E-KM) contribute positively to the performance of manufacturing firms ,(Muhammed et al,2017)states that is to provide an overview of knowledge management and highlight the important of this field of practice and also successful implementation of knowledge management positively impacts organizational performance .

According to the studies that were mentioned above this study developed the hypothesis as following:

H1: Knowledge management is positively relates to competitive advantage:

Developed sub hypotheses from first hypotheses as follows:

H1: 1a: knowledge acquisition is positively related to cost

H1: 1b: knowledge sharing is positively related to cost

H1:1c: knowledge storing is positively related to cost

H1: 1d: knowledge application is positively related to cost

The knowledge management is positively related to cost

H1:2a: knowledge acquisition is positively related to quality

H1:2b: knowledge sharing is positively related to quality

H1: 2C: knowledge storing is positively related to quality

H1:2d: knowledge application is positively related to quality

The knowledge management is positively related to quality

H1:3a: knowledge acquisition is positively related to flexibility

H1:3b: knowledge sharing is positively related to flexibility

H1:3c: knowledge storing is positively related to flexibility

H1:3d: knowledge application is positively related to flexibility

The knowledge management is positively related to flexibility

H1:4a: knowledge acquisition is positively related to delivery

H1:4b: knowledge sharing is positively related to delivery

H1:4c: knowledge storing is positively related to delivery

H1:4d: knowledge application is positively related to delivery

The knowledge management is positively related to delivery

3.3.2. H2. Relationship between knowledge management and relationship innovation capabilities

In literature a number of scholars like (Stephen,2017) states that knowledge management practices lead to innovation knowledge management practices play a significant role in innovation,(Samina et al ,2015) states that the role of knowledge management in the implementation with the help of knowledge management process and strategies which eventually leads to innovation ,(Eugenie et al,2016) indicates a significant effect of innovation in the relationship between knowledge management and business performance ,(Jeevan et al,2015) investigates that significant relationship between knowledge management and innovation capacity,

(Ebrahim et al, 2017) emphasizes the importance of knowledge management and links it with innovation. Positive impact of knowledge management and knowledge management strategy on innovation, (Samsir, 2017) showed that knowledge management had positive and significant effect on product innovation, (Marianne &, 2017) states that knowledge management provided strong support for business excellence endeavours and contributed to innovation. Propose that the effective management of knowledge is one significant way of achieving sustained forms of innovation and performance.

(Mehdi et al,2016) showed that there is a significant positive relationship between knowledge management and innovation ,knowledge management process have a positive and significant relationship with decision –making process in organization Moreover ,there is a significant relationship between creativity ,innovation ,decision –making process with employees performance ,(Maleeha &Tayyab,2016) suggested that knowledge management acquisition has a positive impact on product service and marketing innovation ,knowledge management diffusion also positively relates with product service and marketing innovation .

Knowledge management positively related to innovation capabilities

Developed sub hypotheses from second hypotheses as follows:

H2: 1a: knowledge acquisition is positively related to radical innovation

H2: 1b: knowledge sharing is positively related to radical innovation

H2:1c: knowledge storing is positively related to radical innovation

H2: 1d: knowledge application is positively related to innovation

The knowledge management is positively related to radical innovation

H2: 2a: knowledge acquisition is positively related to incremental innovation

H2: 2b: knowledge sharing is positively related to incremental innovation

H2: 2c: knowledge storing is positively related to incremental innovation

H2: 2d: knowledge application is positively related to incremental innovation

The knowledge management is positively related to incremental innovation

3.3.3. H3. Relationship between relationship innovation and competitive advantage

Titus et al ,(2017) emphasizes that organizational innovation plays significant role in sustainable competitive advantage and innovation forms the basis for building sustainable competitive advantage ,(Aida ,2017) product innovation affected competitive advantage in small and medium enterprises of typical food products of Riau in Kepulauan Meranti Regency,also product innovation in company is a basic need ,which in turn will lead to a competitive advantage ,shows that product innovation has a positive effect on competitive advantage.

(Mburu, 2016) shows that innovation strategies influence competitive advantage and innovation strategies had a positive and significant effect on competitive advantage. Product innovation is critical in enhancing competitive advantage ,(Eugenie et al,2016) stated that innovation had a positive effect of business performance, (Marcelo et al ,2016) states that the radical innovation becomes a source of competitive advantage for companies in emerging economics ,also radical innovations play a crucial role for organizational performance.

H3/ the innovation capabilities are positively related to competitive advantage.

Developed sub hypotheses from third hypotheses as follows:

H3: 1a: radical innovation is positively related to cost

H3: 1b: incremental innovation is positively related to cost

H3: 1c: radical innovation is positively related to quality

H3: 1d: incremental innovation is positively related to quality

H3: 1e: radical innovation is positively related to flexibility

H3: 1f: incremental innovation is positively related to flexibility

H3: 1g: radical innovation is positively related to delivery

H3:1h: incremental innovation is positively related to delivery

The innovation is positively related

to competitive advantage

3.3.4. H4. The innovation capabilities mediate the relationship between knowledge management and competitive advantage:

It has been expressed by many authors such as (Eren Durmus-Ozdemir&Khamroz Abdukhoshimov,2017) states that knowledge management process affect all innovation components and direct effect of the knowledge management process on firm performance ,marketing product and process innovation are mediator in the relationship between the knowledge management process and performance ,(Eugenie et al ,2016).

Emphasizes that innovation had a positive effect on business performance. There was no direct effect of knowledge management on business performance ,except through the

full mediation of innovation. This implies that without innovation, SMEs may not achieve an improved business performance. (Samina et al, 2015) showed that the knowledge management process is contributing in the enhancement of innovation.
The hypothesis to test relationship innovation mediating the relation between knowledge management and competitive advantage, were formed as follows:

H4:1a: the radical innovation mediates the relationship between knowledge acquisition and cost

H4: 1b: the incremental innovation mediates the relationship between knowledge acquisition and cost

H4: 1c: the radical innovation mediates the relationship between knowledge sharing and quality

H4: 1d: the incremental innovation mediates the relationship between knowledge sharing and quality

H4: 1e: the radical innovation mediates the relationship between knowledge storing and flexibility

H4: 1f: the incremental innovation mediates the relationship between knowledge storing and flexibility

H4: 1g: the radical innovation mediates the relationship between knowledge application and delivery

H4: 1h: the incremental innovation mediates the relationship between knowledge application and delivery.

3.3.5. H5. The moderating effect of information technology in the relationship between knowledge management and innovation capabilities

According to resource-based view (RBV), Barney (1991) drew attention to all assets, capabilities, organizational process, firm attributes, information, and knowledge. Controlled by a firm that enables the firm to conceive of and implement strategies that improve its efficiency and effectiveness. Ultimately, firms that are able to leverage resources to implement a value creating strategy not simultaneously being implemented by any current or potential competitor (Barney, 1996).

Ansoff (1991) classified firms' resources into three categories: physical, monetary, and human. These evolved into more detailed descriptions of organizational resources (skills and knowledge) and technology (technological know-how) (Hofer&Schendel, 1978).Knowledge-based view (KBV) derived from RBV of the firm suggests that technology, capital, market share or product sources are easier to copy by other firms while knowledge is the only resources that is difficult to imitate (Tiwana, 2002). Grant (1996) argued that there are two types of knowledge: information and know-how.

Backmann (1999) proposed a five level knowledge hierarchy comprising data, information, knowledge, expertise and capabilities. Zack (1999) divides organizational knowledge into three categories: core knowledge, advanced knowledge and innovative knowledge. Core knowledge is the basic knowledge that enables firms to survive in the market in the short- term; advanced knowledge provides the firm with similar knowledge as its rivals and allows the firm to actively complete in the short term. Innovative knowledge gives the firm its competitive position over its rivals. The firm with innovative knowledge is able to introduce innovative products or services (Zack, 1999). Some scholars draw attention of information technology such as:

Anis (2017) considering the necessity of attention to information technologies and their impact on organizational agility, knowing various effective factors affecting it is also of paramount importance , Regina et al(2017) explore information technology that plays an important role in students participation in knowledge management activities for learning,(Samina et al,2015) described that information technology is an important factor in the organization and it help employees to reduce time of knowledge transfer and at the same time information technology is also useful in achieving high efficiency. Information technology is a useful organizational factor for maintaining new knowledge, knowledge transfer and knowledge storage.

Based on the above discussions the following hypotheses are generated:

H5:1a: the effect of knowledge acquisition on radical innovation is stronger when information technology is higher

H5: 1b: the effect of knowledge acquisition on the incremental innovation is stronger when information technology is higher

H5: 1c: the effect of knowledge sharing on radical innovation is stronger when information technology is higher

H5: 1d: the effect of knowledge sharing on incremental innovation is stronger when information technology is higher

H5: 1e: the effect of knowledge storing on radical innovation is stronger when information technology is higher

H5: 1f: the effect of knowledge storing on incremental innovation is stronger when information technology is higher

H5: 1g: the effect of knowledge application on radical innovation is stronger when information technology is higher

H5: 1h: the effect of knowledge application on incremental innovation is stronger when information technology is higher.

H5- information technology moderates the relationship between knowledge management and innovation.

3.4. Control variables

In a line with the previous studies control variables were used to examine their effect on firms across section of industries (e.g., Narver& Slater, 1990; Jaworski &Kohli, 1993). According to Armstrong&Shimizu (2007) Controlling for industry effects is important for two reasons, firstly the performance of the firms is often influenced by general industry environments such as industry of economic cycle, and secondly the relationship between performance and resources may be industry dependent. Firm size and firm age have long been emphasized as an important factors that influence new product development performance (Chen, Li& Liu, 2015) and product market performance (Mu,2015) of a firms as control variables in analysis because their omission might confound the analysis. Therefore firm size as calculated by the number of employees.

3.5. Summary of Chapter

This chapter depicted of this thesis. Firstly, a general discussion on theory of the research, conceptual framework was presented with the result of the structured literature review, hypotheses development. The control variables were presented.

CHAPTER IV:
RESEARCH METHODOLOGY

CHAPTER: IV

RESEARCH METHODOLOGY

4.0. Introduction

This chapter will present the section in methodology highlights the sampling procedures, the measurements of variables, the development of research instrument, the administration of data collection, pre-test and the statistical techniques that are used to test the hypotheses.

4.1. Research Methodology

Consistent with the purpose of this research, the study relied on the Positivism philosophy, deduction approach to theory development, mono-method quantitative methodological choice, survey strategy and cross-sectional Time horizon. The data were collected through questionnaires

Quantitative
•Deductive •How, what •Tests hypotheses •Positivism •Objectivism •Employs measurement •Macro •Detached researcher

Qualitative
•Inductive •Relation, effect, impact, influence •Produces theories •Phenomenology •Constructionism •Does not employ measurement •Micro •Involved researcher

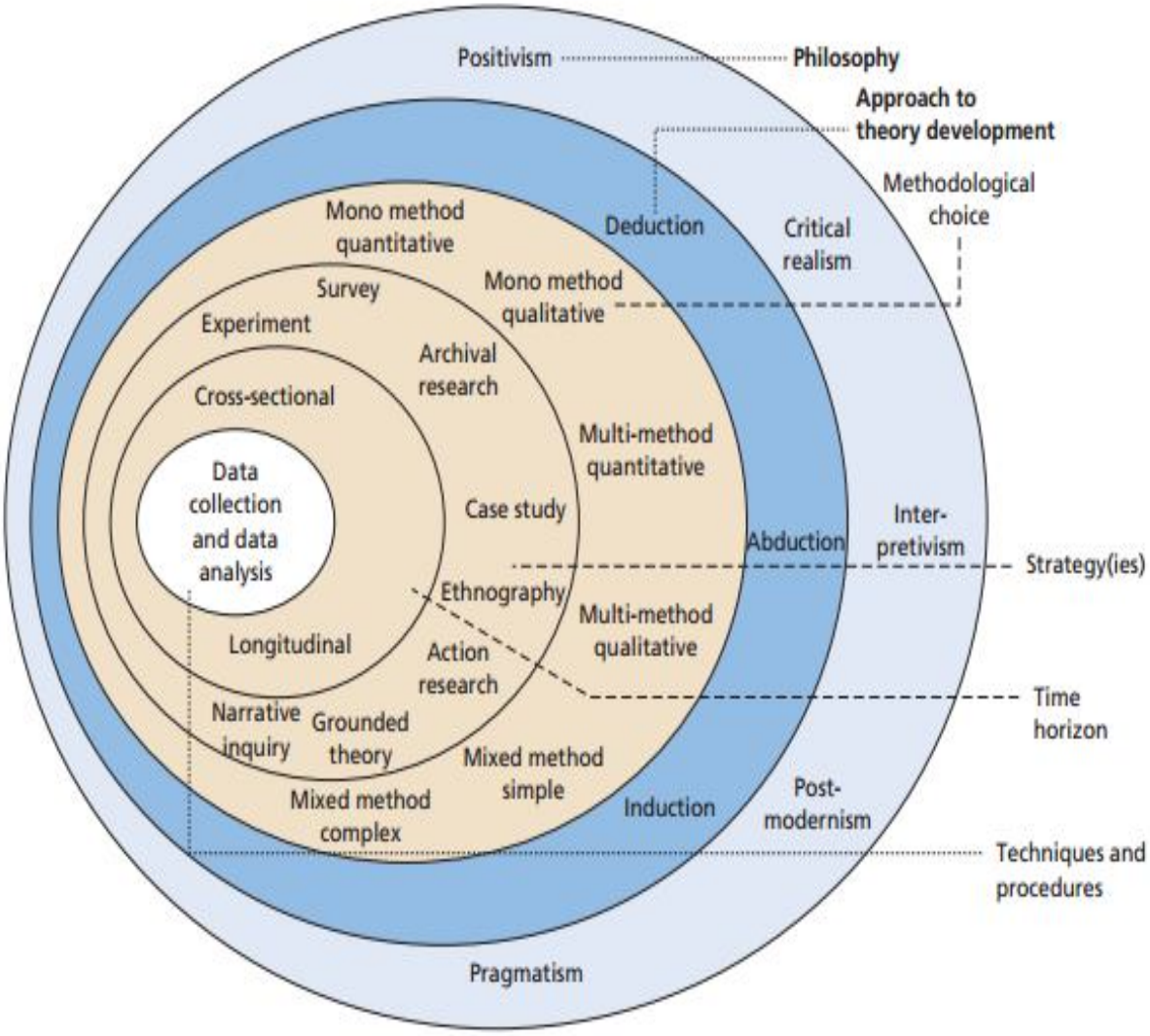


Figure (4. 1)

The research onion

Source: Mark Saunders, Philip Lewis &Adrian Thornhill (2008)

4.2. Research population and sample:

It was well known that most of the firms in Sudan are located in the Khartoum state which represents the capital of country. Therefore the population of this study was the industry firms located in the Khartoum state. The research employed convenient sample where self-administrated survey was used to distribute 300 questionnaires to the industrial firms in Khartoum state.

4.3. The Measurement for Variables:

In the following sub-suctions, the measurements of the variables used in this study are discussed in detail. Measures for all constructs were taken from the existing literature. Moreover, the questionnaire items were adopted from different resources to suit this study.

4.4. The Measurement for knowledge management (KM)

In this study the scale that used to assess the knowledge management (KM) was adopted from (Musa, 2013), (Kor& Maden, 2013), (Naresh& Hire math, 2017) and (Dahiyat, 2015) which consist of 18 items arranged in four dimensions;

(1) Knowledge acquisition; (2) knowledge sharing; (3) knowledge storing; and (4) knowledge application, Innovation capabilities is measured as two constructs with a total of 7 items: (1) radical innovation and (2) incremental innovation, derived from (Regient et al, 2017). Competitive advantage is measured as four constructs with a total of 17 items (1) quality,(2) cost, (3)delivery and(4) flexibility derived from (Sani, 2014), (Pong&Himmanshu, 2017), (Khalifa, 2016)and (Vilani,2017). Information technology is measured a total of 4 items adopted from (Mekonnen, 2017).

4.4.1. Measurement for knowledge acquisition (IV)

According to Musa (2013) knowledge acquisition which is related with using either existing knowledge or capturing new knowledge is measured as four items adopted from (Kiessling, T. S., Richey, R. G., Meng, J. &Dabic, M. (2009) and are evaluating on five- point likert scale.

Table (4.2)Measurements for acquisition

No		Source
	In our firm	Musa (,2013)
1	in our company employees use the internet to obtain the information necessary to perform their duties	
2	The company relies on external sources to obtain information about new products	
3	our company has the ability to convert the information available from competitors to new products	
4	our company has stored information that can be converted into data that helps employees perform their tasks	

Source: by researcher from data (2018)

4.4.1.1. Measures for knowledge sharing (IV):

Knowledge sharing defined as business process that requires collective knowledge skills expertise and dissemination of knowledge across the organizational units (Musa 2013). Sharing knowledge was measured using four items adapted from (Gold et al, 2001)

Table (4.3) measurement for sharing knowledge

No		Source
	Items	Musa (,2013)
1	Collective work is encourage in our company providing information at the company level	
2	Our company provides technology systems supported by internet network	
3	The business environment encourage the sharing of information	
4	The company shares information with suppliers and customers	

Prepared by searcher (2018)

4.4.1.2. Measure for knowledge storing (IV)

This process consists of codifying, storing, refining, indexing, evaluating and updating the knowledge in organization repository (Naresh&Hiremath, 2017).Storing knowledge was measured using four items adapted from (Tan & Wang, 2015).

Table (4.4) measurements for knowledge storing

No	Items	Source
1	My firm utilizes various print materials (such as newsletters, handbooks, annual reports, manuals and etc…..) to store the knowledge	Naresh& Hire math,(2017)
2	My firm utilizes audios, videos to store the knowledge	
3	My firm has good IT infrastructure to store the knowledge	
4	The company can provide information systems for available knowledge	

Prepared by researcher (2018)

4.4.1.3. Measure for knowledge application (IV)

Application of knowledge can assist the organization to improve efficiency and reduce cost (Dahiyat, 2015), (Kor&Ceyda, 2013). Application knowledge was measured using five items adapted from

Table (4.5) measurements for application knowledge

No	Items	Source
1	My firm applying experiential knowledge	Dahiyat,(2015), Buruc& Ceyda,(2013)
2	My firm uses available knowledge to improve it is productivity	
3	My firm undertakes a set of activities designed for using the available knowledge to solve new problems	
4	My firm undertakes a set of activities designed for using the available knowledge in the development of new products	
5	My firm applying knowledge to solve new problems	

Prepared by researcher (2018)

4.4.2. Measures for innovation capabilities (MV)

4.4.2.1. Measurement for radical innovation

Radical innovation is ability to make prevailing technological or technologies obsolete by transforming the old knowledge into new knowledge thereby producing fundamental changes in an organization (Regient et al, 2016). Radical was measured using four items, five- point likert scale adapted from the work of Gallouj&Weinstein (1997) and Hertog (2000).

Table (4.6) measurement for radical innovation

No	Items	Source
1	The products offered by the company are entirely new	Regient et al, (2016)
2	The products offered by the company are new compared to competitors	
3	The company's new products are innovative	

Source: prepared by searcher (2018)

4.4.2.2. Measures for incremental innovation (MV)

Incremental innovation is defined as cumulative and gradual nature of technological changes in organization to create services (Regient et al, 2016). Incremental innovation was measured using three items, five-point likert scale adapted from Janse et al (2006).

Table (4.7) measurements for Incremental innovation

No	Items	Source
1	my firm continuously improves the maintenance processes	Regient et al,(2016)
2	my firm improves the efficiency of the products and services that are delivered	
3	my firm contributes to a higher degree of usage and effectiveness of the asset	
4	In our company there is a change in the concrete aspects using modern technology	

Prepared by researcher (2018)

4.4.3. Measures for competitive advantage (DV)

4.4.3.1. Measure for cost (DV)

Company that emphasize cost as a competitive priority focus on lowering cost, improving productivity, maximum capacity utilization, reducing inventory (Sani, 2014). Cost was measured using five items, five-point likert scale adapted from Word et al, (1995).

Table (4.8) measurements for cost

No	Items	Source
1	my firm has low cost of production than others	Sani (2014)
2	my firm operates low inventory	
3	my firm produces at maximum capacity utilization	
4	my firm operates low overhead cost	
5	my firm exercises adequate control on supply and procurement	

Prepared by researcher (2018)

4.4.3.2. Measure for quality (DV)

Quality is ability to satisfy the need and expectations of customer (Sachitra, 2017), was measured using four items, five-point likert scale adapted from (Bregman&Kiefsjo, 1996)

Table (4.9) measurements for quality

No	Items	Source
1	we are able to compete based on quality	Sachitra(2017)
2	we offer high quality products to our customers	
3	we offer products that are very durable	

Prepared by researcher (2018)

4.4.3.3. Measure for delivery (DV)

Delivery is a competitive priority because customers are interested in satisfying their needs and wants in the right quantity at the right time (Pong& Himanshu, 2017). Delivery was measured using four items five-point likert scale, adapted from

Table (4.10) measurements for delivery

No	Items	Source
1	providing short time delivery	Pong& Himanshu,(2017
2	dependability delivery promise	
3	delivery accuracy	
4	delivery availability (the probability that item will be available in stock at order time	

Prepared by researcher (2018)

4.4.3.4. Measure for flexibility (DV)

Flexibility is the abilities of organization to response to environment change and extent to which services match consumer satisfaction (Khalifa, 2016)**.** Flexibility was measured using four items, five-point likert scale, adapted from (Venkatraman& Ramanujam, 1986) and (Melville et al, 2004).

Table (4.11) measurements for flexibility

No	Items	Source
1	our firm reducing the time for market acceptance of an services	Khalifa (2016**)**
2	our firm increasing the speed at which we respond to customer requests	
3	our firm tracking customer trends	
4	our firm improving relationship with customers	

Prepared by researcher (2018)

4.4.4. Measure for information technology (MV)

Information technology is widely used in an organization, and thus qualifies as a natural medium for the flow of knowledge in the organization (Mekonnen, 2017). Information

technology was measured using four items, five-point likert scale, adapted from Allamah& Zare (2011).

Table (4.12) measurements for information technology

No	Items	Source
1	My firm uses recent technology	Mekonnen (2017)
2	My firm uses recent technology promotes our business relation with the society	
3	IT tools in my firm are simple to use and have user friendly interface	
4	In my firm IT tools are used to support collaborative work (e.g. video conferencing systems, communication)	

Source prepared by researcher (2018)

4. 5. Development of questionnaire:

According to Kumar, Asker and Day, (2001), there are four steps in developing a questionnaire. These steps includes: planning what to measure, developing the questionnaire, question wording, questionnaire layout pretesting correcting problems and its implementations

4.5.1. Planning what to Measure:

This step is based on the research objectives, problem statement, and the research issues. The survey questions were designed precisely to give clear ideas about the problems for the target respondents to answer. The questions on the research instrument were divided into the following**:**

(1) Questions about Personal Informational (2) questions covered knowledge management variables namely; (knowledge acquisition, knowledge sharing, knowledge storing and knowledge application), innovation capabilities variables namely (radical and incremental innovation), competitive advantage variables namely (cost, quality, flexibility and delivery) and information technology

All the responses answers to the top managers elicited on 5 point scale {namely: (1) strongly disagree; (2) disagree; (3) neutral; (4) agree and (5) strongly agree}. So, this type of responses has been chosen from Likert scale for its clarity, and moreover, respondents prefer simple scales that are easily understood (McDonald, 2004).

4.5.2. Formatting questionnaire:

This step involves the conversation of the research objectives into information required to obtain the necessary outputs of the questionnaire. It involved the formatting clear statements. All the research questions in this study had been converted into the relevant questions and clearly stated. The most respondents were familiar with Arabic language. Therefore, the instrument required translation to Arabic language and then to English language again.

4.5.3. Question warding:

This step examines whether the question are clearly understand to all respondents. Thus it is necessary to use simple terminologies to avoid unclear or elusiveness in the meaning. It is important to avoid double- barrelled or misleading and confusing question beside the phrasing and length of question, it is also designed to solicit idea and answers from target respondents. Simple statement can be used. So the questionnaire could be easily understood. Answering the questionnaire was estimated to take approximately twenty to thirty minutes.

4.6. Questionnaire Design

The questionnaire was divided into three parts with a total of 42 items. Part (one) is about firm's profile, it includes questions about: The nature of the firm's work, number of employees, firm experience, the ownership of the firm, and the number of competitors. Part (two) cantered on the items generated for the measurement of the variables related to dimensions of the four constructs that shaped the research model, part three focused on personal information about respondent

4.7. Pre-Testing of Questionnaire

Pre-Testing refers to the testing of questionnaire on small sample of respondents in order to identify and eliminate potential problems (Malhotra, 1999). The aim of pre-test is to validate the data collection instrument and to ensure the appropriateness of the survey administration (Aaker, Kumar, &Day, 2007). Thus in the first stage a first draft of the questionnaire was initially developed in English, then back to back Arabic translation was conducted and back translated into English. This procedure ensures that the English and the Arabic versions of the questionnaire contain equivalent. Therefore,

these variables have an acceptable level of reliability (Sekaran, 2003). Following that, modifications were made to the questionnaire to reduce possible ambiguity of some question and improve general appearance of the questionnaire before using it in the large – scale survey.

Table (4.13) pre-test of variables

Variables	**Cronbach alpha**
Knowledge sharing	.850
Knowledge acquisition	.710
Knowledge storing	.817
Knowledge application	.923
Flexibility	.882
Delivery	.804
Cost	.814
Quality	.865
Radical innovation	.824
Incremental innovation	.804
Information technology	.925

Source prepared from data (2018)

4.8. Data Analysis Techniques

To evaluate the data obtained by questionnaire from respondents' and testing the hypothesis. Statistical package for social science (Spss) version 25 and AMOS were used. The data analysis techniques used in this study were described below.

4.8.1. Descriptive Statistics

According to Aaker et al, (2007) descriptive statistics were used to summarized and describe the key feature of the sample data such as frequency, percentage, mean, standard deviations, and range. Therefore, in this study descriptive statistics were used to describe the firms in Sudan and respondents beside all the variables of the main four constructs shaped the model of this study (knowledge management, innovation capabilities, information technology and competitive advantage).

4.8.2. Factor Analysis

Factor analysis is common statistical method used to find a small set of unobserved variables (also called latent variables, or factors) which can account for the covariance among a larger set of observed variables (also called manifest variables), thus it uses to assess the reliability and validity of measurement scales (Albright, 2006-

2008).Factor analysis an interdependence technique it is primary purpose is to identify the underlying structures or commonalities in the data (Hair, Back, Babin, Anderson, & That, 2010). The factor analysis used to test the validity of items in the survey, e.g. to ensure that the instrument has reasonable construct validity (Ho, 2011; Kuo, 2011).

According to Albright, (2006- 2008) it is possible to distinguish between two categories of factor analysis depending on whether the investigator wishes to explore patterns in the data or to test explicitly stated hypotheses; these are exploratory factor analysis and confirmatory factor analysis.

4.8.2.1. Exploratory factor Analysis

Exploratory factor analysis corresponding to the former task is available in general purpose statistical software such as Spss, SAS and Stata. When carrying out an EFA no substantive constrains are imposed on the data. Instead it is assumed that each common factor affects every observed variable and that the common factors are either all correlated or uncorrelated (Albright, 2006-2008). In this study, exploratory Analysis was used to validate and ensure the goodness of measures under the following conditions:

a) factor loading should be greater than 0.50 for sample than range between 130- 150

b) Any item cross loaded with two factors should be dropped

c) Factor that had given value exceeded 1.0 were accepted, while other were dropped

d) The minimum acceptable value for KMO is 0.6

e) Bartlett's test with p-value less than 0.o5 was used to test the overall significance of correlation among items.

4.8.2.2. Confirmatory factor Analysis

Confirmatory factor analysis (CFA), on the other hand, is theory-driven and its special case of the structural equation model (SEM). With CFA it is possible to place substantively meaningful constraints on the factor model, such as setting the effect of one latent variable to equal zero on a subset of the observed variables (Albright, 2006-2008). The advantage of CFA is that it allows for testing hypotheses about a particular factor structure.

4.8.3. Reliability Analysis

Reliability analysis refers to ability of an instrument to produce consistent or same results. Reliability is a degree to which measures are free from error so that they give same results when repeat measurements are made under constant condition (Ram& Singh, 2009). Reliability analysis was used to test consistency and stability of the measurement instrument and help to assess the goodness of measure (Haire et al, 2010). To ensure the reliability of the instrument in this research a pre-test study was conducted and the value of Cronbach Alpha was calculated to examine the internal consistency and stability of the measurement instrument. The criteria of Cronbach Alpha according to Sekaran (2003) was 0.7o considered to be acceptable, while it was less than 0.60 considered as a poor and those higher than 0.80 are to be good.

4.8.4. Correlation Analysis

Correlation analysis was used to establish a correlation matrix between variables of the study. In this study person correlation was used to see the degree of correlation between the main variables. That is to determine the relationship between knowledge management and innovation capability as mediator and competitive advantage as dependent variable as well as explaining the moderating role of information technology in between knowledge management and innovation capabilities.

4.8.5. Multiple Regression Analysis

Multiple regressions indicate how adequate the predictors are in explaining the dependent variable. It also gives the best predictive model of the linear relationship present among the independent variables (Hair et al, 2010). In addition, multiple regressions are appropriate multivariate method for evaluating construct and relationship between constructs (Taba Chnick& Fidell, 2001). In this research multiple regressions was used to test the research hypothesis that is to determine if the specified independent variables were statistically significant predictors of the dependent variable.

4.8.6. Hierarchal Regression Analysis

Hierarchal regression analysis was used in this research to test the mediating effect of innovation on the relationship between knowledge management and competitive advantage. To test for mediating variables, the commonly applied method requires

estimating three regression equations using ordinary least squares (OLS) (Shaver, 2005). The first step is the regression of dependent variable on independent variable to determine if this relation exists. The second step is to establish whether there is a relationship between the independent variable and the mediating variable. The final step is to assess whether the independent variable still affects the dependent variable.

The outcome of this test either partial mediating effect or full mediating effect. The full mediating exists when the effect of the independent variable on the dependent variable, once controlling for the mediating variable is insignificant, whereas the partial mediating exists when the relationship between the independent variable and the dependent variable is significant.

4.9. Summary of the chapter

This chapter depicted the research methodology which is covered the research design, population, procedure, development of the questionnaire, design of the research instrument. Furthermore, the chapter is highlighting the measurements of the variables and depicted the statistical techniques used in testing the hypothesis. Finally the methods used in collecting and analyzing data and in testing the hypothesis are also described.

CHAPTER IV

DATA ANALYSIS AND FINDINGS

CHAPTER IV

DATA ANALYSIS AND FINDINGS

5.0. Introduction

this chapter shows the process through which the data that was collected from firms represents various industries in Sudan was analyzed to presents the findings. The chapter was organized into four sections. The first section concerns with data cleaning, response rate, and the characteristics of both firms and respondents, followed by the goodness of measures which discusses the validity and reliability of the measurement. The third section shows the descriptive analysis of the study variables. The last section focuses on the results of path analysis and hypotheses testing.

5.1. Data Cleaning

Data cleaning deals with detecting and removing errors and inconsistencies from data in order to improve the quality of data. The need for data cleaning is cantered on improving the quality of data to make them" fit for use" by users through reducing errors in the data and improving their documentation and presentation (Chapman, 2005).Data quality problems are present in single data collections due to misspellings during data entry, missing information or other invalid data.

When multiple data sources need to be integrated, or analysis programs need to be used, the need for data cleaning increases significantly. Thus in this study data cleaning is used to manipulates missing data, unengaged responses, and outliers

5.1.1. Missing Data:

Missing data is common and always expected in the process of collecting and entering data due to lack of concentration and/or the misunderstanding among respondents, and missing information or other invalid data during the entry of data. Missing data can cause several problems. The most apparent problem is that there simply won't be enough

data points to run the analysis and particularly in structural equation model (SEM).

Both exploratory and confirmatory factor analysis and path models require a certain number of data points in order to compute estimates. Additionally, missing data might represent bias issues. Some people may not have answered particular Questions in survey because of some common issue, If missing data is more than 10% of the responses on a particular variable, or from a particular respondent, that variable or respondent may cause some challenge related to the data. In this study the proportion of missing data is lower than 10% therefore there no need to remove any of responses.

5.1.2. unengaged response:

Unengaged responses means some responses giving same answer for all the questionnaire it seems to be random answers , in this case we use standard deviation to find out any unengaged response this means that any standard deviation of responses less than 0.5 when Likert's five point scale is used just deleted

5.1.3. Outliers:

It's very important to check outliers in the dataset. Outliers can influence the results of analysis. If there is a really high sample size, the need for removing the outliers is wanted, if the analysis running with a smaller dataset, you may want to be less liberal about deleting records. However, outliers will influence smaller datasets more than largest ones. However in this dataset outliers were checked

5.2 Response rate:

It was well known that most of the firms in Sudan are Located in the Towns which represents the capital of the country (Khartoum, Bahri, and Omdurman) therefore; the population of this study was the industrial firms located in these areas. The researcher employed convenient sample where self-administrated survey was used to distribute 300 questionnaires to the firms across the towns, given to top administrative were asked to fill the questionnaire, the overall response rate was.70% this was considered as high rate due to questionnaires given one by one to respondents and in researches used a self–administrated survey (Sekaran, 2003). Those who didn't responded to fill the questionnaire some were mentioned that they were not authorized

to fill the questionnaires while others were not transparent in their justifications. Below is Table

(5.1) to shows the summary of questionnaire response rate

Table (5.1) Response rate of questionnaire

Total distributed questionnaires	300
Total questionnaires received from respondents	220
Valid questionnaires received from respondents	207
Invalid questionnaires	13
Questionnaires not received	80
Overall response rate	207
Useable response rate	70%

Source: prepared by researcher from data (2018)

5.3 profile of the responded firms and respondents

Based on the descriptive statistics using the frequency analysis this part investigates the profiles of firms that participated in the survey on the light of seven characteristics, these are the nature of work firm number of employees, age of the firm, the nature of the firm (commercial or industrial), the firm ownership, the firm number of competitors and finally the firm experience. The Spss output presented in table (5.2) shows that (96.6%) of the responded firms were industrial, where (3.4) were classified as commercial work, and Table (5.2) profile of responded firm, in terms of firm number of employees almost (38.6%) of responded firms are large firms with more than 200employee, while the small one with less than 50 employees are (13.5%). The responded firm's number of employees ranged 50-100 is (16.4%), where others ranged 101-150 is (15.9%).

Concerning the firm experience of the firms almost half of responded firms are well established firms (36.2%) with more than 20 years, where the newly established firms are (7.2%) with less than 5 years, from 5- 10 are (17.9%), from 10- 15 are (25.6%), while others ranged 15-20 are (13.0%). The majority of responded firms are fully owned by special firm (52.7%), multinational firms owned by (13.0%), international firms owned by (34.3%). The competition among the responded firms is to some extend high because (36.2) has more than 20 competitors, while (22.7%) of the respondents has 5- 10, also less than 5 the same competitors, while (15.9%) of the competitors has 10-

15, and beside (13.0%) of the firms has less than 15 -20 competitors there was only firms represents few competitors.

Table (5.2) profile of respondents

Variable	Category	Frequency	Percent%
the nature of the work	Commercial	7	3.4
	Industrial	200	96.6
Number of employees	Less than 50	27	13.0
	From 50 t0 100	34	16.4
	From 101 to 150	33	15.9
	More than 200	80	38.6
Ownership	Government	71	34.3
	Special	109	52.7
	Multi national	27	13.0
Experience	Less than 5	15	7.2
	From 5 to 10	37	17.9
	From 10 to 15	53	25.6
	From 15 to 20	27	13.0
	More than 20	75	36.2
The number of competitors	Less than 5	47	22.7
	From 5 to 10	47	22.7
	From 10 to 15	33	15.9
	From 15 to 20	27	13.0
	More than 20	53	25.6

Source: prepared by researcher from data (2018)

Based on table (5.3) shows the respondent's profile, the table reveals that (65.7%) of the managers are males where (34.3%) are females. With regard respondents ages (36.2%) are in middle age 31- 40years, (32.9%) their age range is 20-30 years, while the rest are between 41-50 years (23.2%), the respondents age (6.8%) their age range is 50-60 years. Regarding the respondent academic qualification the data shows that small number of the respondents (1.9%) is holding secondary certificates, where most of them studied at university as highest level of education (98%), distributed in (41.5%) Bachelor degree, (30.9) master degree, (11.1) high diploma degree, (5.8%) diploma degree and (8.7%) are holding PhD. Regarding of job title respondents (3.9%) general manager, (14.0%) branch manager,(30.o%) deputy and (51.7%) department managers. In terms of respondents experience the date indicates that few (12.6%) of the manager have less than 16-20, compared to a great deal (26.1%) of the respondent have 5- 10 experience in their firm,(20.8%) of the managers have less than 5 experience,(25.6) of respondent 11- 15 of manager experience, (15.0) more than 20 years of respondents. This means that questionnaires were answered by the well experienced personnel in the firm.

Table (5.3) basic information of responding

Variable		Frequency	Percent %
Gender of	MALE	136	65.7
	FIMALE	71	34.3
Age	20- 30	68	32.9
	31- 40	75	36.2
	41- 50	48	23.2
	51- 60	14	6.8
	More than 60	2	1.0
Education	Secondary	4	1.9
	Diploma	12	5.8
	Bachelor	86	41.5
	High Diploma	23	11.1
	Master	64	30.9
	PhD	18	8.7
Job title	General manager	8	3.9
	Branch manager	29	14.0
	Deputy	62	30.0
	Department manager	107	51.7
Years Experience	Less than 5	43	20.8
	From 5 to 10	54	26.1
	From 11 to 15	53	25.6
	From 16 to 20	26	12.6
	More than 20	31	15.0

Source: prepared by researcher from data (2018)

5.4.Goodness of measures

This section, reports the results of validity and reliability tests as a means to assess the goodness of measure in this study constructs (Sekaran, 2003). The study used exploratory factor analysis (EFA) and (CFA) confirmatory factor analysis. The following are the detailed information of each

5.4.1.Exploratory factor analysis (EFA):

Exploratory factor analysis for critical success factor influence CRM Exploratory Factor Analysis (EFA) is a statistical approach for determining the correlation among the variables in a dataset. This type of analysis provides a factor structure (a grouping of variables based on strong correlations). In general, an (EFA) prepares the variables to be used for cleaner structural equation modelling (SEM). This means the (EFA) will be able to spot problematic variables much more easily than the (CFA). Therefore, this

study used exploratory factor analysis for testing the validity and uni-dimensionality of measures to all variables under study, followed the assumptions recommended by (Lowry & Gaskin, 2014)as follow:

(*There must be a clean pattern matrix then Adequacy and Convergent validity and Discriminant validity and finally Reliability*).

We using Maximum Likelihood., the summary of results were showed in Table (5.4) and the SPSS output attached in appendix B3. As shown in Table (5.4) below all the remaining items has more than recommended value of at least 0. 5 in measure of sample adequacy (MSA) with (KMO) (above the recommended minimum level of 0.60), and Bartlett's test of sphericity is significant ($p<.01$). Thus, the items are appropriate for factor analysis.

5.4.2.Convergent validity:

Convergent validity means that the variables within a single factor are highly correlated. This is evident by the factor loadings**. Sufficient/significant loadings** depend on the sample size of dataset

Exploratory factor analysis for independent variables (EFA)

Exploratory Factor Analysis (EFA) is a multivariate technique for analyzing the structure of interrelationships among a large number of variables by defining sets of variables that are highly interrelated (Hair et al., 2009). These groups of variables are known as factors and are assumed to represent dimensions within the data. In this way EFA is able to determine whether the information derived from the dataset could be summarized in a smaller set of components (factors). EFA has an exploratory character because the researcher has little control over the specification of the structure (Hair et al., 2009). EFA is primarily used when the relationships between the observed and the latent variables (factors) are unknown or uncertain (Gounaris et al., 2004).

The EFA results will be confirmed through Confirmatory Factor Analysis (CFA) in the next section of the study and then the derived factors will be included in the structural model for the examination of the relationships between the Variables.

Table (5.4) EFA for KMP

Items names:	F1	F2	F3	F4
Acquisition				
in our company employees use the internet to obtain the information necessary to perform their duties				.719
our company has the ability to convert the information available from competitors to new products				.813
our company has stored information that can be converted into data that helps employees perform their tasks				.789
Sharing				
Our company provides technology systems supported by internet network			.549	
The business environment encourage the sharing of information			.825	
The company shares information with suppliers and customers			.983	
Storing				
My firm utilizes various print materials (such as newsletters, handbooks, annual reports, manuals and etc…..) to store the knowledge		.932		
My firm utilizes audios, videos to store the knowledge		.547		
My firm has good IT infrastructure to store the knowledge		.826		
The company can provide information systems for available knowledge		.732		
Application				
My firm applying experiential knowledge	.883			
My firm uses available knowledge to improve it is productivity	.902			
My firm undertakes a set of activities designed for using the available knowledge to solve new problems	.897			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.				.841
Bartlett's Test of Sphericity	Approx. Chi-Square			1146.643
	Df			78
	Sig.			.000

Variables loaded significantly on factor with Coefficient of at least 0.5, * Items deleted due to high cross loading.

5.4.3.Discriminate validity

Discriminant validity refers to the extent to which factors are distinct and uncorrelated. The rule is that variables should relate more strongly to their own factor than to another factor. Two primary methods exist for determining Discriminant validity during an (EFA). The first method is to examine the rotated component matrix instate of pattern matrix when principle component used. Variables should load significantly only on one factor. If cross loading do exist (variable loads on multiple factors) then the cross loading should differ by more than 0.2. The second method is to examine the

factor correlation matrix. The correlation between factors should not exceed 0.7 The following Table (5.5) shows the Discriminant validity.

Table (5.5) Discriminant validity of KMP

Component	1	2	3	4
1	1.000	.460	.437	.168
2	.460	1.000	.626	.358
3	.437	.626	1.000	.361
4	.168	.358	.361	1.000
Extraction Method: Principal Component Analysis. Rotation Method: Promax with Kaiser Normalization.				

5.4.4. Exploratory factor analysis for Competitive advantage

Using Maximum Likelihood., the summary of results was showed in Table (5.6) and the SPSS output attached in appendix B3. As shown in Table (5.6) below all the remaining items has more than recommended value of at least 0.45 in measure of sample adequacy (MSA) with (KMO) (above the recommended minimum level of 0.60), and Bartlett's test of sphericity is significant ($p<.01$). Thus, the items are appropriate for factor analysis.

Table (5.6) exploratory factor analysis for Competitive advantage

Items names:	**F1**	**F2**	**F3**	**F4**
my firm has low cost of production than others	.751			
my firm operates low inventory	.852			
my firm produces at maximum capacity utilization	.854			
my firm operates low overhead cost	.824			
our firm reducing the time for market acceptance of an services		.845		
our firm increasing the speed at which we respond to customer requests		.951		
our firm tracking customer trends		848		
our firm improving relationship with customers		.656		
we offer products that are very durable			.829	
Provide products compatible with customer specifications			.946	
providing short time delivery				.961
dependability delivery promise				.817
Kaiser-Meyer-Olkin Measure of Sampling Adequacy				.849
Bartlett's Test of Sphericity	Approx. Chi-Square			1425.235
	Df			66
	Sig.			000

Variables loaded significantly on factor with Coefficient of at least 0.5, * Items deleted due to high cross loading.

5.4.5.Discriminant validity for Competitive advantage

Discriminant validity refers to the extent to which factors are distinct and uncorrelated. The rule is that variables should relate more strongly to their own factor than to another factor. Two primary methods exist for determining Discriminant validity during an (EFA). The first method is to examine the rotated component matrix instate of pattern matrix when principle component used. Variables should load significantly only on one factor. If cross loading do exist (variable loads on multiple factors) then the cross loading should differ by more than 0.2. The second method is to examine the factor correlation matrix. The correlation between factors should not exceed 0.7. The following Table (5.7) shows the Discriminant validity.

Table (5.7) Discriminant validity for Competitive advantage.

Component	Cost	Flexibility	Quality	Delivery
Cost	1.000	.605	.208	.209
Flexibility	.605	1.000	.423	.413
Quality	.208	.423	1.000	.468
Delivery	.209	.413	.468	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

Source: researcher from data analysis (2018)

5.4.6.Exploratory factor analysis for Innovation capability

Using Maximum Likelihood., the summary of results was showed in Table (5.8) and the SPSS output attached in appendix B3. As shown in Table (5.8) below all the remaining items has more than recommended value of at least 0.45 in measure of sample adequacy (MSA) with (KMO) (above the recommended minimum level of 0.60), and Bartlett's test of sphericity is significant ($p<.01$). Thus, the items are appropriate for factor analysis.

Table (5.8) EFA for Innovation capability

Items names:	F1	F2
my firm continuously improves the maintenance processes	.817	
my firm improves the efficiency of the products and services that are delivered	.858	
my firm contributes to a higher degree of usage and effectiveness of the asset	.847	
In our company there is a change in the concrete aspects using modern technology	.832	
The products offered by the company are entirely new		.902
The products offered by the company are new compared to competitors		.903
The company's new products are innovative		.845
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	.818	
Bartlett's Test of Sphericity	Approx.Chi-Square 739.265 Df 21 Sig. .000	

Variables loaded significantly on factor with Coefficient of at least 0.5, * Items deleted due to high cross loading.

5.4.7.Discriminant validity for Innovation capability

Discriminate validity refers to the extent to which factors are distinct and uncorrelated. The rule is that variables should relate more strongly to their own factor than to another factor. Two primary methods exist for determining discriminate validity during an (EFA). The first method is to examine the rotated component matrix instate of pattern matrix when principle component used. Variables should load significantly only on one factor. If cross loading do exist (variable loads on multiple factors) then the cross loading should differ by more than 0.2. The second method is to examine the factor correlation matrix. The correlation between factors should not

Exceed 0.7. The following Table (5.9) shows the discriminate validity.

Table (5.9) Discriminate validity for Innovation capability

Component	1	2
1	1.000	.465
2	.465	1.000

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

5.4.8.Exploratory factor analysis for Information technology

Using Maximum Likelihood., the summary of results was showed in Table (5.10) and the SPSS output attached in appendix B3. As shown in Table (5.10) below all the remaining items has more than recommended value of at least 0.45 in measure of sample adequacy (MSA) with (KMO) (above the recommended minimum level of 0.60), and Bartlett's test of sphericity is significant ($p<.01$). Thus, the items are appropriate for factor analysis

Table (5.10) EFA for Information technology

Items		F1
My firm uses recent technology		.893
My firm uses recent technology promotes our business relation with the society		.924
IT tools in my firm are simple to use and have user friendly interface		.905
In my firm IT tools are used to support collaborative work (e.g. video conferencing systems, communication)		.889
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.782
Bartlett's Test of Sphericity	Approx. Chi-Square	655.117
	Df	6
	Sig.	.000

Variables loaded significantly on factor with Coefficient of at least 0.5, * Items deleted due to high cross loading.

5.5.Reliability

Reliability is a one of the basic psychometric requirement of scale validity. Reliability is concerned with the ability of an instrument to produce similar result, time and again under the assumption that group of respondents and prevailing conditions remain same. It reflects the degree to which an instrument is free from random error and consistently measures the underlying construct with reasonable accuracy (Churchill, 1979; Leedy and Ormrod, 2001; Yang et al., 2007; Hair at al. 2010). Internal consistency is an important aspect of reliability. It describes the extent to which the different scale items of a same construct correlate with one another. A higher degree of internal consistency, not only proves the convergence of scale items towards the common definition of underlying construct but it also affirms the claim that amount of variance captured by a scale is significantly higher to the amount of error variances i.e. random error in a scale.

Random error is assessed by squaring the inter-item correlation and subtracting the same from 1.00. As the estimate of reliability increases, the fraction of a test score that can be attributed to random error decreases.

Cronbach alpha is one of the most popular methods for assessing internal consistency (Churchill, 1979; Peter, 1981). Closer the cronbach's alpha to 1, higher the internal consistency. In general, the reliabilities less than 0.70 indicates a poor estimate of observed variance i.e. amount of error variance in the test score is relatively higher to the observed variance. In context of the present study, reliability of the various constructs has been assessed through cronbach's alpha.

The value of cronbach's alpha for all the constructs (Table 5.11) are above the threshold limit of 0.60.

Table (5.11) Reliability for Study Variables after EFA

Construct	Variable	Number of items	Cronbach's alpha
knowledge management process	Knowledge acquisition	3	**.649**
	Knowledge sharing	3	**.768**
	Knowledge storing	4	**.813**
	Knowledge application	3	**.877**
Competitive advantage	Cost	4	**.849**
	Quality	2	**.859**
	Flexibility	4	**.890**
	Delivery	2	**.780**
Innovation capability	Radical innovation	3	**.860**
	Incremental	4	**.860**
Information technology	Information technology	4	**.924**

Source: prepared from data analysis (2018)

5.5.1. Validity

The validity of the various constructs of interest has been examined by employing Campbell and Fiske criteria of validity. Campbell and Fiske (1959) proposed two aspects of construct validity: convergent and divergent validity. Convergent validity is the degree to which multiple attempts to measure the same concept are in agreement. Whereas, discriminate or divergent validity examines the extent to which the group of items representing a specific construct- differentiates that construct from another set of items - representing some other distinct construct (Bagozzi et al., 1991).

The convergent validity has often been assessed by looking at the standardized factor loadings (SFL), average variance extracted (AVE) and composite reliability (CR). SFL

reflect the amount of explained variance by an indicator in accordance to the underlying construct (Hair et al., 2008; Markus, 2012; Byrne, 2013). Loading of .5 or more confirm the convergence of scale item i.e. the indicator is strongly related with its associated construct (Bagozzi et al., 1991; Hair et al., 2008; Byrne, 2013). AVE provides the summary of overall convergence of a scale and reflects the average communality (Fornell and Larker, 1981) i.e. the variance captured by an instrument through all its items. An AVE of less than .5 indicates that, on average, more error (i.e. systematic error) remains in measure than variance explained by the latent factor structure (Hair et al., 2008), whereas a score of more than .5 affirms the higher amount of explained variance. CR indicates the internal consistency of the instrument. Any value of .70 or higher affirms high degree of internal consistency between different scale items.

Divergent validity tests whether the concepts that are supposed to be unrelated are, in fact, unrelated. It is generally examined through the comparison of the AVE score with the squared correlations of respective constructs. A lower index of shared variance (squared correlation) between each pair of constructs against the minimum of the AVEs of both of the concerned constructs affirms the divergent validity of the underlying constructs (Fornell and Larker, 1981). The logic here is based on the idea that if two or more concepts are unique, then valid measures of each should not correlate too highly (Bagozzi et al., 1991).

In context of present study, the convergent and divergent validity of different constructs have been examined during the validation of measurement models.

5.6. Confirmatory factor Analysis:

Confirmatory Factor Analysis (CFA) has been utilized to estimate measurement adequacy (Hair et al., 1998). In the context of the scale development and validation, recent literature (e.g. Rentz et al., 2002) affirms the superiority of CFA over Exploratory Factor Analysis. To assess the fit between theory and reality, CFA rather concentrating on a single index, often rely upon numerous fit indices like: Normed Chi-square index, Goodness-of-fit index (GFI), Adjusted goodness-of-fit index (AGFI), Root mean square residual (RMR) and Root mean square error of approximation (RMSEA) – as indicators of absolute fit indices (Hu and Bentler, 1995; MacCallum et al., 1996; Steiger, 2007); Comparative Fit Index (CFI), Tucker-Lewis index (TLI), and Normed fit index (NFI) – as indicators of incremental fit indices (Bentler and Bonnet, 1980; Mulaik et al, 1989; Bentler, 1990; Hu and Bentler, 1995; Kline, 2005; Tabachnick

and Fidell, 2007); Parsimony goodness-of-fit index (PGFI) and Parsimony Normed fit index (PNFI) – as indicators of parsimony fit indices. In contrast, these fit statistics are generally not available in standard methods of Exploratory Factor Analysis. A careful consideration is that assessing a measurement model through numerous fit indices is more parsimony approach than one with absolute or single criteria (Hair et al., 1998).

In the context of present study, following criteria (Table 5.12) has been adopted for the measurement and validation of various constructs:

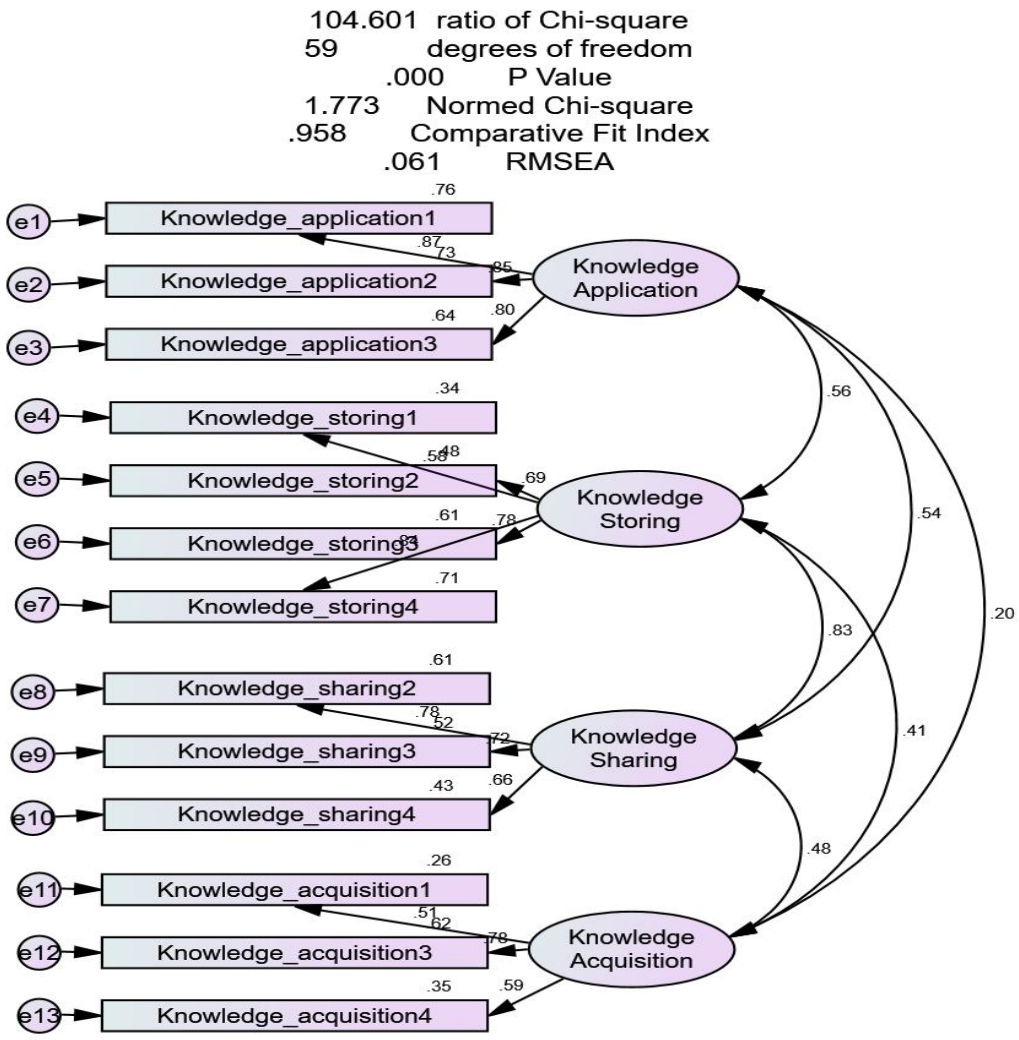
Table (5.12) Criteria

S. No.	Parameter	Criteria
1	Normed Chi-square (ratio of Chi-square to degrees of freedom)	Less than 3
2	Goodness-of-Fit Index (GFI)	At least .90
3	Adjusted Goodness-of-Fit Index (AGFI)	At least .90
4	Normed Fit Index (NFI)	At least .90
5	Comparative Fit Index (CFI)	At least .90
6	Root Mean Square Residual (RMR)	Less than .10
7	Root Mean Square Error of Approximation (RMSEA)	Less than .08
8	Standardized Residuals	Less than 2.5
9	Standardized factor loadings (SFL)	At least .50
10	Average Variance Extracted (AVE)	At least .50
11	Composite Reliability (CR)	At least .70

Source: prepared from data analysis (2018)

5.6.1.1.Measurement and Validation of knowledge management process

To assess the degree of correspondence between the manifest variables and latent construct of (KMP) a multidimensional CFA model (Figure 5.1) has been conceptualized and tested for its psychometric properties. The result of CFA show in figure (5.1) CFA OF (KMP)



Source: prepared from data analysis (2018)

Figure (5.1) CFA for knowledge management process

Figure (5.1) show Confirmatory Factor Analysis (CFA) is the next step after exploratory factor analysis to determine the factor structure of your dataset. In the EFA we explore the factor structure (how the variables relate and group based on inter-variable correlations); in the CFA we confirm the factor structure we extracted in the EFA, **the structural model of** Confirmatory Factor Analysis (CFA) **reveals the** same measures that can be calculated to determine goodness of fit show in Table **(5.13)**

Table (5.13) Model **Fit Indices for knowledge management process**

Measure	Estimate	Threshold	Interpretation
CMIN	104.601	--	--
DF	59	--	--
CMIN/DF	1.773	Between 1 and 3	Excellent
CFI	0.958	>0.95	Excellent
SRMR	0.046	<0.08	Excellent
RMSEA	0.061	<0.06	Acceptable
PClose	0.162	>0.05	Excellent

Source prepared by researcher from data (2018)

Table(5.14)Psychometric Properties of knowledge management process

	CR	AVE	MSV	Max R(H)	Knowledge application	Knowledg e storing	Knowledge sharing	Knowledge acquisition
Knowledge application	0.879	0.707	0.317	0.883	0.841			
Knowledge storing	0.817	0.533	0.687	0.844	0.563***	0.730		
Knowledge sharing	0.765	0.522	0.687	0.774	0.537***	0.829***	0.722	
Knowledge acquisition	0.665	0.407	0.233	0.713	0.198*	0.413***	0.482***	0.638

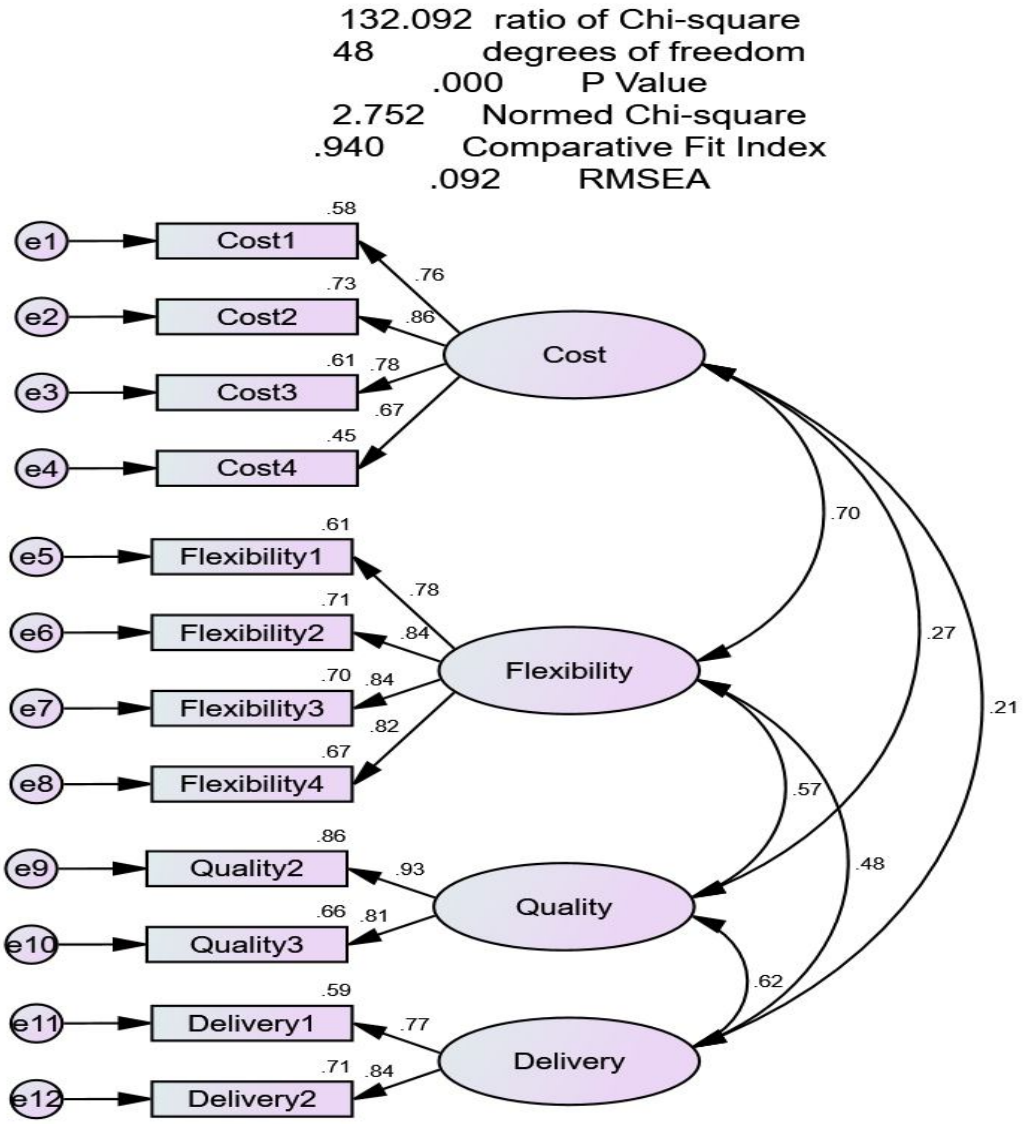
Source prepared by researcher from data (2018)

Validity Concerns

Table (5.14) show the **Discriminate Validity:** the square root of the AVE for Knowledge storing is less than its correlation with Knowledge sharing. **Reliability:** the CR for Knowledge acquisition is less than 0.70. **Convergent Validity:** the AVE for Knowledge acquisition is less than 0.50. **Discriminate Validity:** the AVE for Knowledge storing is less than the MSV. **Discriminate Validity:** the AVE for Knowledge sharing is less than the MSV.

5.6.1.2. Measurement and Validation of Competitive advantage

To assess the degree of correspondence between the manifest variables and latent construct of (CA) a multi-dimensional CFA model (Figure 5.2) has been conceptualized and tested for its psychometric properties. The result of CFA show in figure (5.2)



Source: prepared from data analysis (2018)

Figure (5.2) CFA for CA

Figure (5.2) show Confirmatory Factor Analysis (CFA) is the next step after exploratory factor analysis to determine the factor structure of your dataset. In the EFA we explore the factor structure (how the variables relate and group based on inter-variable correlations); in the CFA we confirm the factor structure we extracted in the EFA, **the structural model of** Confirmatory Factor Analysis (CFA) **reveals the** same measures that can be calculated to determine goodness of fit show in Table **(5.16)**

Table (5.15) Model **Fit Indices of Competitive advantage.**

Measure	**Estimate**	**Threshold**	**Interpretation**
CMIN	132.092	--	--
DF	48	--	--
CMIN/DF	2.752	Between 1 and 3	Excellent
CFI	0.940	>0.95	Acceptable
SRMR	0.056	<0.08	Excellent
RMSEA	0.092	<0.06	Terrible
PClose	0.000	>0.05	Terrible

Source prepared by researcher from data (2018)

Table (5.16) Psychometric Properties of Competitive advantage

	CR	AVE	MSV	MaxR(H)	Cost	Flexibility	Quality	Delivery
Cost	0.852	0.592	0.493	0.866	**0.769**			
Flexibility	0.892	0.674	0.493	0.894	0.702***	**0.821**		
Quality	0.863	0.760	0.380	0.888	0.273**	0.575***	**0.872**	
Delivery	0.785	0.646	0.380	0.792	0.215*	0.483***	0.616***	**0.804**

Source: prepared from data analysis (2018)

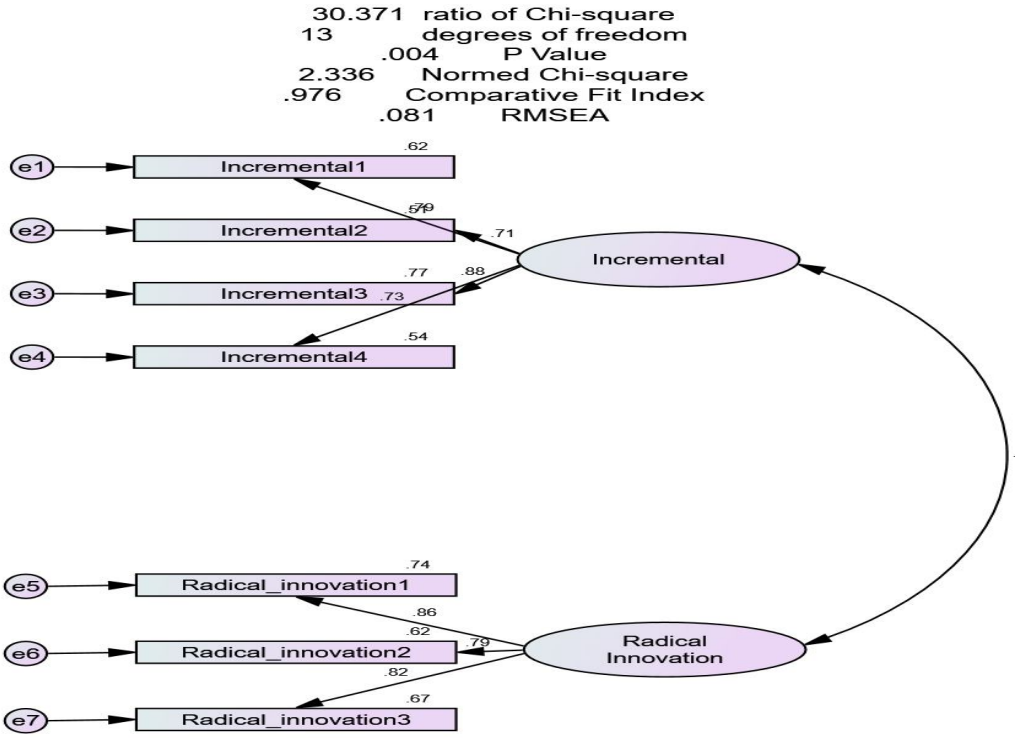
References Significance of Correlations: † p < 0.100 * p < 0.050 ** p < 0.010 *** p < 0.001

Validity Concerns

No validity concerns here.

5.6.1.3.Measurement and Validation of Innovation capability

To assess the degree of correspondence between the manifest variables and latent construct of (INC) a uni-dimensional CFA model (Figure 5.3) has been conceptualized and tested for its psychometric properties. The result of CFA show in figure (5.3)



Source: prepared from data analysis (2018)

Figure (5.3) CFA for Innovation capability

Figure (5.3) show Confirmatory Factor Analysis (CFA) is the next step after exploratory factor analysis to determine the factor structure of your dataset. In the EFA we explore the factor structure (how the variables relate and group based on inter-variable correlations); in the CFA we confirm the factor structure we extracted in the EFA, **the structural model of** Confirmatory Factor Analysis (CFA) **reveals the** same measures that can be calculated to determine goodness of fit show in Table **(5.18)**

Table (5.17) **Model Fit Indices of Innovation capability**

Measure	Estimate	Threshold	Interpretation
CMIN	30.371	--	--
DF	13	--	--
CMIN/DF	2.336	Between 1 and 3	Excellent
CFI	0.976	>0.95	Excellent
SRMR	0.036	<0.08	Excellent
RMSEA	0.081	<0.06	Terrible
PClose	0.083	>0.05	Excellent

Source: prepared from data analysis (2018)

Table (5.18) Psychometric Properties of Innovation capability

	CR	AVE	MaxR(H)	Incremental	Radical innovation
Incremental	0.862	0.611	0.879	0.553	
Radical innovation	0.861	0.675	0.865		0.822

Source: prepared from data analysis (2018)

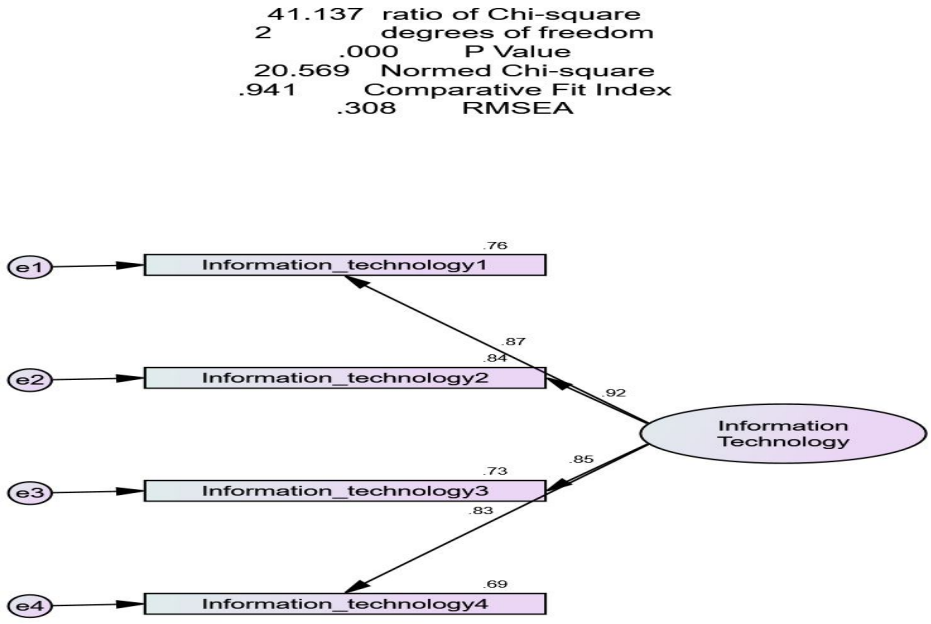
References Significance of Correlations: † p < 0.100 * p < 0.050 ** p < 0.010 *** p < 0.001

Validity Concerns

No validity concerns here.

5.6.1.4.Measurement and Validation of Information technology

To assess the degree of correspondence between the manifest variables and latent construct of (IT) a uni-dimensional CFA model (Figure 5.4) has been conceptualized and tested for its psychometric properties. The result of CFA show in Table (5.20)



Source: prepared from data analysis (2018)

Figure (5.4) CFA for IT

Figure (5.4) show Confirmatory Factor Analysis (CFA) is the next step after exploratory factor analysis to determine the factor structure of your dataset, In the EFA we explore the factor structure (how the variables relate and group based on inter-variable correlations); in the CFA we confirm the factor structure we extracted in the EFA, **the structural model of** Confirmatory Factor Analysis (CFA) **reveals the** same measures that can be calculated to determine goodness of fit show in Table **(5.20)**

Table (5.19) Model Fit Indices of Information technology

Measure	Estimate	Threshold	Interpretation
CMIN	41.137	--	--
DF	2	--	--
CMIN/DF	20.569	Between 1 and 3	Terrible
CFI	0.941	>0.95	Acceptable
SRMR	0.045	<0.08	Excellent
RMSEA	0.308	<0.06	Terrible
PClose	0.000	>0.05	Terrible

Source prepared by researcher from data (2018)

Table (5.20) Psychometric Properties of Information technology

	CR	AVE	MaxR(H)	Information technology
Information technology	0.924	0.753	0.930	

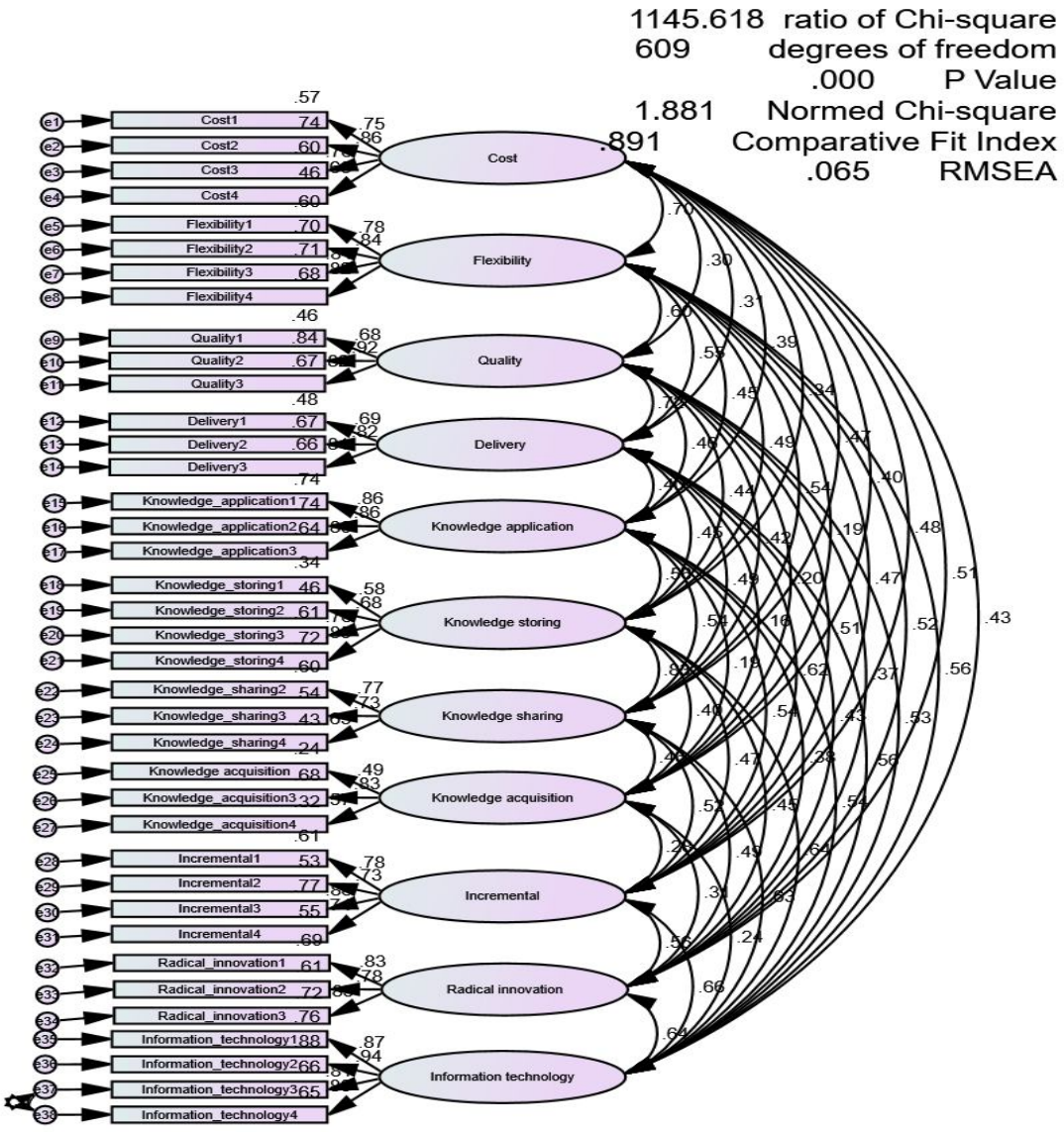
Source: prepared from data analysis (2018)

You only had one latent variable so there is no correlation matrix or MSV.

No validity concerns here.

5.7.Measurement and Validation of model

To assess the degree of correspondence between the manifest variables and latent construct of (***variables***) a uni-dimensional CFA model (Figure 5.5) has been conceptualized and tested for its psychometric properties. The result of CFA show in Table (5.21)



Source: prepared from data analysis (2018)

Figure (5.5) confirmatory factor of all variables

Figure (5.5) show Confirmatory Factor Analysis (CFA) is the next step after exploratory factor analysis to determine the factor structure of your dataset. In the EFA we explore the factor structure (how the variables relate and group based on inter-variable correlations); in the CFA we confirm the factor structure we extracted in the EFA, **the structural model of** Confirmatory Factor Analysis (CFA) **reveals the** same measures that can be calculated to determine goodness of fit show in Table **(5.21)**

Table (5.21) Model Fit Indices of model

Measure	Estimate	Threshold	Interpretation
CMIN	1145.618	--	--
DF	609	--	--
CMIN/DF	1.881	Between 1 and 3	Excellent
CFI	0.891	>0.95	Need More DF
SRMR	0.054	<0.08	Excellent
RMSEA	0.065	<0.06	Acceptable
PClose	0.000	>0.05	Terrible

Source prepared by researcher from data (2018)

5.7.1. Descriptive Statistics

In this section descriptive statistics such as mean and standard deviation was used to describe the characteristics of all variables (Independent, dependent and moderators and mediator) under study.

5.7.1.1. Descriptive analysis of knowledge management processes

Table (5.22) shows the means and standard deviations of the four components of knowledge management processes, knowledge acquisition, knowledge sharing, knowledge storing and knowledge application. The table reveals that the industrial firms in Sudan emphasized more on knowledge storing (means=4.18, standard deviation=1.097), followed by knowledge application (means= 4.17, standard deviation =.88), followed by knowledge acquisition (means =4.13, standard deviation=.926) and knowledge sharing (means=3.87, standard deviation=0.998).

Given that the scale used a 5-point scale (1= strongly disagree, 5= strong agree) it can be concluded that industrial firms operating in Sudan are to some extend highly of knowledge storing, while above average on responsiveness.

Table (5.22) Descriptive Statistics for knowledge management process

Items	Mean	Std. Deviation
Knowledge acquisition		
in our company employees use the internet to obtain the information necessary to perform their duties	4.21	.910
our company has the ability to convert the information available from competitors to new products	4.02	.958
our company has stored information that can be converted into data that helps employees perform their tasks	4.15 **4.13**	.911 **.926**
Knowledge sharing		
Our company provides technology systems supported by internet network	4.01	1.005
The business environment encourage the sharing of information	3.91	.972
The company shares information with suppliers and customers	3.68 **3.87**	1.018 **0.998**
Knowledge storing		
My firm utilizes various print materials (such as newsletters, handbooks, annual reports, manuals and etc…..) to store the knowledge	4.07	1.052
My firm utilizes audios, videos to store the knowledge	3.59	1.119
My firm has good IT infrastructure to store the knowledge	3.76	1.115
The company can provide information systems for available knowledge	3.98 **4.18**	1.059 **1.097**
Knowledge application		
My firm applying experiential knowledge	4.27	.844
My firm uses available knowledge to improve it is productivity	4.19	.877
My firm undertakes a set of activities designed for using the available knowledge to solve new problems	4.07 **4.17**	.917 **.88**

Note: All variables used a 5-point likert scale (1= strongly disagree, 5= strongly agree)

5.7.1.2. Descriptive Statistics for competitive advantage

Table (5.23) shows the means and standard deviations of the four components of competitive advantage, cost, flexibility, quality and delivery. The table reveals that the industrial firms operating in Sudan emphasized more on response in quality (means=4.02, standard deviation=1.018), followed by cost (means=3.98,standard deviation=.962), flexibility (means=3.92, standard deviation=1.01) and delivery (means=3.88, standard deviation=1.006),given that the scale used 5-point scale (1=

strongly disagree, 5=strongly agree), therefore the Sudanese manufacturing firms are highly responding to response, and quality.

Table(5.23) Descriptive Statistics for Competitive advantage		
Cost	Mean	Std. Deviation
my firm has low cost of production than others	4.09	.951
my firm operates low inventory	3.95	.991
my firm produces at maximum capacity utilization	3.90	.966
my firm operates low overhead cost	3.98	.942
	3.98	**.962**
Flexibility		
our firm reducing the time for market acceptance of an services	3.98	.968
our firm increasing the speed at which we respond to customer requests	3.98	.965
our firm tracking customer trends	3.95	1.025
our firm improving relationship with customers	3.78	1.082
	3.92	**1.01**
Quality		
we offer products that are very durable	4.04	.992
Provide products compatible with customer specifications	4.00	1.045
	4.02	**1.018**
Delivery		
providing short time delivery	3.80	1.063
dependability delivery promise	3.86	.944
delivery accuracy	4.00	1.012
Valid N (list wise)	**3.88**	**1.006**

Source: prepared by researcher (2018)

5.7.1.3. Descriptive Statistics for innovation capability

Table (5.24) shows the means and standard deviations of the two components of innovation capability (radical innovation and incremental innovation) the table reveals that the industrial firms operating in Sudan are emphasized more response on incremental innovation (means=3.74, standard deviation=1.111) followed by radical innovation (means=**4.073**, standard deviation=**.913**) given that the scale used 5-point scale (1= strongly disagree, 5=strongly agree), the manufacturing firms operating in Sudan are highly response rate on radical innovation.

Table (5.24) Descriptive Statistics for Innovation capability		
Radical innovation	Mean	Std. Deviation
my firm continuously improves the maintenance processes	4.15	.906
my firm improves the efficiency of the products and services that are delivered	4.14	.791
my firm contributes to a higher degree of usage and effectiveness of the asset	4.00	.995
In our company there is a change in the concrete aspects using modern technology	4.00	.958
	4.073	**.913**
Incremental		
The products offered by the company are entirely new	3.71	1.132
The products offered by the company are new compared to competitors	3.78	1.036
The company's new products are innovative	3.72	1.165
	3.74	**1.111**

Source: prepared by researcher (2018)

5.7.1.4. Descriptive Statistics of information technology

Table (5.25) shows the means and standard deviation of information technology (means=3.92, standard deviation=1.054) given that the scale used 5-point scale (1= strongly disagree, 5=strongly agree),

Table (5.25) Descriptive Statistics for I T

Items	**Mean**	Std. Deviation
My firm uses recent technology	3.96	1.047
My firm uses recent technology promotes our business relation with the society	3.84	1.098
IT tools in my firm are simple to use and have user friendly interface	3.97	1.026
In my firm IT tools are used to support collaborative work (e.g. video conferencing systems, communication)	3.92	1.045
	3.92	**1.054**

Source: prepared by researcher (2018)

5.8. Model Fit and hypotheses testing

The fit index statistic tests the consistency between the predicted and observed data matrix by the equation (Keith, T, 2006). One of the differences that exist between the SEM technique and regression method is that the former one does not have any single statistical test applicable for evaluation of model predictions "strength" (Hair, J.F., et al, 1988). In this regard, Kline (Kline, R.B, 1988) believed that there are "dozens of fit indexes described in SEM literature, more than any single model-fitting program reports". However, according to Hair, Black (Hair, J.F., et al,1988) and Garson (Garson, G.D, et al 2007), the chi-square fit index, also known as chi-square discrepancy test, is considered as the most fundamental and common overall fit measure. Thus, in a good model fit the value of chi-square should not be very significant, i.e., $p>0.05$ (Hair, J.F., et al,1988). However, one problem usually experienced through this test relates to the rejection probability of the model having direct interaction with the sample size. Moreover, the sensitivity level of chi-square fit index is very high, especially, towards the multivariate normality assumption violations (Garson, G.D, et al 2007).

Many indexes have been introduced and developed to avert or reduce the problems related to the chi-square fit index. Some of the indexes included in the absolute fit indexes are as follows:

5.8.1. Normal Chi-Square Fit Index" (CMIN/DF

Normal chi-square fit index, $\chi 2/df$, serves to adjust the testing of chi-square according to the sample size (Byrne, B.M 2007**).** A number of researchers take 5 as an adequate fit value, while more conservative researchers believe that chi-square values larger than 2 or 3 are not acceptable (Garson, G.D, et al 2007**).**

5.8.2."Goodness-of-Fit Index":

GFI is utilized for gauging the discrepancy level between the estimated or predicted covariance and resulted or observed ones (Jöreskog, K.G, 1993**).**

$$GFI = 1 - [\, max[(\chi 2 - df)/n\,, 0/\, max[(\chi null\, 2 - df null)/n\,, 0]\,]$$

The allowable range for GFI is between 0 and 1, where 1 indicates a perfect fit, which demonstrates that measures equal to or larger than 0.90 signify a 'good' fit **(**Garson, G.D, et al 2007**).**

5.8.3. Adjusted Goodness-of-Fit Index"(AGFI) (Jöreskog, K.G., 1993):

AGFI is utilized for adjustment of the GFI relating the complexity of the model.

$$AGFI = 1 - [(1 - GFI)\ dnull/\ ]$$

The measuring of AGFI is between 0 and 1, in which 1 or over 1 (AGFI>1.0) signifies a perfect fit, nevertheless, it cannot be bounded below 0, i.e., (AGFI<0). As in the case of GFI, AGFI values equal to or bigger than 0.90 signify a 'good' fit **(**Garson, G.D, et al 2007**).**

5.8.4."Root Mean Square Error of Approximation" (RMSEA) **(**Steiger, J.H 1990**):**

RMSEA is employed to gauge the approximation error in the population.

$$RMSEA = [\ (\chi 2 - df)/\ (n - 1)df]\ 1/2$$

In cases where the RMSEA value is small, the approximation is believed to be optimal. An approximately 0.05 or smaller value of RMSEA means a more appropriate and closer model fit in connection with the degrees of freedom. Nevertheless, between 0.05 and 0.08 displays the most preferable status and the more optimal fit results **(**Browne, M.W. and R. Cudeck 1970**).**

In addition, the following indexes are also included in the incremental fit measures:

5.8.5."Normed Fit Index or Bentler Bonett Index" **(NFI):**

Normed Fit Index or Bentler Bonett Index or NFI is applicable to contrast and compare the fit ofa suggested model against a null model **(**Bentler, P.M. and D.G. Bonett, 1980**).**

$$NFI = [\chi\ 2/(NullModel)\ \chi\ 2//df(ProposedModel)\ /\ [\chi\ 2/df(NullModel) - \mathbf{1}]$$

This index defines all the observed variables as uncorrelated. The values of NFI range between 0 and 1, where 0.90 signifies an optimal fit **(**Garson, G.D, et al 2007**).**

5.8.6."Tucker Lewis Index or Non-Normed Fit Index" **(TLI or NNFI):**

The TLI or NNFI index is used to gauge parsimony, which is applicable through the evaluation and assessment of the degrees of freedom of the suggested model to the degrees of freedom of the null model **(**Bentler, P.M. and D.G. Bonett, 1980**).**

$$NFI = [\chi 2/(NullModel)\ \chi 2//df(ProposedModel) / [\chi 2/df(NullModel) - 1]$$

However, it is not certain whether TLI can vary from 0 to 1. A fit of model is required to possess TLI that is larger than 0.90 **(**Bentler, P.M. and D.G. Bonett, 1980, Tucker, L.R. and C. Lewis 1970**).**

5.8.7."*Comparative Fit Index" (*CFI) *(Bentler, P.M.,1998):*

CFI is not only less affected by the sample size, but also based on comparison of the hypothesized model to the null model **(**Kline, R.B, 1998**).**

$$CFI = 1 - [\max [(\chi 2 - df), 0] \max [(\chi 2 - df), (\chi null\ 2 - dfnull), 0]]$$

The values of CFI range between 0 and 1. However, its values need to be a minimum of 0.90 to be usable for a model fit **(**Garson, G.D, et al 2007**).**

5.9. Correlation Analysis

Table (5.26) presents the results of the inter correlation among the variables. The correlation analysis was conducted to see the initial picture of the interrelationships among the variables under the study. Therefore, the importance of conducting correlation analysis is to identify any potential problems associated with multi collinearity (Sekaran, 2000). Table 5.26 represents the correlation matrix for the constructs operational zed in this study. These bivariate correlations allow for preliminary inspection and information regarding hypothesized relationships. In addition to that, correlation matrix gives information regarding test for the presence of multicollinearity. The table shows that no correlations near 1.0 (or approaching 0.8 or 0.9) were detected, which indicate that multicollinearity is not a significant problem in this particular data set.

Table (5.26) Person's correlation coefficient for all variables

	1	2	3	4	5	6	7	8	9	10	11
1.Cost	1										
2.flexibility	.702	1									
3.quality	.302	.600	1								
4.delivery	.310	.547	.723	1							
5.application	.386	.445	.459	.401	1						
6.storing	.345	.490	.439	.454	.561	1					
7.Sharing	.467	.540	.423	.486	.539	.826	1				
8.Acquisition	.402	.190	.199	.161	.193	.399	.460	1			
9.incremental	.482	.469	.508	.622	.538	.469	.520	.277	1		
10.Radical	.510	.519	.367	.434	.378	.448	.491	.314	.557	1	
11.Information technology	.435	.558	.530	.563	.545	.641	.630	.235	.659	.639	1

Source: prepared by researcher from data (2018)

As shown in table (5.27) above the correlation analysis provides strong indicators of associations, thus for more examination of the proposed relationships path analysis through structural equation model (SEM) was conducted to gives the best predictive model of the relationship present among the independent variables. In the following are hypotheses testing the last part of data analysis and findings.

5.9.1. Hypotheses Testing

This section discusses the results of hypotheses of the study. The hypotheses were tested with the path analysis that discloses the effect of independent variables on dependent variables and the effect of mediator and moderator in relationships between variables through the structural equation modelling (SEM) that grows out of and serves purposes similar to multiple regressions, but in more powerful way which takes in account the modelling of interactions between variables, nonlinearities, correlated independents, measurement error, correlated error terms,

multiple latent independents each measured by multiple indicators, and one or more latent dependents also each with multiple indicators (Gaskin, 2016),SEM may be used as a more powerful alternative to multiple regression, path analysis, factor analysis, time series analysis, and analysis of covariance. That is, these procedures may be seen as special cases of SEM, or, to put it another way, SEM is an extension of the general linear model (GLM) of which multiple regression is a part. Given that the variables appeared in confirmatory factor analysis encompasses 35 hypotheses in this study. The main effects as well as the mediating effect were examined using path analysis, the statistical procedures of which had been explained in chapter 3 In order to perform path analysis, it is generally agreed that there are at least the assumptions of model fit should be met. It's given that the model fit was done in (CFA), however the need to do it again in structural model is important in order to demonstrate sufficient exploration of alternative models (Gaskin, 2016). Every time the model changes and a hypothesis are tested, model fit must be assessed. Thus the Absolute fit indices and Incremental fit indices assumptions are provided below:

5.9.1.1.Relationship between knowledge management process (Multi-dimensional) and Competitive advantage (Multi-dimensional)

To assess the impact of knowledge management process, such as acquisition, sharing, storing and application on Competitive advantage such as cost, quality, delivery and flexibility, structural equation modelling has been employed and a measurement model of these constructs has been assessed. Figure (5.6) reveals that reflective indicators have been used for the measurement of latent constructs and non-causal relationship has been studied among different constructs, by drawing path.

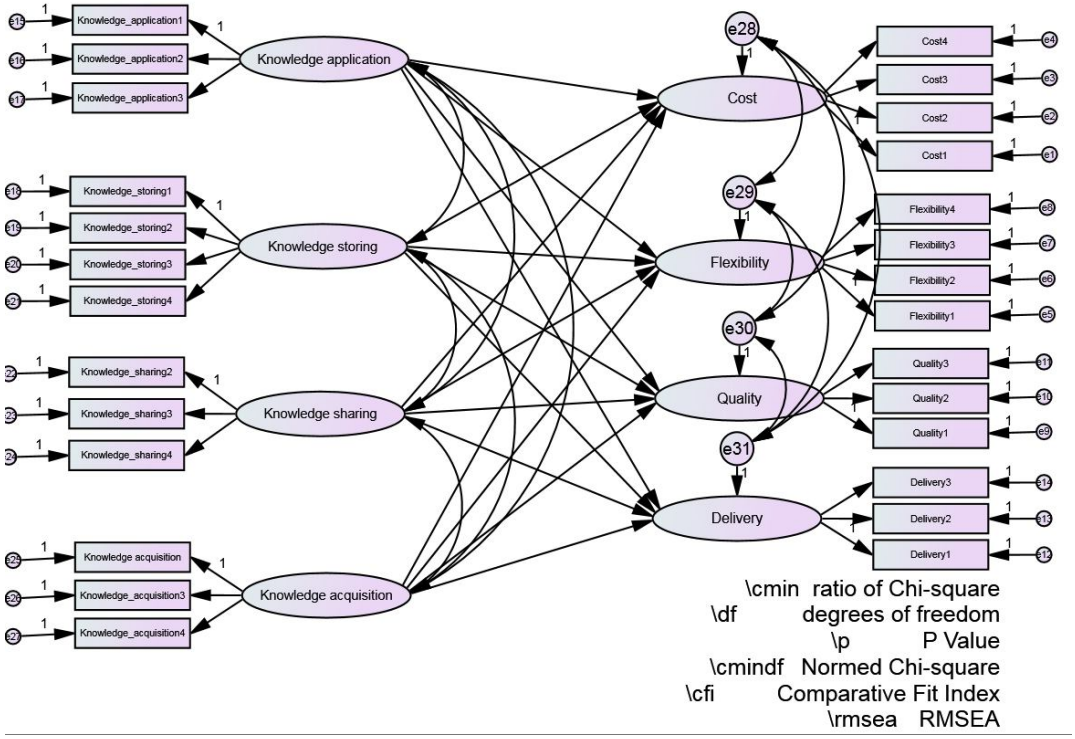


Figure (5.6) relationship between KM and CA

The structural model reveals the same value of model fit shown in Table (5.27), all the model fit indices for the structural model were not only significant but remain same as in the measurement model. The low index of R square (i.e. 0.37, 33, 26, 27) justifies the underlying theoretical model, the model fit of model show in the next table

Table (5.27) model fit of KM and CA

Measure	Estimate	Threshold	Interpretation
CMIN	568.207	--	--
DF	296	--	--
CMIN/DF	1.920	Between 1 and 3	Excellent
CFI	0.909	>0.95	Acceptable
SRMR	0.055	<0.08	Excellent
RMSEA	0.067	<0.06	Acceptable
PClose	0.001	>0.05	Terrible

Source: prepared from data analysis (2018)

The standardized regression weights are used since they allow the researcher to compare directly the relative effect of each independent variable on the dependent variable (Hair, Black, Babin, Anderson and Tatham 2006). The Table 5.28 presents the standardized regression estimates and allowed us to examine the direct association between the study constructs.

Table (5.28) Regression Weights of KM and CA

			Estimate	S.E.	C.R.	P	Results
Cost	<---	Knowledge application	.244	.094	2.589	.010	Supported
Cost	<---	Knowledge storing	-.271	.219	-1.23	.216	Not support
Cost	<---	Knowledge sharing	.375	.187	2.002	.045	Supported
Cost	<---	Knowledge acquisition	.427	.167	2.554	.011	Supported
Flexibility	<---	Knowledge application	.207	.093	2.224	.026	Supported
Flexibility	←-	Knowledge storing	.082	.213	.385	.700	Not support
Flexibility	<---	Knowledge sharing	.392	.185	2.118	.034	Supported
Flexibility	<---	Knowledge acquisition	-.108	.154	-.705	.481	Not support
Quality	<---	Knowledge application	.270	.085	3.161	.002	Supported
Quality	<---	Knowledge storing	.182	.189	.963	.336	Not supported
Quality	←-	Knowledge sharing	.093	.159	.581	.561	Not supported
Quality	←-	Knowledge acquisition	.035	.136	.260	.795	Not supported
Delivery	←-	Knowledge application	.175	.099	1.766	.077	Not supported
Delivery	←-	Knowledge storing	.133	.226	.590	.555	Not supported
Delivery	←-	Knowledge sharing	.321	.195	1.647	.099	Not supported
Delivery	<---	Knowledge acquisition	-.119	.164	-.728	.466	Not supported

Source prepared by researcher from data (2018)

Table (5.28) show the probability of getting a critical ratio as large as 2.589 in absolute value is .010. In other words, the regression weight for Knowledge application in the prediction of Cost is significantly different from zero at the 0.01 level.

The probability of getting a critical ratio as large as 1.236 in absolute value is .216 In other words, the regression weight for Knowledge storing in the prediction of Cost is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 2.002 in absolute value is .045. In other words, the regression weight for Knowledge sharing in the prediction of Cost is significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 2.554 in absolute value is .011. In other words, the regression weight for Knowledge acquisition in the prediction of Cost is significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 2.224 in absolute value is .026. In other words, the regression weight for Knowledge application in the prediction of Flexibility is significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.385 in absolute value is .700 In other words, the regression weight for Knowledge storing in the prediction of Flexibility is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 2.118 in absolute value is .034. In other words, the regression weight for Knowledge sharing in the prediction of Flexibility is significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.705 in absolute value is .481 In other words, the regression weight for Knowledge acquisition in the prediction of Flexibility is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 3.161 in absolute value is .002. In other words, the regression weight for Knowledge application in the prediction of Quality is significantly different from zero at the 0.01 level

The probability of getting a critical ratio as large as 0.963 in absolute value is .336, In other words, the regression weight for Knowledge storing in the prediction of Quality is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.581 in absolute value is .561, In other words, the regression weight for Knowledge sharing in the prediction of Quality is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.26 in absolute value is .795, In other words, the regression weight for Knowledge acquisition in the prediction of Quality is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 1.766 in absolute value is .077, In other words, the regression weight for Knowledge application in the prediction of Delivery is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.59 in absolute value is .555, In other words, the regression weight for Knowledge storing in the prediction of Delivery is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 1.647 in absolute value is .099, In other words, the regression weight for Knowledge sharing in the prediction of Delivery is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.728 in absolute value is .466, In other words, the regression weight for Knowledge acquisition in the prediction of Delivery is not significantly different from zero at the 0.05 level.

Table (5.29) Summary of hypotheses testing results for the relationship between KM and CA

Items		Statement of hypotheses: there is a positive relationship between,	Remark
H1		Knowledge management and competitive advantage	Partially supported
H1.1	H1.a	Knowledge application and cost	Supported
	H1.b	Knowledge storing and cost	Not supported
	H1.c	Knowledge sharing and cost	Supported
	H1.d	Knowledge acquisition and cost	Supported
H1.2	H1.2a	Knowledge application and flexibility	Supported
	H1.2b	Knowledge storing and flexibility	Not supported
	H1.2c	Knowledge sharing and flexibility	Supported
	H1.2d	Knowledge acquisition and flexibility	Not supported
H1.3	H1.3a	Knowledge application and quality	Supported
	H1.3b	Knowledge storing and quality	Not supported
	H1.3c	Knowledge sharing and quality	Not supported
	H1.3d	Knowledge acquisition and quality	Not supported
H1.4	H1.4a	Knowledge application and delivery	Not supported
	H1.4b	Knowledge storing and delivery	Not supported
	H1.4c	Knowledge sharing and delivery	Not supported
	H1.4d	Knowledge acquisition and delivery	Not supported

Source: prepared by researcher from data (2018)

5.9.1.2.Relationship between knowledge management process (Multi-dimensional) and innovation capabilities (Multi-dimensional)

To assess the impact of knowledge management process, such as acquisition, sharing, storing and application on innovation capabilities such as radical, and incremental, structural equation modelling has been employed and a measurement model of these constructs has been assessed. Figure (5.7) reveals that reflective indicators have been used for the measurement of latent constructs and non-causal relationship has been studied among different constructs, by drawing path.

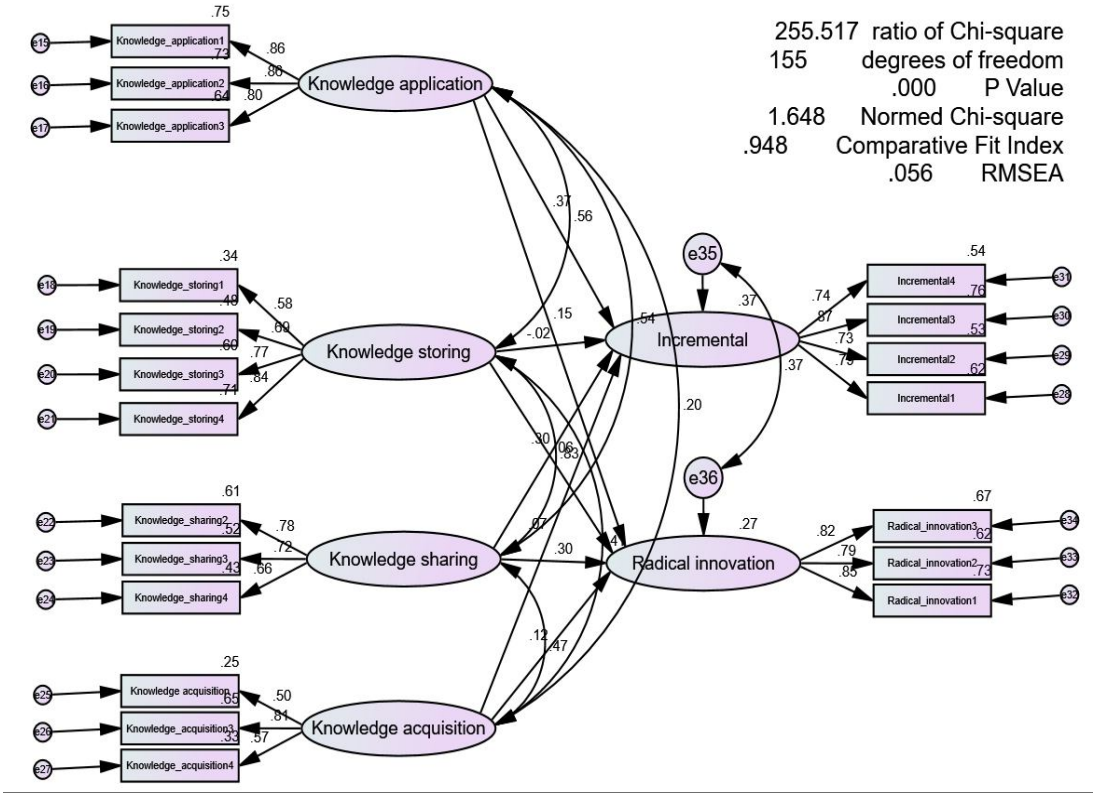


Figure (5.7) relationship between KM and INC

The structural model reveals the same value of model fit shown in Table(5.30), all the model fit indices for the structural model were not only significant but remain same as in the measurement model. The low index of R square (i.e. 0.37, 33, 26, 27) justifies the underlying theoretical model, the model fit of model show in the next table

Table (5.30) model fit of KM and innovation capabilities

Measure	Estimate	Threshold	Interpretation
CMIN	255.517	--	--
DF	155	--	--
CMIN/DF	1.648	Between 1 and 3	Excellent
CFI	0.948	>0.95	Acceptable
SRMR	0.048	<0.08	Excellent
RMSEA	0.056	<0.06	Excellent
PClose	0.202	>0.05	Excellent

Source: prepared by researcher from data (2018)

The standardized regression weights are used since they allow the researcher to compare directly the relative effect of each independent variable on the dependent variable (Hair, Black, Babin, Anderson and Tatham 2006).

The Table (5.31) presents the standardized regression estimates and allowed us to examine the direct association between the studies Constructs

Table (5.31) Regression Weights: of KM and innovation capabilities

			Estimate	S.E.	C.R.	P
Incremental	<---	Knowledge application	.364	.089	4.082	***
Incremental	<---	Knowledge storing	-.025	.202	-.122	.903
Incremental	<---	Knowledge sharing	.276	.171	1.611	.107
Incremental	<---	Knowledge acquisition	.115	.142	.808	.419
Radical innovation	<---	Knowledge application	.199	.124	1.608	.108
Radical innovation	<---	Knowledge storing	.099	.290	.340	.734
Radical innovation	<---	Knowledge sharing	.367	.245	1.501	.133
Radical innovation	<---	Knowledge acquisition	.259	.206	1.257	.209

Source: prepared by researcher from data (2018)

The probability of getting a critical ratio as large as 4.082 in absolute value is less than 0.001. In other words, the regression weight for Knowledge application in the prediction of Incremental is significantly different from zero at the 0.001 level

The probability of getting a critical ratio as large as 0.122 in absolute value is .903, In other words, the regression weight for Knowledge storing in the prediction of Incremental is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 1.611 in absolute value is .107, In other words, the regression weight for Knowledge sharing in the prediction of Incremental is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.808 in absolute value is .419, In other words, the regression weight for Knowledge acquisition in the prediction of Incremental is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 1.608 in absolute value is .108, In other words, the regression weight for Knowledge application in the prediction of Radical innovation is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 0.34 in absolute value is .734, In other words, the regression weight for Knowledge storing in the prediction of Radical innovation is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 1.501 in absolute value is .133, In other words, the regression weight for Knowledge sharing in the prediction of Radical innovation is not significantly different from zero at the 0.05 level

The probability of getting a critical ratio as large as 1.257 in absolute value is .209, In other words, the regression weight for Knowledge acquisition in the prediction of Radical innovation is not significantly different from zero at the 0.05 level

Table (5.32) Summary of hypotheses testing results for the relationship between KM and innovation

Items		Statement of hypotheses: there is a positive relationship between,	Remark
H2		Knowledge management process and innovation capabilities	Partially supported
H2.1	H1.1a	Knowledge application and incremental innovation	Supported
	H1.1b	Knowledge storing and incremental innovation	Not supported
	H1.1c	Knowledge sharing and incremental innovation	Not supported
	H1.1d	Knowledge acquisition and incremental innovation	Not supported
H2.2	H2.2a	Knowledge application and radical innovation	Not supported
	H2.2b	Knowledge storing and radical innovation	Not supported
	H2.2c	Knowledge sharing and radical innovation	Not supported
	H2.2d	Knowledge acquisition and radical innovation	Not supported

Source: prepared by researcher from data (2018)

5.9.1.3.Relationship between innovation capabilities (Multi-dimensional) and Competitive advantage (Multi-dimensional)

To assess the impact of innovation capabilities, such as incremental and radical on Competitive advantage such as cost, quality, delivery and flexibility, structural equation modelling has been employed and a measurement model of these constructs has been assessed. Figure (5.8) reveals that reflective indicators have been used for the measurement of latent constructs and non-causal relationship has been studied among different constructs, by drawing path.

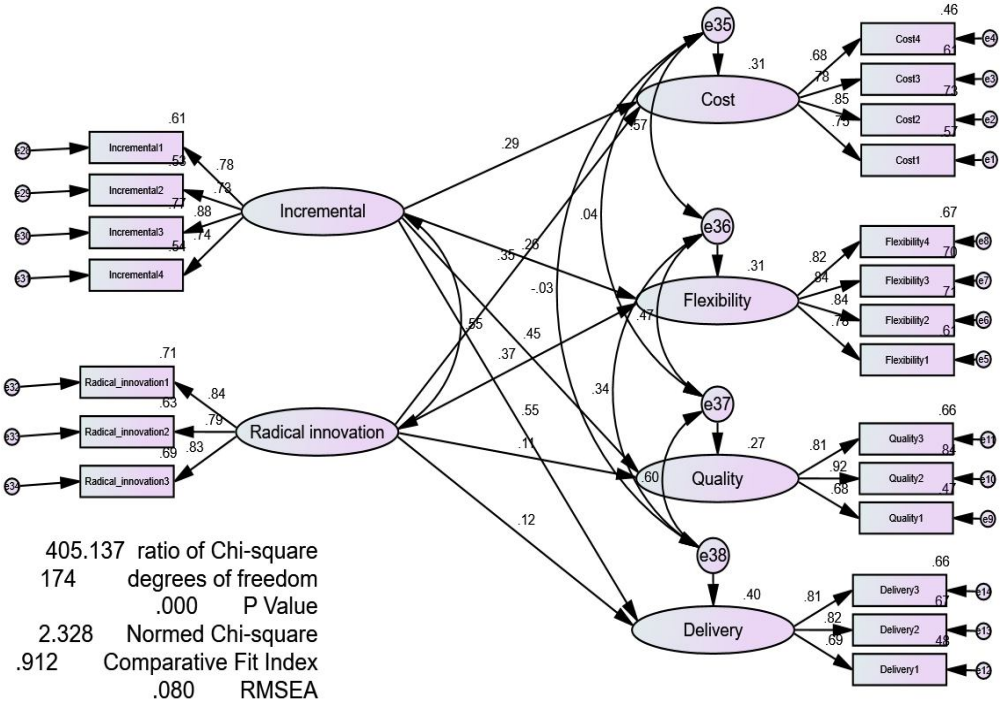


Figure (5.8) relationship between IN and CA

The structural model reveals the same value of model fit shown in Table(5.33) , all the model fit indices for the structural model were not only significant but remain same as in the measurement model. The low index of R square (i.e. 0.37, 33, 26, 27) justifies the underlying theoretical model, the model fit of model show in the next table

Table (5.33) model fit for innovation capabilities and CA

Measure	Estimate	Threshold	Interpretation
CMIN	405.137	--	--
DF	174	--	--
CMIN/DF	2.328	Between 1 and 3	Excellent
CFI	0.912	>0.95	Acceptable
SRMR	0.064	<0.08	Excellent
RMSEA	0.080	<0.06	Terrible

Source: prepared by researcher from data (2018)

The standardized regression weights are used since they allow the researcher to compare directly the relative effect of each independent variable on the dependent variable (Hair, Black, Babin, Anderson and Tatham 2006).

The Table (5.34) presents the standardized regression estimates and allowed us to examine the direct association between the study constructs.

(5.34) Regression Weights for innovation capabilities and CA

			Estimate	S.E.	C.R.	P
Cost	<---	Incremental	.295	.093	3.175	.001
Flexibility	<---	Incremental	.281	.095	2.948	.003
Quality	<---	Incremental	.418	.092	4.529	***
Delivery	<---	Incremental	.575	.105	5.455	***
Cost	<---	Radical innovation	.261	.070	3.733	***
Flexibility	<---	Radical innovation	.294	.072	4.067	***
Quality	<---	Radical innovation	.079	.063	1.260	.208
Delivery	<---	Radical innovation	.095	.068	1.393	.164

Source: prepared by researcher from data (2018)

The probability of getting a critical ratio as large as 3.175 in absolute value is .001. In other words, the regression weight for Incremental in the prediction of Cost is significantly different from zero at the 0.001 level

The probability of getting a critical ratio as large as 2.948 in absolute value is .003. In other words, the regression weight for Incremental in the prediction of Flexibility is significantly different from zero at the 0.01 level, the probability of getting a critical ratio as large as 4.529 in absolute value is less than 0.001. In other words, the regression

weight for Incremental in the prediction of Quality is significantly different from zero at the 0.001 level, the probability of getting a critical ratio as large as 5.455 in absolute value is less than 0.001. In other words, the regression weight for Incremental in the prediction of Delivery is significantly different from zero at the 0.001 level, the probability of getting a critical ratio as large as 3.733 in absolute value is less than 0.001. In other words, the regression weight for Radical innovation in the prediction of Cost is significantly different from zero at the 0.001 level

The probability of getting a critical ratio as large as 4.067 in absolute value is less than 0.001. In other words, the regression weight for Radical innovation in the prediction of Flexibility is significantly different from zero at the 0.001 level

The probability of getting a critical ratio as large as 1.26 in absolute value is .208, In other words, the regression weight for Radical innovation in the prediction of Quality is not significantly different from zero at the 0.05 level, The probability of getting a critical ratio as large as 1.393 in absolute value is .164, In other words, the regression weight for Radical innovation in the prediction of Delivery is not significantly different from zero at the 0.05 level.

Table (5.35) Summary of hypotheses testing results for the relationship between INC and CA

Items		Statement of hypotheses: there is a positive relationship between,	Remark
H3.1		Innovation capabilities and competitive advantage	Partially supported
	H3.1a	Incremental innovation and cost	Supported
	H3.1b	Incremental innovation and flexibility	Supported
	H3.1c	Incremental innovation and quality	Supported
	H3.1d	Incremental innovation and delivery	Supported
H3.2	H3.2a	Radical innovation and cost	Supported
	H3.2b	Radical innovation and flexibility	Supported
	H3.2c	Radical innovation and quality	Not supported
	H3.2d	Radical innovation and delivery	Not supported

Source: prepared by researcher from data (2018)

5.9.1.4.The mediating role of innovation capabilities (incremental) between knowledge management process (Multi-dimensional) and Competitive advantage (Multi-dimensional)

To assess the impact of innovation capabilities such as incremental knowledge management process, such as acquisition, sharing, storing and application on Competitive advantage such as cost, quality, delivery and flexibility, structural equation modelling has been employed and a measurement model of these constructs has been assessed. Figure (5.9) reveals that reflective indicators have been used for the

measurement of latent constructs and non-causal relationship has been studied among different constructs, by drawing path.

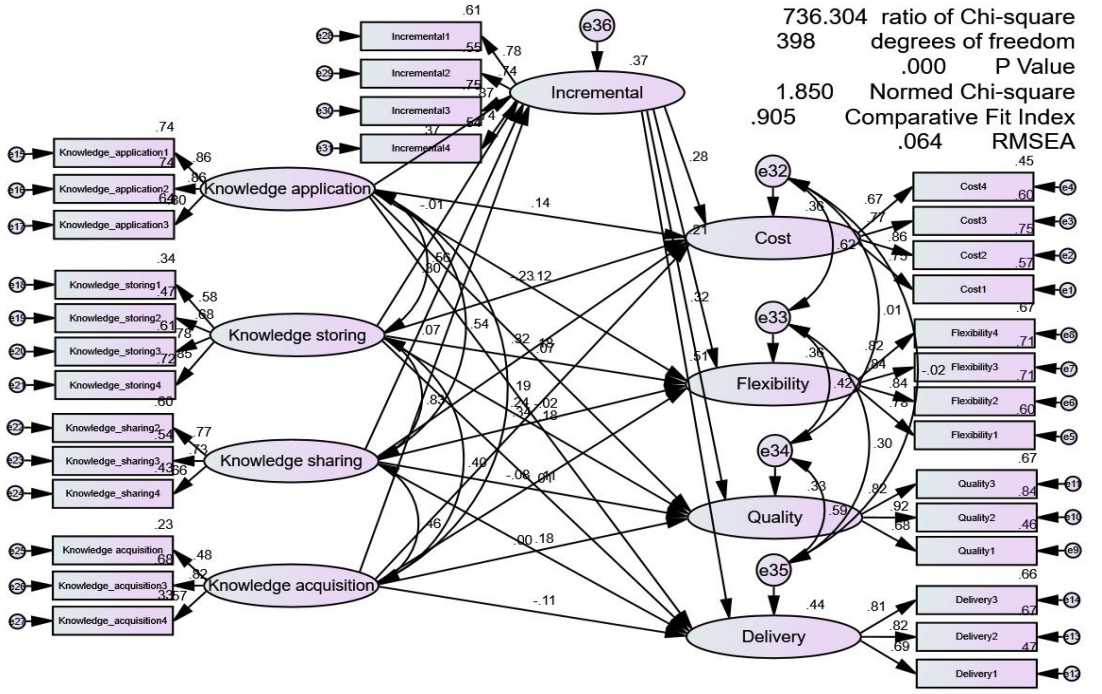


Figure (5.9) mediating role of incremental between KM and CA

The structural model reveals the same value of model fit shown in Table(5.36) , all the model fit indices for the structural model were not only significant but remain same as in the measurement model. The low index of R square (i.e. 0.37, 33, 26, 27) justifies **t**he underlying theoretical model, the model fit of model show in the next table

Table (5.36) model fit of incremental innovation between KM and CA

Measure	Estimate	Threshold	Interpretation
CMIN	736.304	--	--
DF	398	--	--
CMIN/DF	1.850	Between 1 and 3	Excellent
CFI	0.905	>0.95	Acceptable
SRMR	0.055	<0.08	Excellent
RMSEA	0.064	<0.06	Acceptable
PClose	0.001	>0.05	Terrible

The standardized regression weights are used since they allow the researcher to compare directly the relative effect of each independent variable on the dependent variable (Hair, Black, Babin, Anderson and Tatham 2010).

The Table (5.37) presents the standardized regression estimates and allowed us to examine the direct association between the study constructs.

Table (5.37) Regression Weights for incremental between KMP and CA

			Estimate	S.E.	C.R.	P
Incremental	<---	Knowledge application	.362	.089	4.079	***
Incremental	<---	Knowledge storing	-.016	.196	-.079	.937
Incremental	<---	Knowledge sharing	.272	.168	1.621	.105
Incremental	<---	Knowledge acquisition	.115	.142	.813	.416
Cost	<---	Knowledge application	.141	.097	1.449	.147
Flexibility	<---	Knowledge application	.126	.098	1.284	.199
Quality	<---	Knowledge application	.162	.087	1.857	.063
Delivery	<---	Knowledge application	-.019	.096	-.195	.846
Cost	<---	Knowledge storing	-.265	.209	-1.264	.206
Flexibility	<---	Knowledge storing	.085	.208	.409	.683
Quality	<---	Knowledge storing	.189	.183	1.033	.302
Delivery	<---	Knowledge storing	.136	.203	.670	.503
Cost	<---	Knowledge sharing	.294	.182	1.617	.106
Flexibility	<---	Knowledge sharing	.329	.183	1.794	.073
Quality	<---	Knowledge sharing	.010	.157	.064	.949
Delivery	<---	Knowledge sharing	.172	.177	.975	.330
Cost	<---	Knowledge acquisition	.394	.160	2.463	.014
Flexibility	<---	Knowledge acquisition	-.133	.151	-.882	.378
Quality	<---	Knowledge acquisition	.000	.131	.004	.997
Delivery	<---	Knowledge acquisition	-.178	.150	-1.191	.234
Cost	<---	Incremental	.286	.098	2.922	.003
Flexibility	<---	Incremental	.228	.098	2.335	.020
Quality	<---	Incremental	.302	.089	3.381	***
Delivery	<---	Incremental	.531	.107	4.980	***

Source: prepared by researcher from data (2018)

Table (5.38) Indirect Effects for incremental between KMP and CA

	Knowledge acquisition	Knowledge sharing	Knowledge storing	Knowledge application
Incremental				
Delivery	.061	.145	-.008	.192
Type of mediation	NO	NO	NO	Full Mediation
Quality	.035	.082	-.005	.109
Type of mediation	NO	NO	NO	NO
Flexibility	.026	.062	-.004	.082
Type of mediation	NO	NO	NO	NO
Cost	.033	.078	-.004	.103
Type of mediation	NO	NO	NO	Full Mediation

Source: prepared by researcher from data (2018)

Table(5.39) summarizes the results of testing hypotheses concerning the mediating effect of incremental innovation between knowledge management(KM) and competitive advantage(CA), the results of mediating role indicates four component of KM influences the competitive advantage (cost, flexibility, quality and delivery

Table (5.39) summary of hypotheses testing results for mediated effects of incremental innovation

Item		Statement of Hypothesis: There is a positive relationship between,	
H4.1	H4.1a	Incremental innovation mediate the relationship between knowledge application and cost	Not supported
	H4.1b	Incremental innovation mediate the relationship between knowledge application and flexibility	Not supported
	H4.1c	Incremental innovation mediate the relationship between knowledge application and quality	Not supported
	H41.d	Incremental innovation mediate the relationship between knowledge application and delivery	Not supported
H4.2	H4.2a	Incremental innovation mediate the relationship between knowledge storing and cost	Not supported
	H4.2b	Incremental innovation mediate the relationship between knowledge storing and flexibility	Not supported
	H4.2c	Incremental innovation mediate the relationship between knowledge storing and quality	Not supported
	H4.2d	Incremental innovation mediate the relationship between knowledge storing and delivery	Not supported
H4.3	H4.3a	Incremental innovation mediate the relationship between knowledge sharing and cost	Not supported
	H4.3b	Incremental innovation mediate the relationship between knowledge sharing and flexibility	Not supported
	H4.3c	Incremental innovation mediate the relationship between knowledge sharing and quality	Not supported
	H4.3d	Incremental innovation mediate the relationship between knowledge sharing and delivery	Not supported
H4.4	H4.4a	Incremental innovation mediate the relationship between knowledge acquisition and cost	Supported
	H4.4b	Incremental innovation mediate the relationship between knowledge acquisition and flexibility	Not supported
	H4.4c	Incremental innovation mediate the relationship between knowledge acquisition and quality	Not supported
	H4.4d	Incremental innovation mediate the relationship between knowledge acquisition and delivery	Not supported

Source: prepared by researcher from data (2018)

5.9.1.5. Radical innovation mediates the Relationship between knowledge management process (Multi-dimensional) and Competitive advantage (Multi-dimensional)

To assess the impact of radical innovation on knowledge management process, such as (acquisition, sharing, storing and application) and Competitive advantage such as cost, quality, delivery and flexibility, structural equation modelling has been employed and a measurement model of these constructs has been assessed. Figure (5.10) reveals that reflective indicators have been used for the measurement of latent constructs and non-causal relationship has been studied among different constructs, by drawing path.

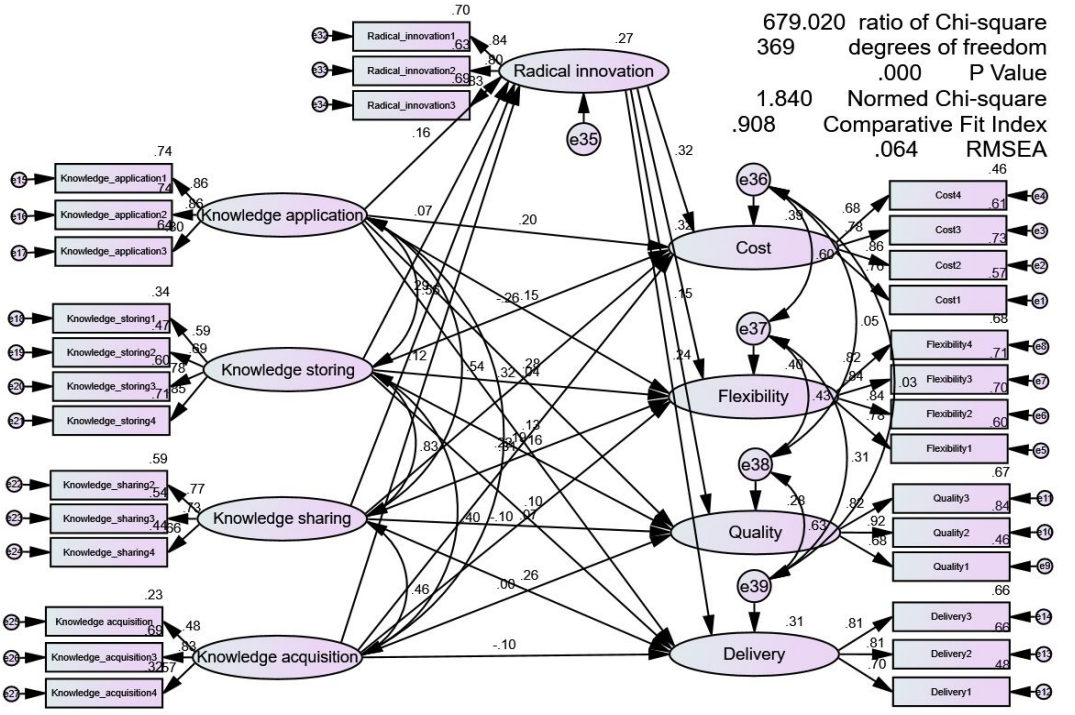


Figure (5.10) mediating role of radical between KM and CA

The structural model reveals the same value of model fit shown in Table (5.40) , all the model fit indices for the structural model were not only significant but remain same as in the measurement model. The low index of R square (i.e. 0.37, 33, 26, 27) justifies the underlying theoretical model, the model fit of model show in the next table

Table (5.40) model fit of radical innovation between KM and CA

Measure	Estimate	Threshold	Interpretation
CMIN	679.020	--	--
DF	369	--	--
CMIN/DF	1.840	Between 1 and 3	Excellent
CFI	0.908	>0.95	Acceptable
SRMR	0.055	<0.08	Excellent
RMSEA	0.064	<0.06	Acceptable
PClose	0.002	>0.05	Terrible

Source: prepared by researcher from data (2018)

The standardized regression weights are used since they allow the researcher to compare directly the relative effect of each independent variable on the dependent variable (Hair, Black, Babin, Anderson and Tatham 2006). The Table (5.41) presents the standardized regression estimates and allowed us to examine the direct association between the study constructs.

Table (5.41) Regression Weights of radical innovation between KMP and CA

			Estimate	S.E.	C.R.	P
Radical innovation	<---	Knowledge application	.203	.122	1.660	.097
Radical innovation	<---	Knowledge storing	.106	.280	.379	.705
Radical innovation	<---	Knowledge sharing	.358	.240	1.494	.135
Radical innovation	<---	Knowledge acquisition	.267	.204	1.310	.190
Cost	<---	Knowledge application	.196	.090	2.169	.030
Flexibility	<---	Knowledge application	.157	.089	1.756	.079
Quality	<---	Knowledge application	.248	.085	2.928	.003
Delivery	<---	Knowledge application	.137	.097	1.413	.158
Cost	<---	Knowledge storing	-.306	.208	-1.466	.143
Flexibility	<---	Knowledge storing	.053	.202	.264	.792
Quality	<---	Knowledge storing	.171	.186	.915	.360
Delivery	<---	Knowledge storing	.115	.219	.524	.600
Cost	<---	Knowledge sharing	.295	.180	1.640	.101
Flexibility	<---	Knowledge sharing	.302	.178	1.699	.089
Quality	<---	Knowledge sharing	.055	.160	.345	.730
Delivery	<---	Knowledge sharing	.250	.191	1.310	.190
Cost	<---	Knowledge acquisition	.360	.156	2.301	.021
Flexibility	<---	Knowledge acquisition	-.171	.148	-1.158	.247
Quality	<---	Knowledge acquisition	.005	.134	.038	.970
Delivery	<---	Knowledge acquisition	-.169	.160	-1.055	.292
Cost	<---	Radical innovation	.245	.067	3.685	***
Flexibility	<---	Radical innovation	.252	.066	3.812	***
Quality	<---	Radical innovation	.105	.059	1.768	.077
Delivery	<---	Radical innovation	.189	.071	2.673	.008

Table (5.42) Indirect Effects of radical innovation between KMP and CA

	Knowledge acquisition	Knowledge sharing	Knowledge storing	Knowledge application
Radical innovation				
Delivery	.051	.068	.020	.038
Type of mediation	NO	NO	NO	NO
Quality	.028	.038	.011	.021
Type of mediation	NO	NO	NO	NO
Flexibility	.067	.090	.027	.051
Type of mediation	NO	NO	NO	NO
Cost	.066	.088	.026	.050
Type of mediation	NO	NO	NO	NO

Source: prepared by researcher from data (2018)

Table(5.43) summarizes the results of testing hypotheses concerning the mediating effect of radical innovation between knowledge management(KM) and competitive advantage(CA), the results of mediating role indicates four component of KM influences the competitive advantage (cost, flexibility, quality and delivery

Table (5.43) **Summary of Hypotheses Testing Results for Mediated Effects of radical innovation between KM and CA**

Items		Statement of hypotheses: there is a positive relationship between,	Remark
H5		Radical innovation mediate the relationship between KM and CA	Partial support
H5.1	H5.1a	radical innovation mediate the relationship between knowledge application and cost	Supported
	H5.1b	radical innovation mediate the relationship between knowledge application and flexibility	Not supported
	H5.1c	radical innovation mediate the relationship between knowledge application and quality	Supported
	H5.1d	radical innovation mediate the relationship between knowledge application and delivery	Not supported
H5.2	H5.2a	radical innovation mediate the relationship between knowledge storing and cost	Not supported
	H5.2b	radical innovation mediate the relationship between knowledge storing and flexibility	Not supported
	H5.2c	radical innovation mediate the relationship between knowledge storing and quality	Not supported
	H5.2d	radical innovation mediate the relationship between knowledge storing and delivery	Not supported
H5.3	H5.3a	Radical innovation mediate the relationship between knowledge sharing and cost	Not supported
	H5.3b	Radical innovation mediate the relationship between knowledge sharing and flexibility	Not supported
	H5.3c	Radical innovation mediate the relationship between knowledge sharing and quality	Not supported
	H5.3d	Radical innovation mediate the relationship between knowledge sharing and delivery	Not supported
H5.4	H5.4a	Radical innovation mediate the relationship between knowledge acquisition and cost	Supported
	H5.4b	Radical innovation mediate the relationship between knowledge acquisition and flexibility	Not supported
	H5.4c	Radical innovation mediate the relationship between knowledge acquisition and quality	Not supported
	H5.4d	Radical innovation mediate the relationship between knowledge acquisition and delivery	Not supported

Source: prepared by researcher from data (2018)

5.9.2. The moderator role of information technology in the relationship between knowledge management and innovation capabilities

The three hypotheses predict that the of information technology moderate the relationship between KM and innovation capabilities, as shown in figure (5.11) below

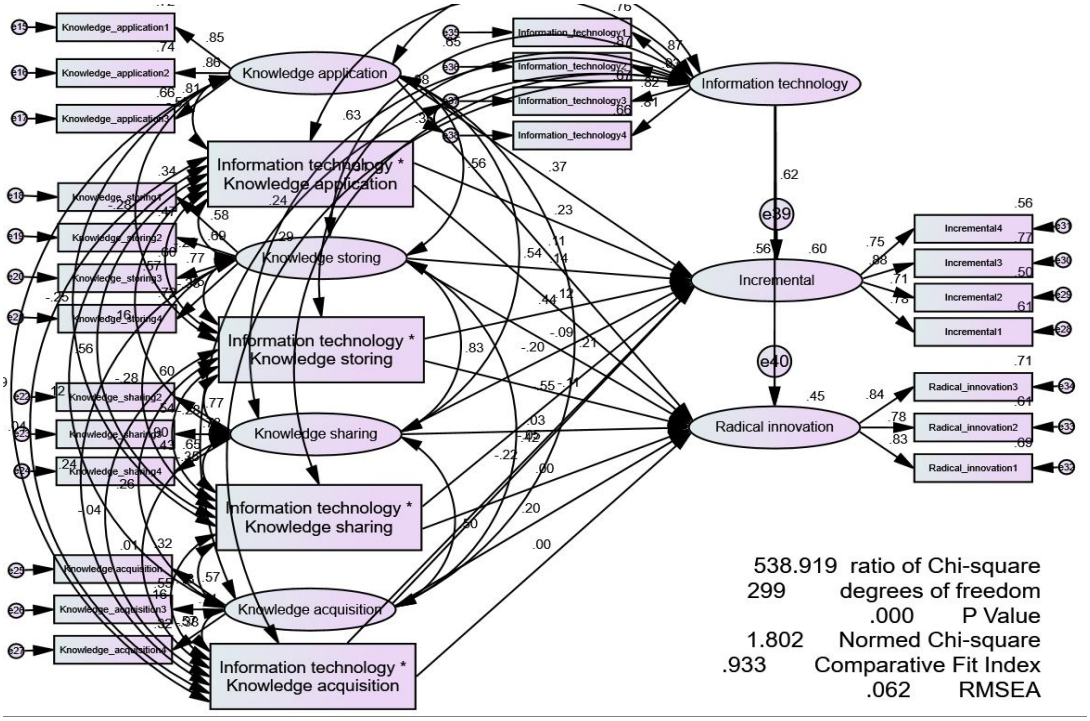


Figure (5.11) the moderating effects of IT between KM and IN

Table (5.44) moderating effect of IT between KMP and innovation capability

Measure	Estimate	Threshold	Interpretation
CMIN	538.919	--	--
DF	299	--	--
CMIN/DF	1.802	Between 1 and 3	Excellent
CFI	0.933	>0.95	Acceptable
SRMR	0.048	<0.08	Excellent
RMSEA	0.062	<0.06	Acceptable
PClose	0.009	>0.05	Terrible

In order to test these hypotheses many criteria must be met. According to Gaskin,(2016) in arranging for a hypothesis to be supported global tests of model fit are the first assumption must be met, to let a local test (p-value) to have meaning. Next is the global test of variance explained or R-squared. Lastly, if a regression weight is significant, but is in the wrong direction, our hypothesis is not supported. Instead, there is counter-evidence.In brief the conditions for testing moderating variable are, observing significant p-values and good model fit, but the R-square must be greater than 0.025 to explain sufficient variance in the dependent variable. Also the process requires introduction of a multiplicative interaction term into the path analysis. Accordingly, the interaction terms were created by multiplying the information technology.

To make obvious if the moderator effect is present on the proposed relationship; three or four maximum conditions were used. First, the model fit indices is adequate. Second, the P-value is significant. Third, the R-square must explain sufficient variance in the dependent variable. Fourth, the interaction term is also statistically significant. Additionally, in order to establish whether moderator is a pure or a quasi-moderating this research applied the criteria mentioned by Sharma et al (1981).

If the coefficients of both the multiplicative interaction term and the moderator variable are significant, the moderator is a quasi-moderator. However, if the coefficient of the multiplicative interaction term was significant and the coefficient of the moderator variable effect was not significant, the moderator is a pure moderator. A pure moderator effect implies that the moderator variable (information technology) modifies the relationship (i.e. the regression coefficient) between the predictor variable (knowledge management) and criterion variable (innovation capabilities).

5.9.2.1. The moderating effects of information technology on the relationship between knowledge management process and radical innovation

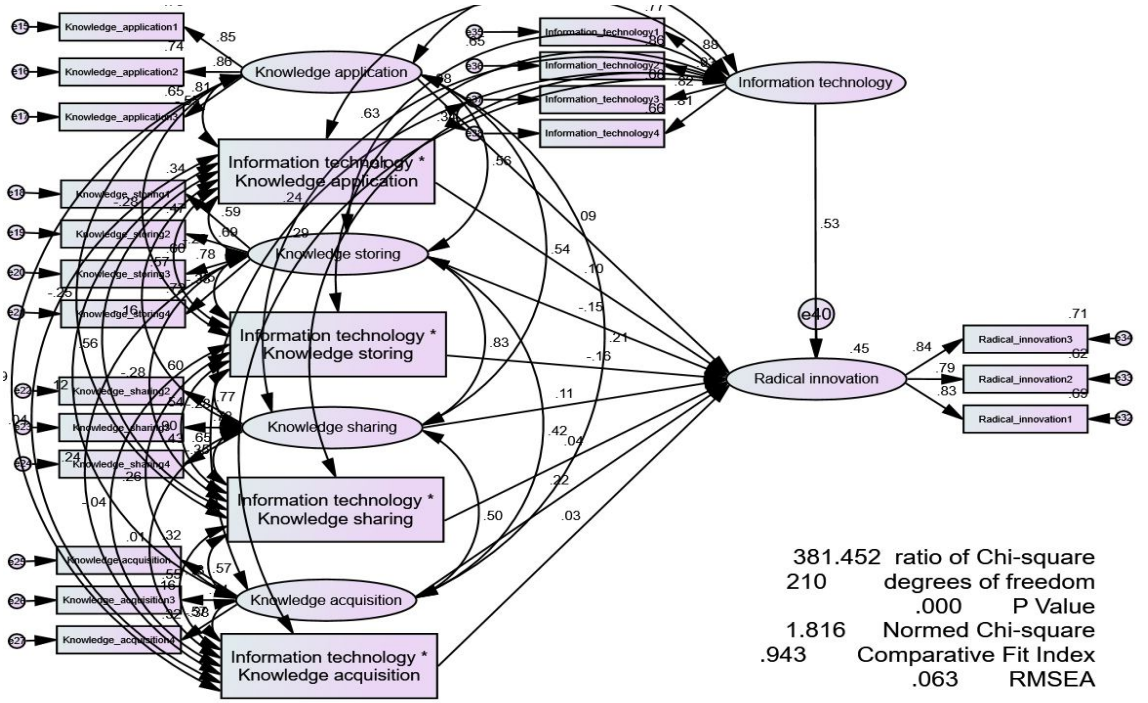


Figure (5.12) path of moderating role of IT between KMP and radical innovation

Table (5.45) the model fit of moderating effect of IT between KMP and radical

Measure	Estimate	Threshold	Interpretation
CMIN	381.452	--	--
DF	210	--	--
CMIN/DF	1.816	Between 1 and 3	Excellent
CFI	0.943	>0.95	Acceptable
SRMR	0.046	<0.08	Excellent
RMSEA	0.063	<0.06	Acceptable
PClose	0.019	>0.05	Acceptable

Source: prepared by researcher from data (2018)

Table (5.46) Regression Weights for direct effect of IT between KMP &radical

			Estimate	S.E	C.R	P
Radical innovation	<---	Knowledge application	.111	.155	.721	.471
Radical innovation	<---	Knowledge storing	-.225	.367	-.613	.540
Radical innovation	<---	Knowledge sharing	.136	.290	.470	.638
Radical innovation	<---	Knowledge acquisition	.394	.308	1.280	.200
Radical innovation	<---	Information technology	.543	.122	4.431	***
Radical innovation	<---	IT x knowledge application	.066	.071	.939	.348
Radical innovation	<---	IT x knowledge storing	-.128	.174	-.734	.463
Radical innovation	<---	IT x knowledge sharing	.039	.178	.217	.828
Radical innovation	<---	IT x knowledge acquisition	.023	.111	.210	.834

Source: prepared by researcher from data (2018)

Table (4.46) shows the results of direct and moderating effects of information technology on the relationship between knowledge management and radical innovation are as follows:

5.9.2.2. The moderating effect of information technology in the relationship between knowledge application and radical innovation.

This subsection proposed that information technology would moderate the relationship between knowledge application and radical innovation

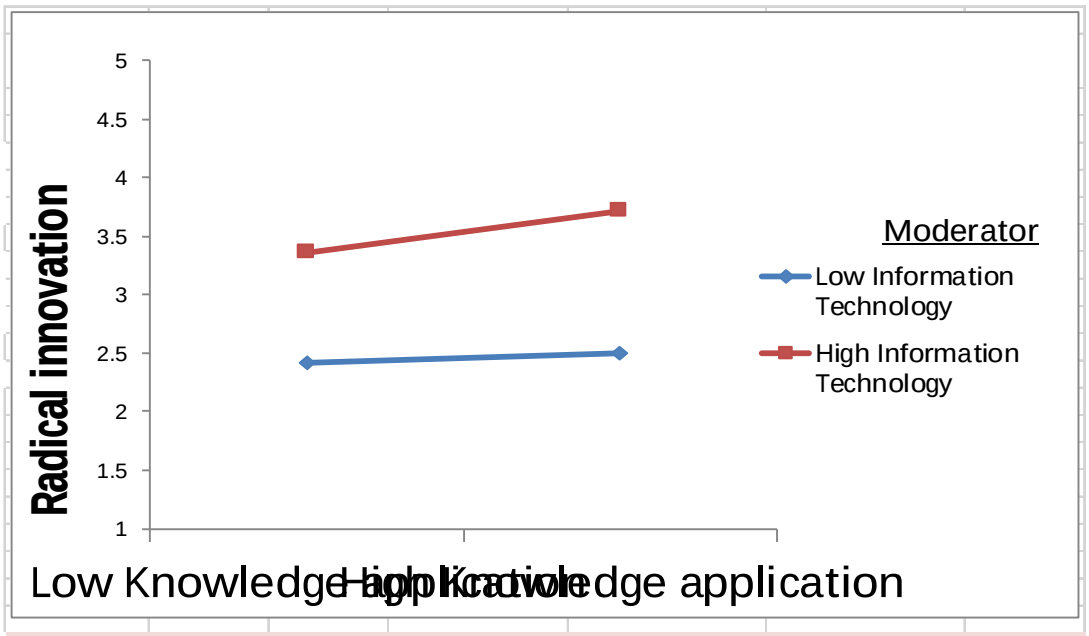


Figure (5.13) moderating effect of IT between application and radical innovation

The results in the table (4.47) show that the interaction term of knowledge application and information technology was not significant (estimate=.066, p>.05) for predicting radical innovation. The results reveals that the coefficient of the information technology effect was significant (estimate=.543, p<.001). However information technology shows no moderating effect between knowledge application and radical innovation. Figure (5.13) shows the moderating effect of information technology on the relationship between knowledge application and radical innovation. This figure indicates that industrial firms are facing low level information technology shows positive impact of knowledge application on radical innovation at a high range of knowledge application. The figure indicate that information technology strengthens the positive relationship /between knowledge application and radical innovation

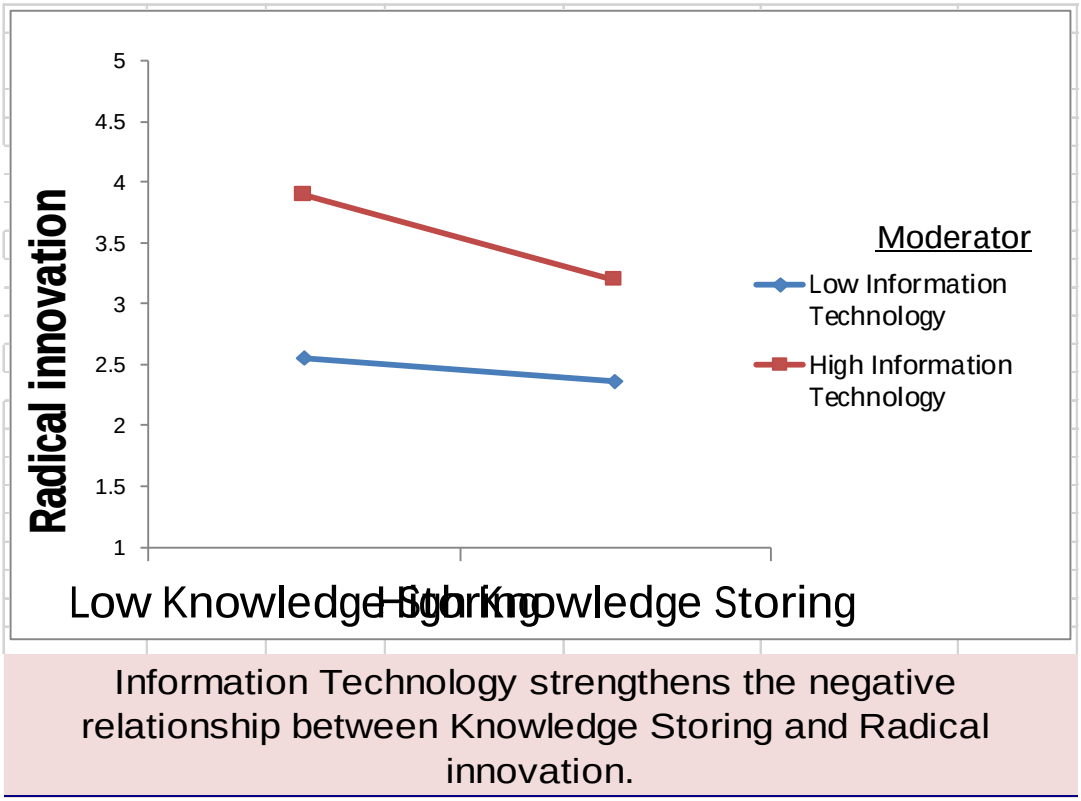


Figure (5.14) the moderating effect of IT between storing and radical innovation

Regarding the moderating effect of information technology on the relationship between knowledge storing and radical innovation, figure (5.14) shows that information technology strengthens the negative relationship between knowledge storing and radical innovation. Additionally, the figure shows that in high ranges of knowledge storing that facing high information technology to achieve best radical innovation, however, from low range of knowledge storing industrial firms that were facing with low information technology to achieve radical innovation less than industrial firms facing high information technology.

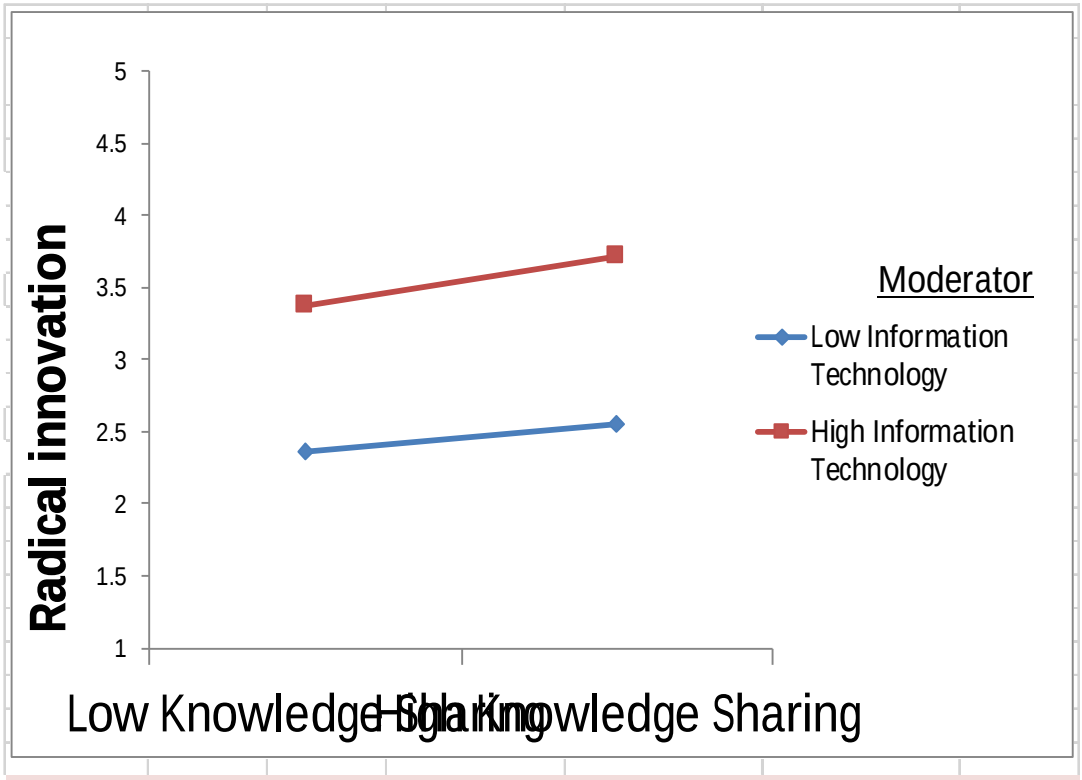


Figure (4.15) moderating effect of IT between knowledge sharing and radical

The results proposed that information technology would strengthen the positive relationship between knowledge sharing and radical innovation. Therefore, the figure shows that in high range of sharing, industrial firms that facing high information technology were make to achieve better radical innovation compare with industrial firms that facing low information technology.

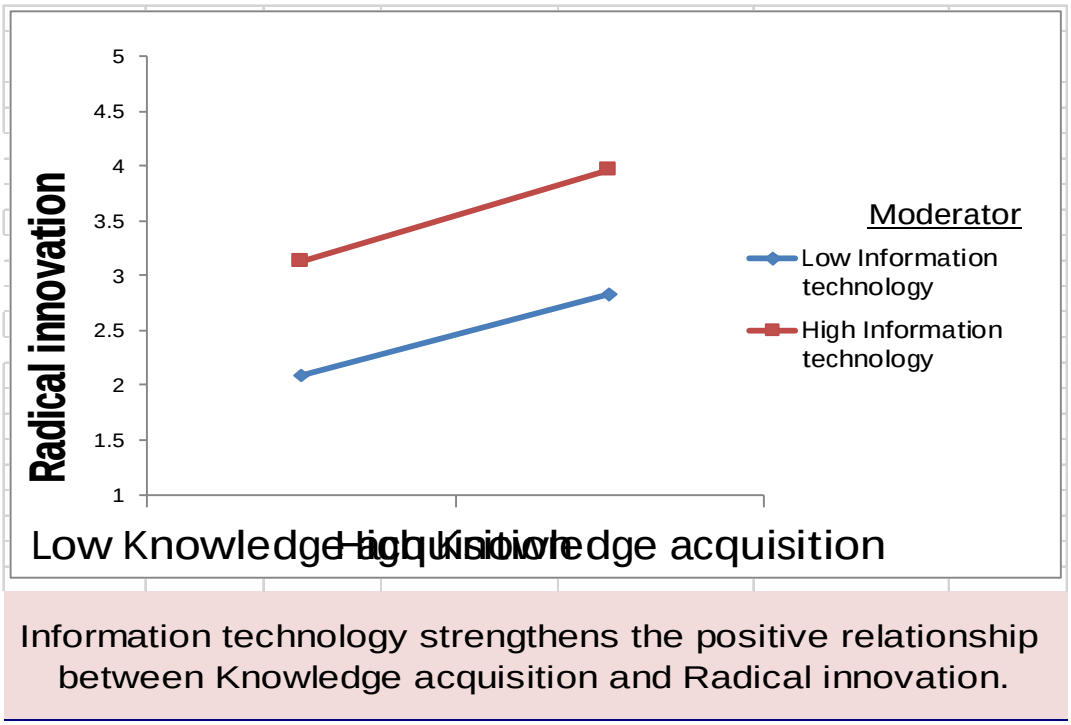


Figure (5.16) moderating effect of IT between knowledge acquisition and radical

The results show that information technology would strengthen the positive relationship between knowledge acquisition and radical information. Moreover the coefficient of information technology of interaction effect was not significant.

5.9.2.3. The moderating effects of information technology on the relationship between knowledge management process and incremental innovation

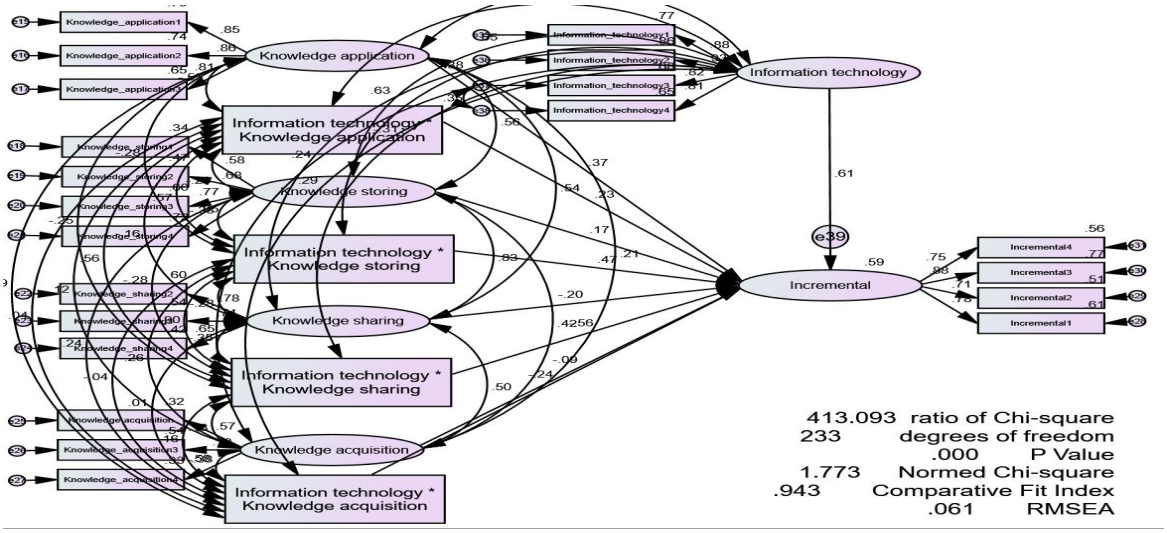


Figure (5.17) the moderating effect of IT between KMP and incremental

Table (5.47) the model fit of moderating effect of IT between KMP and incremental

Measure	Estimate	Threshold	Interpretation
CMIN	413.093	--	--
DF	233	--	--
CMIN/DF	1.773	Between 1 and 3	Excellent
CFI	0.943	>0.95	Acceptable
SRMR	0.046	<0.08	Excellent
RMSEA	0.061	<0.06	Acceptable
PClose	0.030	>0.05	Acceptable

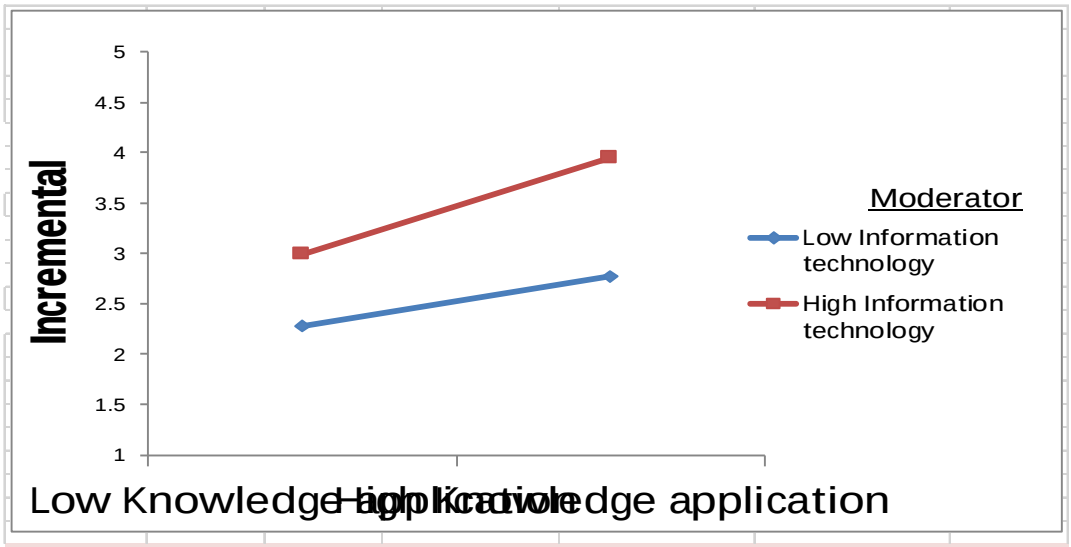
Source: prepared by researcher from data (2018)

Table (5.48) Regression Weights for direct of IT between KMP and incremental

Item			Estimate	S.E	C.R	P
Incremental	<---	Knowledge application	.364	.108	3.365	***
Incremental	<---	Knowledge storing	.199	.248	.803	.422
incremental	<---	Knowledge sharing	-.179	.198	-.900	.368
Incremental	<---	Knowledge acquisition	-.120	.206	-.584	.559
Incremental	<---	Information technology	.472	.086	5.490	***
Incremental	<---	IT x knowledge application	.117	.048	2.416	.016
Incremental	<---	IT x knowledge storing	.278	.119	2.342	.019
Incremental	<---	IT x knowledge sharing	-.364	.123	-2.968	.003
Incremental	<---	IT x knowledge acquisition	-.165	.075	-2.189	.029

Source: prepared by researcher from data (2018)

This subsection proposed that information technology moderate the relationship between knowledge management and incremental innovation. The results in table (5.48) shows that the interaction term of knowledge application and information technology was significant (estimate =.364, p<.05) for predicting incremental innovation. However the information technology shows is moderate the relationship between knowledge management and incremental innovation, because the regression weight of the interaction term is significant.Figure (5.18) shows the moderating effect of information technology between application and incremental innovation

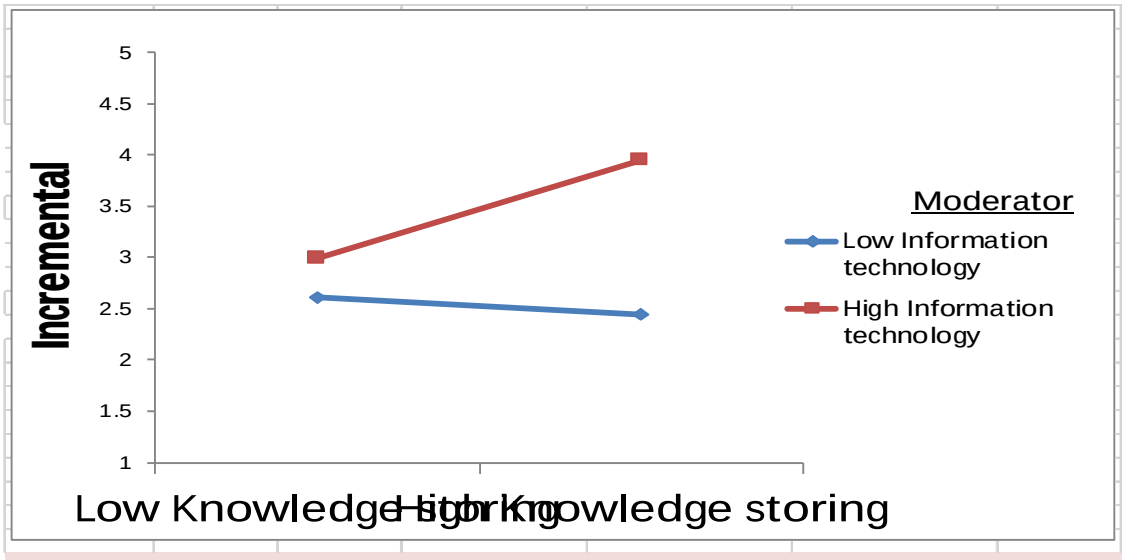


Information technology strengthens the positive relationship between Knowledge application and Incremental .

Source prepared by researcher from data (2018)

Figure (5.18) moderating effect of IT between application and incremental

The results revealed that information technology would strengthen the positive relationship between knowledge application and incremental innovation. Therefore, the figure shows that in high range of knowledge application, industrial firms that facing high information technology were make to achieve better incremental innovation compare with industrial firms that facing low information technology.

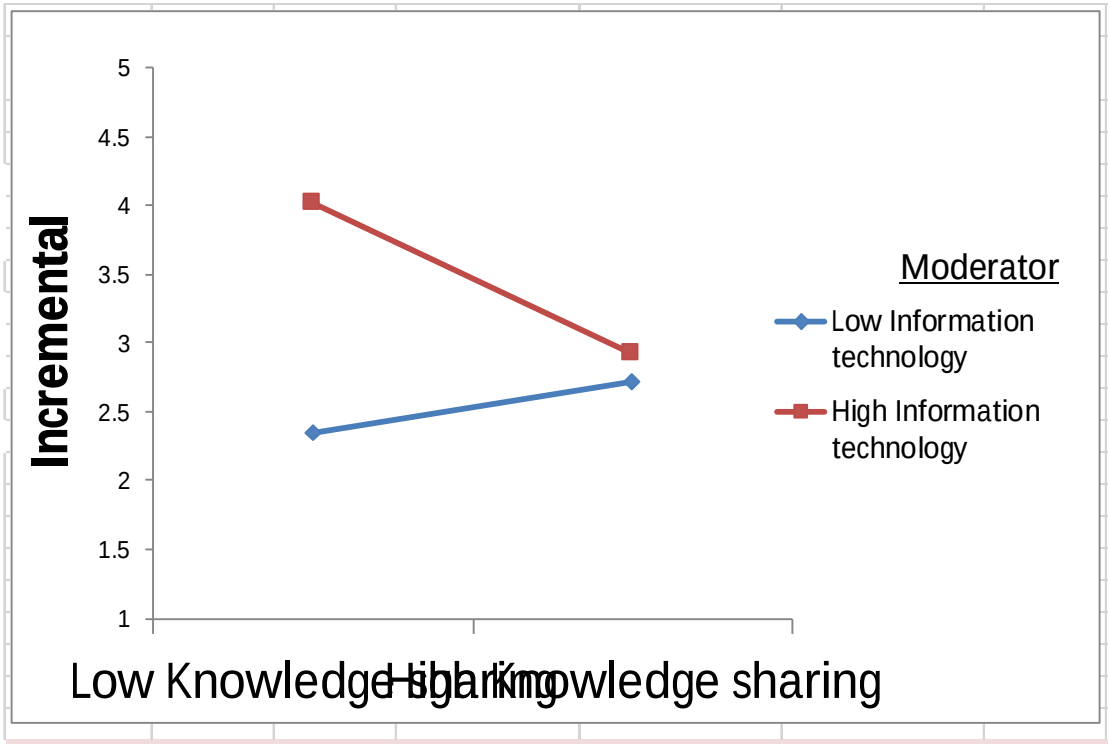


Information technology strengthens the positive relationship between Knowledge storing and Incremental .

Figure (5.19) moderating effect of IT between knowledge storing and incremental

The results show that information technology strengthens the positive relationship between knowledge storing and incremental innovation. Therefore, the results shows that in high range of knowledge storing in firms that facing high information technology that was make to achieve greater incremental innovation compare with firms that facing low information technology

Figure (5.20) moderating effect of IT between knowledge sharing and incremental



Information technology strengthens the negative relationship between Knowledge sharing and Incremental.

The result revealed that information technology strengthens the negative relationship between knowledge sharing and incremental innovation. Therefore, the results shows that in high range of knowledge sharing in firms that facing high information technology that was make to achieve greater incremental innovation compare with firms that facing low information technology

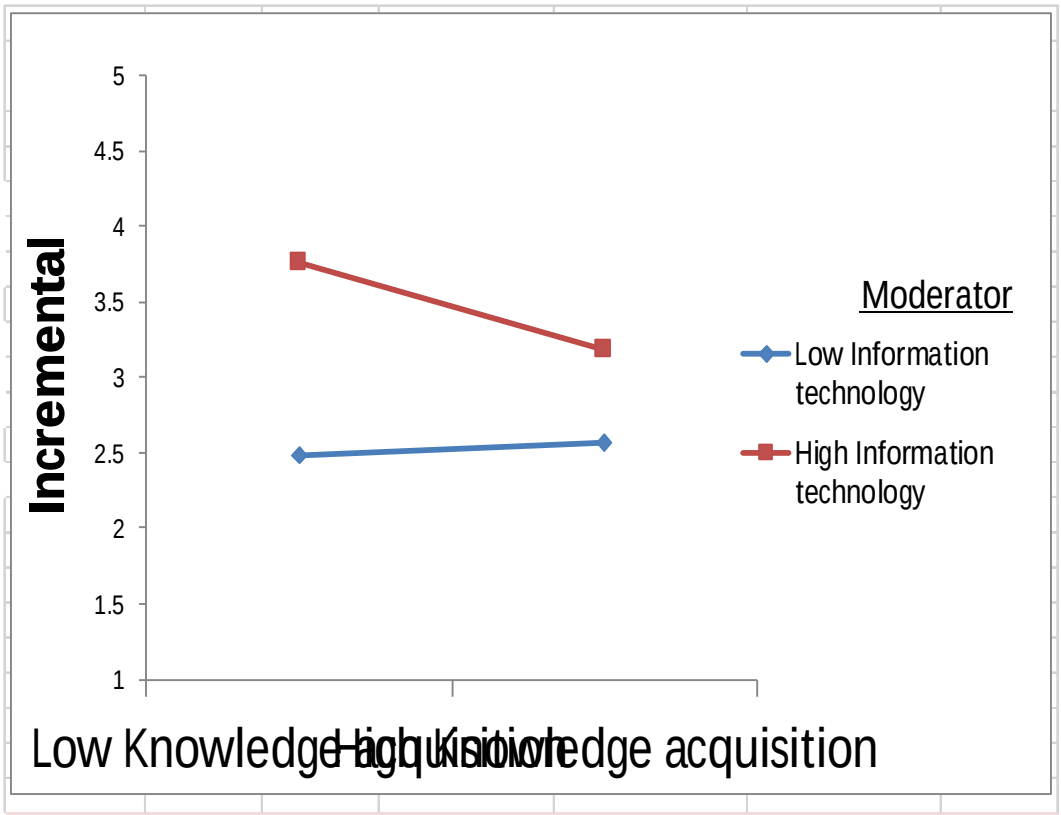


Figure (5.21) moderating effect of IT between acquisition and incremental

The result revealed that information technology strengthens the negative relationship between knowledge acquisition and incremental innovation. Therefore, the results shows that in high range of knowledge acquisition in firms that facing high information technology that was make to achieve greater incremental innovation compare with firms that facing low information technology.

Table **(5.49)** summary of results the moderating effect between KM and innovation capabilities

Table **(5.49)** summary of results the moderating effect between KM and IN

Item	Statement of hypotheses: information technology moderates the relationship between,	Remark
H5.1	Information technology moderates the relationship between KM and radical innovation	Not supported
H5.1.1	IT moderates the relationship between application and radical	Not supported
H 5.1.2	IT moderate the relationship between storing and radical	Not supported
H5.1.3	IT moderate the relationship between sharing and radical	Not supported
H5.1.4	IT moderate the relationship between acquisition and radical	Not supported
H5.2	Information technology moderates the relationship between KM and incremental innovation	Full supported
H5.2.1	IT moderates the relationship between application and incremental	Supported
H5.2.2	IT moderates the relationship between storing and incremental	Supported
H5.2.3	IT moderates the relationship between sharing and incremental	Supported
H5.2.4	IT moderates the relationship between acquisition and incremental	Supported

Source: prepared by researcher from data (2018)

5.9.3. Summary of the chapter

This chapter is concerned with data analysis that was generated from firms operated in Sudan to show the findings for testing the hypotheses of the study. For analyzing data different statistical systems and techniques were used. For example, IBM (SPSS and AMOS) statistics version 23 were conducted in this study in addition to other techniques like data cleaning which used for detecting and removing errors and inconsistencies to improve the quality of data followed by the validity and reliability to insure the goodness of measures for the study variables. Then, to identify the characteristics of all variables under study beside, responding firms and respondents descriptive statistical techniques were used. Furthermore, Person's correlations were also implemented to identify the interrelationships among all the variables. Finally, path analysis in AMOS was used to test the direct and indirect effects for testing the hypotheses

CHAPTER VI:
DISCUSSION AND CONCLUSION

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DISCUSSION AND CONCLUSION

6.0. Chapter Overview

This chapter summarized the research findings are illustrated initially followed by discussion of the results in light of prior researches.

The primary objective of this study is to examine the relationships between knowledge management process (knowledge acquisition, knowledge sharing, and knowledge storing and knowledge application) and competitive advantage (cost, quality, flexibility, and delivery) also study tried to test the mediating role of innovation capabilities (radical innovation and incremental innovation) on the relationship between knowledge management and competitive advantage: in addition to test the moderating effect of information technology of interaction between knowledge management and innovation capabilities. To achieve this objective, it was necessary first to hypothesise theses causal relationships and second to empirically examine the relationships.

The research model of this thesis was developed both from the literature review. Methodological issues were also addressed for the examination of the relationship in the conceptual model the data was collected from a purposive sample by a cross-sectional survey from (300) Sudanese manufacturing firms. The research model and hypotheses were tested with Structural Equation Modelling (SEM).

1. What is the relationship between knowledge management processes and competitive advantage?

2. What is the impact of knowledge management on relationship innovation capabilities in Sudanese manufacturing firms?

3. What is the relationship between innovation capabilities and competitive advantage?

4. Dose innovation capabilities mediate the relationship between knowledge management and competitive advantage?

5. Does information technology moderate the relationship between knowledge management processes and innovation capabilities?

In Exploratory factor analysis for knowledge management dimensions such as knowledge acquisition was excluded one item, therefore in Sudanese industrial firms didn't adopt on external sources to obtain information about new products, also in sharing knowledge was excluded item, industrial firms un knowing the collective work at the level company, in knowledge application Sudanese industrial firms didn't used activities designed for develop new products, in Exploratory factor analysis for competitive advantage(CA) (quality) were excluded one item, therefore in Sudanese firms didn't used the culture of how to offer highly reliable products, also in CA delivery was excluded two items, the result indicates that the Sudanese environment inconsequential for how to accuracy and availability of delivery products.

Descriptive analysis was also conducted for the variables of the studied knowledge management process (knowledge acquisition, knowledge sharing, and knowledge storing and knowledge application) the result out lined that the Sudanese manufacturing firms have average level of knowledge storing(mean=**4.18**,Std=**1.097)** Competitive advantage (cost, quality, flexibility and delivery) the result revealed that the Sudanese manufacturing firms have achieved high score of quality (mean=**4.02**,Std=**1.018),** innovation capabilities (radical and incremental) the result shows that the Sudanese manufacturing firms have average level of radical innovation (mean=**4.073**,Std=**.913**) and information technology was achieved (mean=**3.92,**Std=**1.054)** in Sudanese manufacturing firms.

The results of the person correlation between all variables of the construct were revealed positive and significant where the results show that the correlation between knowledge management process (KM) and competitive advantage (CA) is positive and significant, also a correlation between innovation capability and competitive advantage was a significant and positive relationship.

For that, the path analysis (Structural Equation Modelling) was used to test the hypotheses of the study.

6.1. H1. Predict that there is a positive relationship between knowledge management and competitive advantage. The results outlined that knowledge management process (knowledge application, knowledge sharing, and knowledge

acquisition) supported and positive effect on competitive advantage cost, while knowledge storing show not supported on competitive advantage cost. Also, the results revealed that two dimensions of knowledge management process (knowledge application and knowledge sharing) have a positive effect on competitive advantage flexibility, while knowledge management (acquisition and storing) show no positive significant on competitive advantage flexibility. The results outlined that knowledge management application has a positive and significant effect on competitive advantage quality, however, knowledge management (sharing, storing and acquisition) show no effect on competitive advantage quality. Also, the finding revealed that knowledge management process (knowledge application, knowledge sharing, knowledge storing and knowledge acquisition) have no positive effect and not supported on competitive advantage (delivery).

6.1.1. H2. Predict that there is a positive relationship between knowledge management process and innovation capability.

The results outlined that knowledge management process (application) has a positive effect and significant on incremental innovation, while knowledge management process (knowledge sharing, knowledge storing and knowledge acquisition) is not significant on incremental innovation, the results prove that top management in industrial firms is the effect on incremental innovation. Knowledge management process (knowledge application, knowledge sharing, knowledge storing and knowledge acquisition) not positive on radical innovation

6.1.1.1. H3. Predict that there is a positive relationship between innovation capability and competitive advantage.

The results revealed that incremental innovation has a positive effect and supported on competitive advantage (cost, quality, flexibility, and delivery). Also, the finding shows that radical innovation is a positive effect on two dimensions of competitive advantage, while radical innovation not significant and not supported on competitive advantage (quality and delivery).

6.1.1.2. H4. Predict that the mediating effect of innovation capability between knowledge management and competitive advantage.

The results outlined that incremental innovation is full mediation between knowledge management (knowledge application, knowledge storing, and knowledge

sharing and knowledge acquisition) and competitive advantage (cost, quality, flexibility, and delivery). However radical innovation is partial mediation between knowledge management process (application, sharing, storing and acquisition) and competitive advantage (cost, quality, flexibility, and delivery).

6.1.1.3. H5. The moderating effect of information technology between knowledge management and innovation capability,

The result revealed that information technology has moderate the effect between knowledge management process (application, sharing, storing and acquisition) and innovation capability.

6.2. Discussion:

This section is focused on the discussion of the study findings. The discussion is mainly based on previous studies; the discussion included the relationship between knowledge management and competitive advantage, knowledge management and innovation, innovation capability and competitive advantage and the moderating role of information technology.

6.2.1. The relationship between knowledge management and competitive advantage.

The study aimed to investigate the relationship between knowledge management process (knowledge application, knowledge sharing, knowledge storing and knowledge acquisition) and competitive advantage (cost, quality, flexibility, and delivery)

The result revealed that the knowledge management process (application, sharing and acquisition) was positively significant with cost, Also the results revealed that two dimensions of knowledge management process (knowledge application and knowledge sharing) have a positive effect on competitive advantage flexibility, this result confirmed that Sudanese manufacturing firms can achieve competitive advantage through the alignment of knowledge management process (sharing, application and acquisition). The results consistent with previous empirical studies (e.g., Laith et al, 2015) confirm that a positive and strong effect of knowledge management process on organizational performance, (Coling, 2016) shows that knowledge management is the main key for the organizations to stay competitive,

(Ganzalo &Asndra,2017) show that manufacturing SEMs have good knowledge management which can be regarded as a competitive advantage,

(Mohammed &F ayez,2016) showed significant impact of knowledge management process on the organizational performance, and showed significant impact of the quality assurance standards on improving the impact of knowledge management on the organizational performance,(Forogh, Atefe &Mona,2016) revealed that the spearman correlation coefficient between knowledge management and competitive advantage there is a significant relationship and confirms that increased knowledge will also increase their competitive advantage,(Hossein,2016) showed that all research hypotheses were confirmed and it indicated that knowledge management establishment has affected on organizational excellence among personnel of payam-E-Noor (PNU) University at Western Azerbaijan Province,(Samina,2016) showed that these factors are contributing towards the better and improved organizational performance in banking sector,(Muhammed et al,2017) show that external knowledge management(E-KM) and talent management both contribute positively to the performance of manufacturing firmsn, (Joy,2017) found that the survival of telecommunication firms through adaptability and flexibility result from the knowledge management competencies . However knowledge storing has not significant relation with competitive advantage cost, this result it different from previous studies in environmental factors and culture in Sudanese industrial firms

6.2.2. Relationship between knowledge management and innovation capabilities

This section deals with the relationship between knowledge management and innovation capability as the first sub hypotheses represent in knowledge management process (sharing ,storing, acquisition and application) and incremental innovation the findings revealed that knowledge application is significant effect of incremental innovation, this result indicate that top management in industrial firms believed application knowledge will lead to innovation, while knowledge management process (sharing, storing and acquisition) was not significant effect on incremental innovation, therefore, in Sudanese manufacturing firms proven that (sharing, storing and acquisition) will not lead to incremental innovation.

On the other hand the understanding of top management of industrial firms were un known how to achieve the incremental innovation through the knowledge management process, this findings different from previous studies (Leith et al, 2015) indicates that a positive effect of organizational innovation. The finding contribute to understanding the relationship between knowledge management process and innovation,

(Samsir, Aida &Zulfadil, 2017) showed that knowledge management had positive and significant effect on product innovation. The positive effect showed that the better the knowledge management owned by the entrepreneurs of small and medium enterprises of typical food products, (Mehdi& Abdolali, 2016)showed that there is a significant positive relationship between knowledge management process and innovation,(Marianne&Danny,2017) indicate that principles of the Australian Business Excellence framework (ABEF) shaped KM activities through fostering continuous improvement which in turn encourage a stronger focus on incremental rather than radical forms of innovation, (Brucu&Ceyda,2013) show that knowledge management process relate positively to innovativeness which in turn increases innovations in organizations,(Ebrahim et al,2017)shown that there is a clear link between knowledge management and innovation. These findings imply KMP played crucial and important role for organizations and studied in the same environment.

Whereas (Eugenie, John& Laura, 2016) indicate that only knowledge management (sharing) was found positive and significant predictor of innovation. This implies that effective knowledge management through knowledge sharing may lead to innovation. This result it different from the finding of this study in variance of communities culture.

Second sub hypotheses knowledge management process (application, sharing, storing and acquisition) and radical innovation. The result revealed that knowledge management process is not significant and not supported on radical innovation. This results indicate that mangers of industrial firms considered radical innovation is generally a complex process implies a difficult, lengthy and risky process This result is not similarity the results of the past studies (Maleeha &Tayyab, 2018) suggest that knowledge management acquisition has a positive impact on product, service and marketing innovation, (Mahmoud& As'ad,2016) emerged that knowledge management dimensions(sharing, acquisition, application and protection) were found to be positively associated with products innovation, whereas knowledge creation and knowledge storing were not significant, this result similar with finding of this study maybe studied in same circumstance of environmental

6.2.3. Relationship between innovation capabilities and competitive advantage

The relationship between incremental innovation and competitive advantage

The study findings revealed that incremental innovation is significant and supported for competitive advantage dimensions (cost, quality, flexibility and delivery) this result confirmed that industrial firms managers believes that continuous improvement of the product will enhance competitive advantage. Also incremental innovation is the dominant from of innovation. For instance, Puga &Trefler (2010) provide evidence of the rise of incremental innovation in low-wage countries and show how it has been contributing to increasing exports of high-quality and sophisticated manufactured goods. This result agrees with previous studies (Titus, Gregory & Fred, 2017) revealed that organizational innovation, product innovation, administration innovation and process innovation play significant role in sustainable competitive advantage,

(Mburu, 2016) indicated that logistic firms in Mombasa County utilized innovation strategies namely: product innovation strategies, process innovation strategies, market innovation and organizational innovation strategies. Overall, it was shown that innovation strategies influence competitive advantage in logistic firms. Product innovation strategy had a positive and significant effect on competitive advantage,(Karanja, Kahuthia& Gakenia, 2018) showed that process innovation has the highest positive influence on organizational performance,

Relationship between radical innovation and competitive advantage

The results revealed that radical innovation is significant effect on competitive advantage (cost and flexibility). Therefore, this finding indicate that top managers of the firms are concentrate on the low cost and reducing the time for market, the result support by (Marcelo et al, 2016) brings a proper understanding that radical innovation play a crucial role for organizational performance in emerging economies. While radical innovation was not significant and not supported with competitive advantage (quality and delivery). This result accordance with (Regien et al, 2015) find that term specificity has an inverse-u-shaped effect on incremental innovation and negative effect on radical innovation, furthermore, Sudanese industrial firms are see the radical innovation a complex process. Generally implies a difficult lengthy and risky process.

6.2.4. The mediating role of innovation capabilities between knowledge management and competitive advantage

The mediating role of incremental innovation between knowledge management processes (acquisition, sharing, storing and application) and competitive advantage (cost, quality, flexibility and delivery). The findings outlined that incremental innovation has full mediation the relationship between knowledge management process and competitive advantage however there is no direct effect between knowledge management and competitive advantage, this result implies that without incremental innovation, industrial firms may not achieve an improved the competitive advantage. This result accordance with previous studies (Eugenie, John &Laura,2016) revealed that innovation had a positive effect on business performance, however there was no direct effect of knowledge management on business performance, except through the full mediation of innovation,

(Eren & Kharmorz, 2017) provide support for the mediating role of the innovation is confirmed that is marketing innovation practices contribute to the firm innovation performance directly or through the improvement of the knowledge harvesting process marketing, product and process innovation dimensions contribute to firm performance directly or through the improvement of the knowledge transformation,(Laith et al, 2015) the result provide evidence of the mediating effect of organizational innovation on the relationship between knowledge management process and organizational performance.

Second sub hypotheses the radical innovation mediate the relationship between knowledge management and competitive advantage. The results revealed that radical innovation has not mediated the relationship between knowledge management and competitive advantage. The result refers that radical innovation play important role for achieve competitive advantage in industrial firms. This result different from previous studies (Titus et al, 2016; Samina et al, 2015; Samsir, Aida& Zulfadil, 2017) shows that product innovation mediated between knowledge management and competitive advantage, therefore, this various perhaps in environmental and technological, otherwise Sudanese industrial firms had low technological than foreign industries

6.2.5. The moderating effect between knowledge management and innovation capabilities

In this interaction effect the general results shows that Information technology has moderates the relationship between knowledge management and radical innovation. Knowledge management process (application, sharing and acquisition) strengthens positive relationship with radical innovation, while knowledge storing strengthens negative relationship with radical.

These results supported past studies (Mitali, 2013) explore the role of technology (IT) in facilitating knowledge management (KM). Moreover study also provides an insight about the tools and techniques use for implementation of KM and IT role for enabling KM, (Lawrence, Ruth &John, 2018) summarized information technology will be a critical lynchpin for making accelerated radical innovation a reality. IT will make it possible to bridge the valley of death between the time that technology is developed and that time that products utilizing it end up in marketplace. IT wills bride language and cultural barriers that exist today between companies and individuals in different parts of the world,

Second sub hypotheses the moderating effect of information technology in the relationship between knowledge application and radical innovation

This section discusses the interaction effect of information technology and knowledge application on radical innovation to explain the moderating role of information technology in this relationship.

In general result shows that information technology moderate the relationship between one dimension of knowledge management process (knowledge application) and radical innovation. Hence information technology strengthens the positive relationship between knowledge application and radical innovation. This indicates that, industrial firms facing a high level of IT, the high application knowledge with information technology leads the industrial firms to achieve greater radical innovation. Also whenever, industrial firms are confronted by the fierce competition in business environment, there will be a high range of information technology to enhance radical innovation by utilization of greater knowledge management process. This result support by (Tcarev, 2018) proved that the development of decent ICT infrastructure helps to implement KM strategy. Current level of technological applications allows enhancing knowledge management processes saving time and efforts of employees.

The result also shows that industrial firms are facing low level information technology at low response range to keep the industrial firms radical innovation when IT remain stable.

Third Sub hypotheses the moderating effect of information technology in the relationship between knowledge storing and radical innovation

The finding shows that information technology strengthens the negative relationship between knowledge storing and radical innovation. Additionally, the industrial firms are facing a high ranges knowledge storing that facing high information technology to achieve best radical innovation, while at the low level of information technology the effect of storing knowledge on radical innovation increases, therefore, to managers of the industrial firms in Sudan are facing how to store the information and how to reuse

Fourth sub hypotheses the moderating effect of IT between knowledge sharing and radical

The result shows that information technology would strengthen the positive relationship between sharing knowledge and radical innovation. Industrial firm face high level of information technology, industrial firms facing a high level of IT, the high knowledge sharing with information technology leads the industrial firms to achieve greater radical innovation

Fifth sub hypotheses the moderating effect of IT between knowledge acquisition and radical

This section discusses the interaction effect of information technology and knowledge acquisition on radical innovation to explain the moderating role of information technology in this relationship.

The results show that information technology would strengthen the positive relationship between knowledge acquisition and radical information

6.2.6. The moderating effect of information technology in the relationship between knowledge management and incremental innovation.

For moderating effect of information technology in the relationship between knowledge management process (sharing, storing, acquisition and application) and incremental innovation, the results show that information technology was moderate the relationship between KMP (knowledge application, knowledge storing) and incremental innovation, in which strengthens the positive relationship between knowledge management process (application, storing)and incremental innovation. This result indicates that firms are facing low level of information technology show positive impact of knowledge management process and incremental innovation at a high range of information technology.

However, for the firms that facing high level of KM, IT was found to have greater positive influence on the incremental innovation, while knowledge management process (sharing and acquisition) in which strengthens negative relationship with incremental innovation. These results indicate that in high range of (sharing and acquisition) in firms that facing high information technology that was make to achieve greater incremental innovation. the results approve the previous studies (Ram et al, 2017) ICT was found to assist in the process of getting required knowledge and enabling easy communication among the farm communities and organizations. The a viability of ICT is seen to enhance dissemination of explicit and tacit knowledge and sharing of best practice effectively among the farm communities and expert groups in the organizations,(Nada et al,2016) indicated a positive and statistically significant association between information technology infrastructure and innovation performance.

6.3. Implications of the research

This section contains two sub-sections the theoretical implications and practical implications of research findings which are discussed below:

6.3.1. Theoretical implications

The theoretical contribution of this study has supported the knowledge management process in Sudanese industrial firms. Hence this study helps to fill this void in the literature

The **second** contribution the study has enrich the body of knowledge by developing and empirically testing a model related to knowledge management process, innovation capability, information technology and competitive advantage based on a sample of industrial firms. The model has included mediating effect of innovation capabilities with two dimensions namely; radical innovation and incremental innovation.

The **third** contribution, the propose conceptual framework of the study with a numbers of gaps has been tested accepted without modification which imply that construct and relationship are built on a solid theoretical back ground. Also the variables of the study which was being measured in previous studies,

the **forth** contribution the study findings demonstrate that the relationship between knowledge management process and competitive advantage is not support, relationship between knowledge management and innovation capabilities is not support, the moderating effect of IT between KM and innovation capabilities is strengthens and mediating role of innovation capabilities between KM and CA is also partial mediation

6.3.2. Managerial implication

The findings of the study proposed framework provide a number of valuable implications for managerial practice. The study supported the evidence that knowledge management process and innovation capabilities are very importance in achieving competitive advantage,

For the results of this research has proven that knowledge sharing, knowledge acquisition and knowledge application have positive effect on competitive advantage cost this point outs that as industrial firms become more involved in activities related to competition.

The research findings affirmed that knowledge management process (knowledge sharing, knowledge storing, knowledge acquisition and knowledge application) is not significant and not supported with radical innovation, this result indicate that managers of industrial firms take in to account the importance of radical innovation in achieve competitive advantage.

From managerial point of view the results obtained from testing the conceptual framework of this study improves the common understanding among decision makers,

which makes the firm more likely to be able to effectively response to environmental changes.

6.4. Limitation for the study

This study, like all other studies, suffered various limitations that restrict the generalization of the findings and opens directions of the future research. The following limitation remains based on literature review, research methods, data collection, and statistical analysis.

First, because this study only focused on one sector (industry) in Khartoum state Second, this study distributed questionnaires to verify the hypotheses, which is a temporal cross-sectional approach, and the samples were still materials from the same period. Theoretically, conducting a longitudinal study to collect data can better support casual inference (Chia& Huei, 2016). Therefore the casual inference in this study seems slightly weak.

Third, this study only explores the mediator role of innovation capabilities (radical and incremental) without considering others dimensions. As a consequence, this research fails to enumerate all of the potential factors of all the mediator roles of knowledge management process with competitive advantage.

6.5. Suggestions for future studies

Although the result of the study may contribute to verify the phenomenon in Sudan several suggestions could be made for academicians and business practitioners.

First, the study exposed s number of opportunities for future examination pertaining to the firms that influence the success of implementing knowledge management process as a whole, future research must focuses on knowledge storing; research in this area, particularly in service sector

Second, in the meantime, although this research cannot take into account the dimensions of information technology, future research should use information technology by dimensions

Finally, based on this study's limitations, future research may consider some other mediating variables in the relationship between knowledge management process and competitive advantage.

6.6. The conclusion of the Study.

The purpose of this research was to develop an understanding of the linkage between knowledge management process (acquisition, sharing, storing and application) and competitive advantage (cost, quality, flexibility and delivery), and testing the mediation effect of innovation capabilities beside the moderating role information technology. To achieve this objective, it was necessary first to hypothesis theses causal relationships and second to empirically examine the relationships.

Through empirical study, the research model of this thesis was developed both from the literature review and the interview study conducted the study was applied among large Sudanese industrial companies in Khartoum state .Methodological issues were also addressed. The empirical study, afterwards, examined the research hypotheses. For the examination, the questionnaire survey was conducted research model and hypotheses were tested with SEM (Structural Equation Modelling).

The results of this study revealed that industrial firms in Sudan implemented, this study found that knowledge management have significance effect on competitive advantage. The study Demonstrate that innovation capabilities is essential for gain competitive advantage in industrial firms. In addition, the study further expand the theory of RBV and KBV

In Aggregative, the study outlined several objectives, which it hoped effectively to accomplish. The study provides a numbers of theoretical and practical implications.

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Appendix

بسم الله الرحمن الرحيم

جامعة السودان للعلوم والتكنولوجيا

كليـة الدراسـات العليـا

قسم إدارة الأعمال

إستبانة بحث مقدم لنيل درجة الدكتوراه الفلسفة فى ادارة الاعمال

بحث بعنوان :

الدور المفسرللقدرات الابداعية فى العلاقة بين ادارة المعرفة والميزة التنافسية

(دراسة على عينة من الشركات الصناعية بولاية الخرطوم)

الدارس : أنور تبن محمد ارباب

ت : - 0121051992

المشرف د : صديق بلل ابرهيم

0912797197

السيد/:.....

المحترم

السلام عليكم ورحمة الله وبركاته

اهديكم اطيب التحيات وبعد

الموضوع : استبانة بحث مقدم لنيل درجة الدكتوراه

أحيطكم علما بأنني الان بصدد اجراء بحث علمي لنيل درجة دكتوراه الفلسفة فى ادارة الاعمال و التي تتناول : الدور المفسرللقدرات الابداعية فى العلاقة بين ادارة المعرفة والميزة التنافسية.

تهدف هذه الاستبانة الي التعرف علي ارائكم حول موضوع البحث اعلاه وعليه اتطلع الي سماحة تعاونكم فى ملأ هذه الاستبانة كاملة , واضعين فى الاعتبار ان دقة اجاباتكم لها أثر كبير فى اثراء هذه الدراسة .

وأود أؤكد لكم ان البيانات المقدمة من قبلكم ستحاط بالسرية الكاملة وتستخدم فقط لأغراض البحث العلمي , املا أن تحظي هذه الاستبانة بعنايتكم واهتمامكم .

مع خالص شكرى وتقديري لتعاونكم للمساهمة في تعزيز البحث العلمي،،،،،،

الدارس : أنور تبن محمد ارباب **المشرف د : صديق بلل ابرهيم**

ت : - 0121051992 **0912797197**

الجزء الأول: معلومات عامة عن الشركة

1- طبيعة نشاط الشركة

تجاري	صناعي	خدمي

2- ملكية الشركة

شركة عامة	شركة خاصة	شركة مختلطة

3- خبرة الشركة في المجال

اقل من 5سنوات	من 5 الي اقل من 10	من 10 الي اقل من 15	من 15 الي اقل من 20	اكثر من 20سنة

4- عدد العاملين بالشركة

عدد الموظفين	اقل من 50	من 50الي 100	من 101الي 150	من 151 الي 200	أكثر من 200

5- عدد المنافسين فى نفس المجال

عدد المنافسين	اقل من 5 منافس	من 5 الي اقل من 10	من 10 الي اقل من 15	من 15 الي اقل من 20	20 منافس فأكثر

القسم الاول: يقيس أبعادادارة المعرفة بمؤسستكم:

(اكتساب المعرفة, مشاركة المعرفة, خزن المعرفة, تطبيق المعرفة)الرجاء وضع علامة (✓) امام الخيار الذي يناسب وجهه نظرك في العبارة المذكورة

اكتساب المعرفة:(knowledge acquisition)

م	العبارات	اوافق بشدة	اوافق	محايد	لا اوافق	لا اوافق بشدة
1	في شركتنا يقوم الموظفون باستخدام الانترنت للحصول علي المعلومات اللازمة لأداء مهامهم					
2	تعتمد الشركة على المصادر الخارجية للحصول علي المعلومات عن المنتجات جديدة					
3	شركتنا لديها المقدرة لتحويل المعلومات المتوفرة من المنافسين الي منتجات جديدة					
4	تمتلك شركتنا معلومات مختزنة يمكن تحويلها الى بيانات تساعد الموظفين فى اداء مهامهم					
	مشاركة المعرفة :(knowledge sharing)					
1	يتم تشجيع العمل الجماعى فى شركتنا عن طريق توفير المعلومات علي مستوي الشركة					
2	توفر شركتنا أنظمة تقنية مدعومة بالشبكة الانترنت					
3	أن بيئه عمل الشركة تشجع مشاركة المعلومات					
4	تشارك الشركة المعلومات مع الموردين والزبائن					
	خزن المعرفة					
1	تستخدم شركتنا مطبوعات مثل (خطابات, كتيبات, تقارير سنوية ...الخ) لتخزين البيانات					
2	تستخدم شركتنا الوسائل السمعية والبصرية لتخزين المعلومات					
3	تمتلك شركتنا بنية تحتية متكاملة فى تقنية المعلومات					
4	تستطيع الشركة توفير نظم معلومات للمعرفة المتوفرة					

	تطبيق المعرفة:(knowledge application)					
م	العبارة	اوافق بشدة	اوافق	محايد	لا اوافق	لا اوافق بشدة
1	تطبق شر كتنا معارف مبنية علي التجارب والخبرات					
2	تستخدم شركتنا المعرفة المتاحة لتطوير الانتاجية					
3	تستخدم شركتنا مجموعة انشطة مبنية علي المعرفة المتاحة لحل المشاكل الجديدة					
4	تستخدم شركتنا انشطة مبنية علي المعلومات المتاحة لتطوير منتج جديد					

القسم الثاني: الميزة التنافسية: (المرونة , التسليم , الجودة , التكلفة)

الرجاء وضع علامة (✓) امام الخيار الذي يناسب وجهه نظرك في العبارة المذكورة

المرونة: (flexibility)

م	العبارات	اوافق بشدة	اوافق	محايد	لا اوافق	لا اوافق بشدة
1	لدي الشركة القدرة علي الاستجابة السريعة لحاجات العملاء					
2	تستجيب الشركة بسهولة لرغبات العملاء فى الوقت المحدد					
3	تستجيب الشركة بشكل فعال للتغيرات فى الاسواق					
4	لدي الشركة القدرة علي الوفاء بتلبية حاجات ورغبات مختلف عملائها					
	التسليم :					
1	توفر شركتنا وقت قصير للتسليم					
2	تقدم الشركة لعملائها الرئيسيين خدمات بمستوى عالي					
3	في شركتنا هنالك دقة في عملية التسليم					
4	لدي شركتنا الجاهزية للتسليم في اي وقت					
	الجودة :quality **رجاء قيم الجودة الخاصة بشركتك مقارنة بالمنافسين الرئيسيين لك** **من خلال الثلاث سنوات الاخيرة مقارنة بالمنافسين الرئيسيين**	افضل بكثير	افضل	لا ادري	أسوأ	أسوأ بكثير
1	تقدم منتجات متجددة					
2	تقدم منتجات موثوقة					
3	تقدم منتجات متوافقة مع مواصفات الزبون					

	التكلفة: قيم التكلفة الخاصة بشركتك مقارنة بالمنافسيين لك من خلال الثلاث سنوات الاخيرة مقارنة بالمنافسين الرئيسيين	افضل بكثير	افضل	لا ادري	أسوأ	أسوأ بكثير
1	تكلفة الانتاج					
2	الحد الادني من المخزون					
3	تحسين الانتاجية					
4	فعالية استخدام المنتج					

القسم الثالث : القدرات الابداعية : (الابداع الجزرى , الابداع المتدرج)

الرجاء وضع علامة (✓) امام الخيار الذي يناسب وجهه نظرك فى العبارة المذكورة

الابداع المتدرج

م	العبارات	اوافق بشدة	اوافق	محايد	لا اوافق	لا اوافق بشدة
1	تقوم شركتنا بعمليات تحسين مستمر للمنتجات					
2	تقوم شركتنا بعمليات تسليم المنتجات الحالية					
3	تحسن شركتنا من كفاءة المنتجات التي يتم تقديمها					
4	في شركتنا توجد تغيير فى الجوانب الملموسة باستخدام التكنولوجيا الحديثة					
	الابداع الجزري					
1	منتجات التي تقدمها الشركة تعتبر جديدة كلياً					
2	المنتجات التي تقدمها الشركة جديدة مقارنة بالمنافسين					
3	المنتجات الجديدة التى تقدمها الشركة تتسم بالابتكار					

القسم الرابع : تكنولوجيا المعلومات

الرجاء وضع علامة (✓) امام الخيار الذي يناسب وجهه نظرك في العبارة المذكورة.

م	العبارات	اوافق بشدة	اوافق	محايد	لا اوافق	لا اوافق بشدة
1	تمتلك شركتنا تكنولوجيا حديثة					
2	تمتلك شركتنا التكنولوجيا لتعزيز جودة المنتجات فى كل الاقسام					
3	تمتلك شركتنا وسائل تقنية يسهل التعامل معها					
4	تمتلك شركتنا تقنية المعلومات لتدعيم العمل					

الجزء الثالث : المعلومات الشخصية :

فضلا ضع علامة (✓) تحت الاجابة التى تناسب اجابتك

1- النوع:

ذكر	أنثي

2- العمر:

20- 30 سنة	31- 40سنة	41- 50 سنة	51- 60سنة	أكثر من 60 سنة

3- عنوان الوظيفة:

مدير عام	مدير فرع	نائب مدير	مدير ادارة

4- المؤهل العلمي:

ثانوي	دبلوم وسيط	بكلاريوس	دبلوم عالى	ماجستير	دكتوراه

5- سنوات الخبرة

اقل من 5 سنة	من 5- 10 سنة	من 11- 15 سنة	من16– 20 سنة	أكثر من 20 سنة

مع خالص الشكر والتقدير

Part one: personnel information.

Please mark (√) in front of a phrase that suits you

1.1 Sex

Male ☐

Female ☐

2. Age

Age group	**Less than**	**30- 40**	**41- 50**	**51- 60**	**More than 60**	
choice						

3. Jobs title

Director general	Branch manager	Deputy Director	Director of the Department

4. Academic Qualification:

Secondary	Diploma	**Bachelor**	**Higher diploma**	**Master**	**PHD**

5. Years of Experience:

5 or less	5- 10	11- 15	16- 20	More than 20

6. The nature of the company's activity:

Industrial	Service

7. Company ownership:

Public company	Private company	Mixed company

8. Number of employees:

Less than 50	50- 100	101- 150	151- 200	More than 200

9. Number of competitors:

Less than 5	5- 10	10- 15	15- 20	More than 20

Part two items of variables:

Here we assess the degree of knowledge management process, (acquisition, sharing, storing and application) in your firm. Please tick (√) in appropriate responsible box according to the best of your knowledge, using the scale below.

Strongly Disagree	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***
1	**2**	**3**	**4**	**5**

Knowledge acquisition

NO	Items	Strongly Agree	*Agree*	*Neutral*	*Disagree*	*Strongly Disagree*
1	in our company employees use the internet to obtain the information necessary to perform their duties					
2	The company relies on external sources to obtain information about new products					
3	our company has the ability to convert the information available from competitors to new products					
4	our company has stored information that can be converted into data that helps employees perform their tasks					
	Knowledge sharing:					
5	Collective work is encourage in our company providing information at the company level					
6	Our company provides technology systems supported by internet network					
7	The business environment encourage the sharing of information					
8	The company shares information with suppliers and customers					
	Knowledge storing:					
9	My firm utilizes various print materials (such as newsletters, handbooks, annual reports, manuals and etc…..) to store the knowledge					

10	My firm utilizes audios, videos to store the knowledge					
11	My firm has good IT infrastructure to store the knowledge					
12	The company can provide information systems for available knowledge					
	Knowledge application:					
13	My firm applying experiential knowledge					
14	My firm uses available knowledge to improve it is productivity					
15	My firm undertakes a set of activities designed for using the available knowledge to solve new problems					
16	My firm undertakes a set of activities designed for development new products					

2. Competitive advantage:In this part we assess the degree of competitive advantage (cost, quality, delivery and flexibility

Cost:

NO	Items	*Strongly Agree*	*Agree*	*Neutral*	*Disagree*	*Strongly Disagree*
1	my firm has low cost of production than others					
2	my firm operates low inventory					
3	my firm produces at maximum capacity utilization					
4	my firm operates low overhead cost					
	Quality:					
5	we are able to compete based on quality					
6	we offer products that are very durable					
7	we offer high quality products to our customers					
	Flexibility:					
8	our firm reducing the time for market acceptance of an services					
9	our firm increasing the speed at which we respond to customer requests					
10	our firm tracking customer trends					
11	our firm improving relationship with customers					

	Delivery:					
12	providing short time delivery					
13	dependability delivery promise					
14	delivery accuracy					
15	delivery availability (the probability that item will be available in stock at order time					

3. Innovation capability:Here we assess the innovation capabilities (radical and incremental) please tick your response using the scale

Radical innovation:

NO	Items	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	The products offered by the company are entirely new					
2	The products offered by the company are new compared to competitors					
3	The company's new products are innovative					
	Incremental:					
4	my firm continuously improves the maintenance processes					
5	my firm improves the efficiency of the products and services that are delivered					
6	my firm contributes to a higher degree of usage and effectiveness of the asset					
7	In our company there is a change in the concrete aspects using modern technology					

4. Information technology:

Here we assess the information technology please tick your response

No	Items	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
1	My firm uses recent technology					
2	My firm uses recent technology promotes our business relation with the society					
3	IT tools in my firm are simple to use and have user friendly interface					
4	In my firm IT tools are used to support collaborative work (e.g. video conferencing systems, communication)					

in our company employees use the internet to obtain the information necessary to perform their duties

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	2	1.0	1.0	1.0
	غيرموافق	11	5.3	5.3	6.3
	محايد	23	11.1	11.1	17.4
	موافق	76	36.7	36.7	54.1
	موافقبشدة	95	45.9	45.9	100.0
	Total	207	100.0	100.0	

The company relies on external sources to obtain information about new products

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	7	3.4	3.4	3.4
	غيرموافق	35	16.9	16.9	20.3
	محايد	29	14.0	14.0	34.3
	موافق	76	36.7	36.7	71.0
	موافقبشدة	60	29.0	29.0	100.0
	Total	207	100.0	100.0	

our company has the ability to convert the information available from competitors to new products

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	2	1.0	1.0	1.0
	غيرموافق	16	7.7	7.7	8.7
	محايد	32	15.5	15.5	24.2
	موافق	82	39.6	39.6	63.8
	موافقبشدة	75	36.2	36.2	100.0
	Total	207	100.0	100.0	

our company has stored information that can be converted into data that helps employees perform their tasks

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	2	1.0	1.0	1.0
	غيرموافق	12	5.8	5.8	6.8
	محايد	24	11.6	11.6	18.4
	موافق	83	40.1	40.1	58.5
	موافقبشدة	86	41.5	41.5	100.0
	Total	207	100.0	100.0	

My firm utilizes various print materials (such as newsletters, handbooks, annual reports, manuals and etc…..) to store the knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	8	3.9	3.9	3.9
	غيرموافق	11	5.3	5.3	9.2
	محايد	26	12.6	12.6	21.7
	موافق	75	36.2	36.2	58.0
	موافقبشدة	87	42.0	42.0	100.0
	Total	207	100.0	100.0	

My firm utilizes audios, videos to store the knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	5	2.4	2.4	2.4
	غيرموافق	36	17.4	17.4	19.8
	محايد	50	24.2	24.2	44.0
	موافق	63	30.4	30.4	74.4
	موافقبشدة	53	25.6	25.6	100.0
	Total	207	100.0	100.0	

My firm has good IT infrastructure to store the knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	8	3.9	3.9	3.9
	غيرموافق	24	11.6	11.6	15.5
	محايد	39	18.8	18.8	34.3
	موافق	75	36.2	36.2	70.5
	موافقبشدة	61	29.5	29.5	100.0
	Total	207	100.0	100.0	

The company can provide information systems for available knowledge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	8	3.9	3.9	3.9
	غيرموافق	15	7.2	7.2	11.1
	محايد	25	12.1	12.1	23.2
	موافق	85	41.1	41.1	64.3
	موافقبشدة	74	35.7	35.7	100.0
	Total	207	100.0	100.0	

my firm produces at maximum capacity utilization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	4	1.9	1.9	1.9
	غيرموافق	14	6.8	6.8	8.7
	محايد	41	19.8	19.8	28.5
	موافق	87	42.0	42.0	70.5
	موافقبشدة	61	29.5	29.5	100.0
	Total	207	100.0	100.0	

my firm operates low overhead cost

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	2	1.0	1.0	1.0
	غيرموافق	12	5.8	5.8	6.8
	محايد	46	22.2	22.3	29.1
	موافق	75	36.2	36.4	65.5
	موافقبشدة	71	34.3	34.5	100.0
	Total	206	99.5	100.0	
Missing	System	1	.5		
Total		207	100.0		

our firm reducing the time for market acceptance of an services

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	3	1.4	1.4	1.4
	غيرموافق	17	8.2	8.2	9.7
	محايد	30	14.5	14.5	24.2
	موافق	89	43.0	43.0	67.1
	موافقبشدة	68	32.9	32.9	100.0
	Total	207	100.0	100.0	

our firm increasing the speed at which we respond to customer requests

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	5	2.4	2.4	2.4
	غيرموافق	8	3.9	3.9	6.3
	محايد	44	21.3	21.3	27.5
	موافق	79	38.2	38.2	65.7
	موافقبشدة	71	34.3	34.3	100.0
	Total	207	100.0	100.0	

our firm tracking customer trends

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	7	3.4	3.4	3.4
	غيرموافق	10	4.8	4.8	8.2
	محايد	42	20.3	20.3	28.5
	موافق	76	36.7	36.7	65.2
	موافقبشدة	72	34.8	34.8	100.0
	Total	207	100.0	100.0	

our firm improving relationship with customers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	7	3.4	3.4	3.4
	غيرموافق	21	10.1	10.1	13.5
	محايد	43	20.8	20.8	34.3
	موافق	75	36.2	36.2	70.5
	موافقبشدة	61	29.5	29.5	100.0
	Total	207	100.0	100.0	

we offer products that are highly reliable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	7	3.4	3.4	3.4
	غيرموافق	9	4.3	4.3	7.7
	محايد	20	9.7	9.7	17.4
	موافق	96	46.4	46.4	63.8
	موافقبشدة	75	36.2	36.2	100.0
	Total	207	100.0	100.0	

we offer products that are very durable

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	8	3.9	3.9	3.9
	غيرموافق	6	2.9	2.9	6.8
	محايد	31	15.0	15.0	21.7
	موافق	86	41.5	41.5	63.3
	موافقبشدة	76	36.7	36.7	100.0
	Total	207	100.0	100.0	

Provide products compatible with customer specifications

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	8	3.9	3.9	3.9
	غيرموافق	13	6.3	6.3	10.1
	محايد	26	12.6	12.6	22.7
	موافق	85	41.1	41.1	63.8
	موافقبشدة	75	36.2	36.2	100.0
	Total	207	100.0	100.0	

providing short time delivery

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	10	4.8	4.8	4.8
	غيرموافق	12	5.8	5.8	10.6
	محايد	45	21.7	21.7	32.4
	موافق	82	39.6	39.6	72.0
	موافقبشدة	58	28.0	28.0	100.0
	Total	207	100.0	100.0	

dependability delivery promise

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	7	3.4	3.4	3.4
	غيرموافق	7	3.4	3.4	6.8
	محايد	46	22.2	22.2	29.0
	موافق	96	46.4	46.4	75.4
	موافقبشدة	51	24.6	24.6	100.0
	Total	207	100.0	100.0	

my firm improves the efficiency of the products and services that are delivered

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	3	1.4	1.4	1.4
	غيرموافق	3	1.4	1.4	2.9
	محايد	25	12.1	12.1	15.0
	موافق	107	51.7	51.7	66.7
	موافقبشدة	69	33.3	33.3	100.0
	Total	207	100.0	100.0	

my firm contributes to a higher degree of usage and effectiveness of the asset

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	6	2.9	2.9	2.9
	غيرموافق	11	5.3	5.3	8.2
	محايد	33	15.9	15.9	24.2
	موافق	84	40.6	40.6	64.7
	موافقبشدة	73	35.3	35.3	100.0
	Total	207	100.0	100.0	

In our company there is a change in the concrete aspects using modern technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	2	1.0	1.0	1.0
	غيرموافق	16	7.7	7.7	8.7
	محايد	35	16.9	16.9	25.6
	موافق	82	39.6	39.6	65.2
	موافقبشدة	72	34.8	34.8	100.0
	Total	207	100.0	100.0	

The products offered by the company are entirely new

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	5	2.4	2.4	2.4
	غيرموافق	32	15.5	15.5	17.9
	محايد	44	21.3	21.3	39.1
	موافق	62	30.0	30.0	69.1
	موافقبشدة	64	30.9	30.9	100.0
	Total	207	100.0	100.0	

The products offered by the company are new compared to competitors

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	5	2.4	2.4	2.4
	غيرموافق	21	10.1	10.1	12.6
	محايد	45	21.7	21.7	34.3
	موافق	79	38.2	38.2	72.5
	موافقبشدة	57	27.5	27.5	100.0
	Total	207	100.0	100.0	

My firm uses recent technology

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	8	3.9	3.9	3.9
	غيرموافق	12	5.8	5.8	9.7
	محايد	33	15.9	15.9	25.6
	موافق	81	39.1	39.1	64.7
	موافقبشدة	73	35.3	35.3	100.0
	Total	207	100.0	100.0	

My firm uses recent technology promotes our business relation with the society

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	10	4.8	4.8	4.8
	غيرموافق	15	7.2	7.2	12.1
	محايد	39	18.8	18.8	30.9
	موافق	78	37.7	37.7	68.6
	موافقبشدة	65	31.4	31.4	100.0
	Total	207	100.0	100.0	

IT tools in my firm are simple to use and have user friendly interface

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	8	3.9	3.9	3.9
	غيرموافق	8	3.9	3.9	7.7
	محايد	40	19.3	19.3	27.1
	موافق	78	37.7	37.7	64.7
	موافقبشدة	73	35.3	35.3	100.0
	Total	207	100.0	100.0	

In my firm IT tools are used to support collaborative work (e.g. video conferencing systems, communication)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	غيرموافقبشدة	7	3.4	3.4	3.4
	غيرموافق	17	8.2	8.3	11.8
	محايد	28	13.5	13.7	25.5
	موافق	85	41.1	41.7	67.2
	موافقبشدة	67	32.4	32.8	100.0
	Total	204	98.6	100.0	
Missing	System	3	1.4		
Total		207	100.0		

النوع

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	زكر	136	65.7	65.7	65.7
	انثي	71	34.3	34.3	100.0
	Total	207	100.0	100.0	

العمر

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-30سنة	68	32.9	32.9	32.9
	31-40سنة	75	36.2	36.2	69.1
	41-50سنة	48	23.2	23.2	92.3
	51-60سنة	14	6.8	6.8	99.0
	سنة60 اكثرمن	2	1.0	1.0	100.0
	Total	207	100.0	100.0	

عنوان الوظيفة

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	مديرعام	8	3.9	3.9	3.9
	مديرفرع	29	14.0	14.0	17.9
	نائبمدير	62	30.0	30.0	47.8
	مديرادارة	107	51.7	51.7	99.5
	5	1	.5	.5	100.0
	Total	207	100.0	100.0	

المؤهل العلمي

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ثانوي	4	1.9	1.9	1.9
	دبلوموسيط	12	5.8	5.8	7.8
	بكلاريوس	86	41.5	41.7	49.5
	دبلومعالي	22	10.6	10.7	60.2
	ماجستير	64	30.9	31.1	91.3
	دكتوراه	18	8.7	8.7	100.0
	Total	206	99.5	100.0	
Missing	System	1	.5		
Total		207	100.0		

سنوات الخبرة

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	سنوات 5 اقلمن	43	20.8	20.8	20.8
	سنة10-5 من	54	26.1	26.1	46.9
	سنة15-11 من	53	25.6	25.6	72.5
	سنة20-16 من	26	12.6	12.6	85.0
	سنة 20 اكثرمن	31	15.0	15.0	100.0
	Total	207	100.0	100.0	

طبيعة نشاط الشركة

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	تجاري	7	3.4	3.4	3.4
	صناعي	200	96.6	96.6	100.0
	Total	207	100.0	100.0	

ملكية الشركة

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	شركةعامة	71	34.3	34.3	34.3
	شركةخاصة	109	52.7	52.7	87.0
	شركةمختلطة	27	13.0	13.0	100.0
	Total	207	100.0	100.0	

عدد العاملين بالشركة

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	موظف50اقلمن	27	13.0	13.0	13.0
	موظف100الي50من	34	16.4	16.4	29.5
	موظف150الي101من	33	15.9	15.9	45.4
	موظف200الي151 من	33	15.9	15.9	61.4
	موظف200 اكثرمن	80	38.6	38.6	100.0
	Total	207	100.0	100.0	

خبرة الشركة فى المجال

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	سنوات5 اقلمن	15	7.2	7.2	7.2
	10الياقلمن5من	37	17.9	17.9	25.1
	سنة15الياقلمن 10 من	53	25.6	25.6	50.7
	سنة20الياقلمن15 من	27	13.0	13.0	63.8
	سنة 20 اكثرمن	75	36.2	36.2	100.0
	Total	207	100.0	100.0	

عدد المنافسين في نفس المجال

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	منافس5 اقلمن	47	22.7	22.7	22.7
	منافس10 الياقلمن5من	47	22.7	22.7	45.4
	منافس15الياقلمن10 من	33	15.9	15.9	61.4
	منافس20الياقلمن15 من	27	13.0	13.0	74.4
	منافسفاكثر20	53	25.6	25.6	100.0
	Total	207	100.0	100.0	

Independent variable (KM)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	91
Number of distinct parameters to be estimated:	32
Degrees of freedom (91 - 32):	59

Result (Default model)

Minimum was achieved
Chi-square = 104.601
Degrees of freedom = 59
Probability level = .000

Scalar Estimates (Group number 1 - Default model)

Maximum Likelihood Estimates

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Knowledge_application1	<---	Knowledge application	1.000				
Knowledge_application2	<---	Knowledge application	1.018	.071	14.275	***	par_1
Knowledge_application3	<---	Knowledge application	.994	.075	13.230	***	par_2
Knowledge_storing1	<---	Knowledge storing	1.000				
Knowledge_storing2	<---	Knowledge storing	1.263	.167	7.558	***	par_3
Knowledge_storing3	<---	Knowledge storing	1.418	.174	8.137	***	par_4
Knowledge_storing4	<---	Knowledge storing	1.458	.172	8.470	***	par_5
Knowledge_sharing2	<---	Knowledge sharing	1.000				
Knowledge_sharing3	<---	Knowledge sharing	.898	.092	9.748	***	par_6
Knowledge_sharing4	<---	Knowledge sharing	.853	.096	8.862	***	par_7
Knowledge_acquisition1	<---	Knowledge acquisition	1.000				
Knowledge_acquisition3	<---	Knowledge acquisition	1.628	.309	5.264	***	par_8
Knowledge_acquisition4	<---	Knowledge acquisition	1.165	.220	5.303	***	par_9

Co variances: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Knowledge application	<-->	Knowledge storing	.252	.048	5.205	***	par_10
Knowledge application	<-->	Knowledge sharing	.308	.056	5.489	***	par_11
Knowledge application	<-->	Knowledge acquisition	.067	.032	2.104	.035	par_12
Knowledge storing	<-->	Knowledge sharing	.396	.066	5.950	***	par_13
Knowledge storing	<-->	Knowledge acquisition	.116	.034	3.436	***	par_14
Knowledge sharing	<-->	Knowledge acquisition	.174	.045	3.852	***	par_15

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	32	104.601	59	.000	1.773
Saturated model	91	.000	0		
Independence model	13	1176.142	78	.000	15.079

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.042	.932	.895	.604
Saturated model	.000	1.000		
Independence model	.334	.386	.284	.331

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.911	.882	.959	.945	.958
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.756	.689	.725
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	45.601	20.942	78.108
Saturated model	.000	.000	.000
Independence model	1098.142	990.875	1212.822

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.508	.221	.102	.379
Saturated model	.000	.000	.000	.000
Independence model	5.709	5.331	4.810	5.887

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.061	.042	.080	.162
Independence model	.261	.248	.275	.000

Dependent variable (CA)

Regression Weights: (Group number 1 - Default model)

		Estimate	S.E.	C.R.	P	Label
Cost1	<--- Cost	1.000				
Cost2	<--- Cost	1.176	.098	11.997	***	par_1
Cost3	<--- Cost	1.047	.095	11.061	***	par_2
Cost4	<--- Cost	.872	.093	9.346	***	par_3
Flexibility1	<--- Flexibility	1.000				
Flexibility2	<--- Flexibility	1.075	.083	13.008	***	par_4
Flexibility3	<--- Flexibility	1.136	.088	12.940	***	par_5
Flexibility4	<--- Flexibility	1.170	.093	12.555	***	par_6
Quality2	<--- Quality	1.000				
Quality3	<--- Quality	.927	.081	11.448	***	par_7
Delivery1	<--- Delivery	1.000				
Delivery2	<--- Delivery	.974	.117	8.304	***	par_8

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	30	132.092	48	.000	2.752
Saturated model	78	.000	0		
Independence model	12	1469.272	66	.000	22.262

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.051	.906	.848	.558
Saturated model	.000	1.000		
Independence model	.398	.323	.200	.273

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.910	.876	.941	.918	.940
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.727	.662	.684
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	84.092	53.648	122.192
Saturated model	.000	.000	.000
Independence model	1403.272	1282.250	1531.682

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.641	.408	.260	.593
Saturated model	.000	.000	.000	.000
Independence model	7.132	6.812	6.225	7.435

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.092	.074	.111	.000
Independence model	.321	.307	.336	.000

The mediating role of innovation capabilities between knowledge management and competitive advantage

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Incremental1	<---	Incremental	1.000				
Incremental2	<---	Incremental	.793	.076	10.462	***	par_1
Incremental3	<---	Incremental	1.228	.095	12.896	***	par_2
Incremental4	<---	Incremental	.987	.091	10.806	***	par_3
Radical_innovation1	<---	Radical innovation	1.000				
Radical_innovation2	<---	Radical innovation	.842	.069	12.272	***	par_4
Radical_innovation3	<---	Radical innovation	.978	.077	12.662	***	par_5

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	15	30.371	13	.004	2.336
Saturated model	28	.000	0		
Independence model	7	750.806	21	.000	35.753

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.029	.962	.918	.447
Saturated model	.000	1.000		
Independence model	.433	.407	.209	.305

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.960	.935	.976	.962	.976
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.619	.594	.604
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	17.371	5.000	37.436
Saturated model	.000	.000	.000
Independence model	729.806	643.963	823.056

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.147	.084	.024	.182
Saturated model	.000	.000	.000	.000
Independence model	3.645	3.543	3.126	3.995

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.081	.043	.118	.083
Independence model	.411	.386	.436	.000

Output moderation (IT)

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	10
Number of distinct parameters to be estimated:	8
Degrees of freedom (10 - 8):	2

Result (Default model)

Minimum was achieved
Chi-square = 41.137
Degrees of freedom = 2
Probability level = .000

Regression Weights: (Group number 1 - Default model)

	Estimate	S.E.	C.R.	P	Label
Information_technology1 <--- Information technology	1.000				
Information_technology2 <--- Information technology	1.105	.061	18.256	***	par_1
Information_technology3 <--- Information technology	.961	.060	16.133	***	par_2
Information_technology4 <--- Information technology	.954	.062	15.393	***	par_3

Model Fit Summary **CMIN**

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	8	41.137	2	.000	20.569
Saturated model	10	.000	0		
Independence model	4	670.290	6	.000	111.715

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.038	.919	.593	.184
Saturated model	.000	1.000		
Independence model	.647	.369	-.051	.222

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.939	.816	.941	.823	.941
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.333	.313	.314
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	.200	.190	.106	.310
Saturated model	.000	.000	.000	.000
Independence model	3.254	3.225	2.830	3.655

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.308	.230	.394	.000
Independence model	.733	.687	.781	.000

Output full model

Computation of degrees of freedom (Default model)

Number of distinct sample moments:	210
Number of distinct parameters to be estimated:	55
Degrees of freedom (210 - 55):	155

Result (Default model)

Minimum was achieved
Chi-square = 255.517
Degrees of freedom = 155
Probability level = .000

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Knowledge_application1	<---	Knowledge application	1.000				
Knowledge_application2	<---	Knowledge application	1.029	.071	14.437	***	par_1
Knowledge_application3	<---	Knowledge application	1.004	.075	13.319	***	par_2
Knowledge_storing1	<---	Knowledge storing	1.000				
Knowledge_storing2	<---	Knowledge storing	1.267	.167	7.579	***	par_3
Knowledge_storing3	<---	Knowledge storing	1.410	.174	8.120	***	par_4
Knowledge_storing4	<---	Knowledge storing	1.462	.172	8.487	***	par_5
Knowledge_sharing2	<---	Knowledge sharing	1.000				
Knowledge_sharing3	<---	Knowledge sharing	.898	.091	9.841	***	par_6
Knowledge_sharing4	<---	Knowledge sharing	.855	.096	8.949	***	par_7
Knowledge_acquisition1	<---	Knowledge acquisition	1.000				
Knowledge_acquisition3	<---	Knowledge acquisition	1.694	.322	5.262	***	par_8
Knowledge_acquisition4	<---	Knowledge acquisition	1.143	.216	5.285	***	par_9
Incremental1	<---	Incremental	1.000				
Incremental2	<---	Incremental	.808	.075	10.720	***	par_10
Incremental3	<---	Incremental	1.216	.094	12.968	***	par_11
Incremental4	<---	Incremental	.988	.091	10.845	***	par_12
Radical_innovation1	<---	Radical innovation	1.000				
Radical_innovation2	<---	Radical innovation	.846	.069	12.322	***	par_13
Radical_innovation3	<---	Radical innovation	.991	.077	12.828	***	par_14

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	55	255.517	155	.000	1.648
Saturated model	210	.000	0		
Independence model	20	2135.442	190	.000	11.239

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.045	.893	.855	.659
Saturated model	.000	1.000		
Independence model	.323	.311	.238	.281

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.880	.853	.949	.937	.948
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.816	.718	.774
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	100.517	60.529	148.407
Saturated model	.000	.000	.000
Independence model	1945.442	1800.486	2097.787

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	1.240	.488	.294	.720
Saturated model	.000	.000	.000	.000
Independence model	10.366	9.444	8.740	10.183

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.056	.044	.068	.202
Independence model	.223	.214	.232	.000

Output of mediating role of radical between KM& CA

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Cost	<---	Knowledge application	.244	.094	2.589	.010	par_28
Flexibility	<---	Knowledge application	.207	.093	2.224	.026	par_29
Quality	<---	Knowledge application	.270	.085	3.161	.002	par_30
Delivery	<---	Knowledge application	.175	.099	1.766	.077	par_31
Cost	<---	Knowledge storing	-.271	.219	-1.236	.216	par_32
Flexibility	<---	Knowledge storing	.082	.213	.385	.700	par_33
Quality	<---	Knowledge storing	.182	.189	.963	.336	par_34
Delivery	<---	Knowledge storing	.133	.226	.590	.555	par_35
Cost	<---	Knowledge sharing	.375	.187	2.002	.045	par_36
Flexibility	<---	Knowledge sharing	.392	.185	2.118	.034	par_37
Quality	<---	Knowledge sharing	.093	.159	.581	.561	par_38
Delivery	<---	Knowledge sharing	.321	.195	1.647	.099	par_39
Cost	<---	Knowledge acquisition	.427	.167	2.554	.011	par_40
Flexibility	<---	Knowledge acquisition	-.108	.154	-.705	.481	par_41
Quality	<---	Knowledge acquisition	.035	.136	.260	.795	par_42
Delivery	<---	Knowledge acquisition	-.119	.164	-.728	.466	par_43

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	88	756.215	377	.000	2.006
Saturated model	465	.000	0		
Independence model	30	3820.735	435	.000	8.783

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.143	.812	.768	.658
Saturated model	.000	1.000		
Independence model	.323	.241	.189	.226

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.802	.772	.890	.871	.888
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	379.215	304.687	461.519
Saturated model	.000	.000	.000
Independence model	3385.735	3191.866	3586.950

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	3.671	1.841	1.479	2.240
Saturated model	.000	.000	.000	.000
Independence model	18.547	16.436	15.494	17.412

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.070	.063	.077	.000
Independence model	.194	.189	.200	.000

Mediating role of incremental between KM & CA

Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
Incremental	<---	Knowledge application	-.443	2.765	-.160	.873	par_21
Incremental	<---	Knowledge storing	-9.342	9.373	-.997	.319	par_22
Incremental	<---	Knowledge sharing	10.803	15.197	.711	.477	par_23
Incremental	<---	Knowledge acquisition	-6.493	19.376	-.335	.738	par_24
Radical_	<---	Knowledge application	3.414	5.164	.661	.509	par_25
Radical_	<---	Knowledge storing	.387	17.406	.022	.982	par_26
Radical_	<---	Knowledge sharing	-10.911	28.398	-.384	.701	par_27
Radical_	<---	Knowledge acquisition	23.655	36.409	.650	.516	par_28

CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	52	339.551	158	.000	2.149
Saturated model	210	.000	0		
Independence model	20	2135.442	190	.000	11.239

RMR, GFI

Model	RMR	GFI	AGFI	PGFI
Default model	.054	.862	.816	.648
Saturated model	.000	1.000		
Independence model	.323	.311	.238	.281

Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.841	.809	.908	.888	.907
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

Parsimony-Adjusted Measures

Model	PRATIO	PNFI	PCFI
Default model	.832	.699	.754
Saturated model	.000	.000	.000
Independence model	1.000	.000	.000

NCP

Model	NCP	LO 90	HI 90
Default model	181.551	132.280	238.570
Saturated model	.000	.000	.000
Independence model	1945.442	1800.486	2097.787

FMIN

Model	FMIN	F0	LO 90	HI 90
Default model	1.648	.881	.642	1.158
Saturated model	.000	.000	.000	.000
Independence model	10.366	9.444	8.740	10.183

RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.075	.064	.086	.000
Independence model	.223	.214	.232	.000