INFLUENCE OF INNOVATION ECOSYSTEM ON KNOWLEDGE ENTREPRENEURSHIP AND INNOVATION PERFORMANCE OF MANUFACTURING FIRMS IN KENYA

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A THESIS SUBMITTED TO THE SCHOOL OF BUSINESS IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE CONFERMENT OF THE DEGREE OF DOCTOR OF PHILOSOPHY (ENTREPRENEURSHIP OPTION) IN BUSINESS MANAGEMENT OF KARATINA UNIVERSITY

DECEMBER, 2020

DECLARATION

Declaration by the student

This thesis is my original work and has not been presented for conferment of a degree in any other University or for any other award.

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Signed This date

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Declaration by the supervisors

We confirm that the work reported in this thesis report was carried out by the candidate under our supervision and has been submitted with our approval as university supervisors.

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DEDICATION

The report is dedicated to my family and colleagues for their constant and immense moral support.

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I sincerely convey my gratitude to Professor Irura Nganga and Dr Maina Kiganane who were instrumental in shaping this thesis. I also acknowledge all the firms, management and staff who participated, facilitated and provided data without which this study could not be possible. Special acknowledgement also to go the faculty members and classmates whose presence, diversity of character, valuable contribution and ideas made the process interesting, thought provoking and memorable.

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ABBREVIATIONS AND ACRONYMS

AVE - Average Variance Extracted

CFA - Confirmatory Factor Analysis

CFI - Comparative Fix Index

CIP - Competitive Industrial Performance

COYA - Company of the Year Award

CR - Composite Reliability

DEA – Data Envelopment Analysis

GDP - Gross Domestic Product

DV - Discriminant Validity

GII - Global Innovation Index

ICT – Information Communication and Technology

IE – Innovation Ecosystem

INSEAD – Institut Europeen d'Administration des Affaires

IO - Innovation Output

IP – Innovation performance

IT - Information and Technology

KAM - Kenya Association of Manufacturers

KE – Knowledge Entrepreneurship

KEIE - Knowledge Entrepreneurship and Innovation Ecosystem

KM - Knowledge Management

OL – Organization Learning

OC- Organization Culture

NACOSTI - National Commission for Science, Technology and Innovation

NIS – National Innovation System

PLS - Partial Least Square

R&D - Research and Development

SEM - Structural Equation Model

SEM-PLS - Structural Equation Model-Partial Least Square

SFA - Stochastic Frontier Analysis

SLE - Supportive Learning Environment

SPSS - Statistical Package for Social Scientists

SRMR - Standard Root Mean Square Residual

SRC - Square Root of Correlation

UNIDO - United Nations Industrial Organization

VIF - Variance Inflation Factor

WIPO – World Intellectual Property Organization

ABSTRACT

The last few decades have been characterized by a turbulent and highly competitive environment at global and local levels which has left businesses exposed to more intense vulnerabilities. The situation is more pronounced in the manufacturing sector which calls for the development of a systematic and comprehensive approach to address the dynamics involved. The purpose of the study was therefore to investigate the influence of Innovation Ecosystem (IE) on Knowledge Entrepreneurship (KE) and Innovation Performance (IP) in manufacturing firms with a focus on major industrial counties in Kenya. Specifically, the study sought to; determine influence of KE on IP, investigate influence of IE on IP and to determine moderating effect of IE on KE and IP in manufacturing firms in Kenya. The theoretical underpinning in this study were innovation, complexity and innovation diffusion theories. The philosophical ideology that guided the study was pragmatism. Mixed method design was used for the study. The target population was 2,484 employees drawn from 828 firms. Multi-stage sampling was employed to sample 295 employees drawn from 101 firms. Primary data was collected using semi-structured questionnaires, interview schedules and checklists. Data was analyzed using descriptive statistics, hieratical multiple regression structural equation model and partial least square. A pilot test was conducted on 22 manufacturing firms to determine the validity and reliability of research instruments. Smart partial least square, Stata and statistical package for social scientists were the main software used for data analysis. Results were presented in graphs, tables and path diagrams. Knowledge entrepreneurship and innovation ecosystem were each found to have contributed 64.54% and 66.74% respectively to innovation performance. The interaction of knowledge entrepreneurship and innovation ecosystem contributed to 72.39% of innovation performance thus confirming the moderating effect. It is concluded that both knowledge entrepreneurship and innovation ecosystem separately have each a significant influence on innovation performance, but their interaction has greater influence thus confirming the innovation ecosystem as a moderator. It is therefore recommended that the operating environment should be enhanced for improved competitiveness of the manufacturing sector. The study is useful to members of the Kenya Association of Manufacturers, management in manufacturing firms, current and potential investors and entrepreneurs, policymakers and scholars. Further study should be carried out on how customers' and suppliers' information can be enhanced for a more enriched KE and on how trust can be managed in Innovation Ecosystem.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

The last two decades have been characterized by a turbulent and highly competitive environment at local and global levels which have left firms exposed to the more intense vulnerabilities. The competitive environment is evidenced by mass customization, rapid change in technology, shortening of product life cycles, globalization of markets and entry of international competitors (Prajogo, Laosirihongthong, Sohal & Boon-itt, 2007).

The scenario has cast doubts on the sustainability of the current business models. This calls for new solutions to tackle the challenges faced. The major exit route from this situation is through enhancing Innovation Performance (IP) to guarantee future survival.

Innovation performance is the degree to which enterprises innovate in terms of new products, processes, management and market (Andreeva & Kianto, 2011) in comparison with the competitors (Zelaya-Zamora & Senoo, 2013).

Innovation Performance raises the competitiveness of firms by putting them in a strategic advantage position. Innovation has therefore been hailed as a panacea for the success of enterprises in the ever-increasingly liberalized markets (Elberdin, 2017). The appropriate inputs and process efficiency in innovation can be evaluated by an investigation of innovation performance which has changed in recent times in several ways. Consumers are becoming more directly involved, technology is continually becoming the core of innovation and ecosystems are defining the types of innovativeness (Majava, Leviankangas, Kinnumen, Kess & Foit, 2016). The emergence of innovation as the driver of progress can be traced from the work of Smith in 1776, but the concept of innovation was well articulated by Schumpeter in1934 (Ogliastri & Ketelhohn, 2013). The trend in research is now moving from the general innovation to innovation performance.

1.1.1. The Global Perspective

The economies of developed nations like Britain, Germany and Japan have been propelled to greater heights of development by their capacity to manage knowledge for greater IP. These countries have increased their entrepreneurial capacities and activities through the knowledge network (Luo & Tung 2007). Despite these countries being faced with instability and uncertainty in macroeconomic conditions, entrepreneurs have overcome the institutional limitations and difficulty to penetrate the international markets through innovation (Story, Boso & Cadogan, 2015). Enterprises and researchers in these countries have been involved in search of new ways of inculcating an innovative culture by developing knowledge that propels their IP. Japan's manufacturing sector, for instance, has been successful in innovation performance due to its prowess in continuous improvement, efficiency and the ability to commercialize novel products (Sumita, 2008).

Innovation performances have greatly impacted on the growth of emerging economies. China has particularly outgrown developed economies and is highly regarded as one of the most attractive places to do business (Luo, Sun & Wang, 2011) due to its competitiveness as a result of addressing its innovation ecosystem. Innovation performance in India has improved due to policy intervention on innovation at the national level which has resulted in tackling broader social-economic issues leading to gaining of competitive advantage

(Weiss, 2011). This has resulted in an impressive development of these countries' manufacturing firms to become among the most competitive globally.

1.1.2. Manufacturing in Africa

Manufacturing firms in Africa are also not spared from the scourge of turbulence. The industry in the continent heavily relies on exhaustible natural resources and is involved in primary and extractive activities whose outputs are semi-finished products used as raw materials in developed economies. Innovation in the continent is therefore paramount in addressing sustainable development challenges and numerous innovation opportunities exist especially in the manufacturing sector (Webersik, 2009).

The situation is worse in Sub-Sahara Africa. This part of the world is the least industrialized (UNIDO, 2017). The major focus on manufacturing in this region is primarily based on extraction. Value addation in the manufacturing sector in this region is therefore important in achieving competitiveness and hence economic development. In South Africa, IP is hailed as a critical component of differentiation and sustainability, however, a report by the Department of Science and Technology (2007), in that country indicate that the nation has not fully mobilized its activities around innovation to overcome its challenges.

1.1.3. Manufacturing in East Africa

East Africa countries have developed different knowledge basis and national innovation systems. The manufacturing sector in this region is increasingly becoming knowledge-driven (The World Bank, 2007). Manufacturing trade in the East African community has been the highest in the recent past among the African regional economic communities. The World Bank Enterprise Survey (2014) shows that the likelihood to innovate in Kenya is relatively higher than other countries in the region although other countries such as Ethiopia are fast catching up.

1.1.4. Manufacturing in Kenya

The growth of manufacturing sector in Kenya has been declining despite the several blue prints developed to revive it. Kenya's Vision 2030 envisages the country becoming the dominant supplier of manufactured products in East and Central Africa through enhanced efficiency and improved competitiveness. However, the share of exports in the region from manufactured goods has been declining.

Manufacturing is one of the big four agenda in the country that focuses on transforming the sector to provide employment. The growth and development of this sector is likely to contribute to more employment opportunities, favorable terms of trade, stimulate more economic activities resulting in a diversified economy. However, this can only be realized by addressing knowledge flow, the operating environment and enhancing IP in the manufacturing sector.

Manufacturing firms in Kenya requires a systematic and comprehensive approach to address the dynamics involved. This has necessitated that they embrace innovation performance because it is crucial to their success (Dagnino, Levanti, Maina & Picone, 2015). Progressive firms are increasingly recognizing knowledge as a critical ingredient that drives innovation and competitiveness. This is because innovation utilizes knowledge by creating capacity which is a precondition for enterprise survival.

Knowledge Entrepreneurship (KE) is increasingly becoming important in driving innovation for high levels of competitiveness. The input of KE has become paramount in determining the effectiveness of innovation performance for many countries especially in the commercialization of novel products. There is need to inculcate an innovation culture by encouraging organization learning, providing the right leadership and adoption of appropriate technology which is can be brought about the development of KE. Zelay-Zamora and Senoo (2013), view knowledge creation capacity as positively related to innovation performance. The scenario has brought about the recognition of the value of knowledge creation capacity in addressing innovation performance and hence competitiveness.

The fact that innovation is complex and uncertain calls for collaborative network in order to learn from each other and increase their innovation performance (Kande, Kirira & Ngondi, 2017). The competitive landscape requires networking of firms and other actors for integrated solutions. Concerted effort from different actors to generate knowledge from within and from different external sources to generate stronger innovation ability is crucial (Yang & Wang, 2017). This has brought about the concept of Innovation Ecosystem (IE).

Innovation Ecosystem is the interaction of operating environment or the context in which the firms find them in. The IE is positively altering the fundamentals of business models, core capabilities and value addition (Celuch, Bourdean, Khayum & Countiesend, 2017). Manufacturing firms are now focusing on achieving an IE that involves universities, other firms, research groups and government agencies. However, the collaboration between different actors in the manufacturing sector is limited. Firms are facing numerous challenges such as operation inefficiency, cost management and inflexibility in responding to market changes (Ndemo & Aiko, 2016).

The innovation ecosystem involves the prevailing external conditions that determine the overall performance of a firm. These external conditions are shaped by the main stakeholders in the industry. Wright, Clarysse, Lockett and Binks (2006) believe that IE is a multi-collaboration linkage that forms a complex system between the key stakeholders. These stakeholders facilitate the flow of information leading to commercialization of knowledge which leads to improved innovation performance (Szerb, Acs, Autio, Ortega-Argiles, & Komlosi, 2013). However, the value of such collaborations and the level of operational efficiency it brings have not been adequately explored.

1.2. Statement of the Problem

Manufacturing firms in Kenya are expected to be the engine of innovation in Kenya given the level of economic activities, the intense flow and exchange of knowledge. However, the growth in the manufacturing sector has been dismal, lagging behind the overall economic growth rate and its contribution to exports has declined as a result of low competitiveness.

The low competitiveness is evidenced by the country's low Competitive Industrial Performance (CIP) index of 0.009 which is below the world's average of 0.067 while other middle-level industrial countries such as South Africa is 0.057 and India is 0.078 which are above the world average (UNIDO, 2020). The sector low competitiveness is manifested in the declining growth rate which threatens to thwart the country's ambition of becoming a globally competitive industrial nation by the year 2030. The World Bank Group (2018) report on Kenya's economic update shows that the growth rate in the sector has been declining from 3.6% to 2.7% and 0.2% in 2015, 2016 and 2017 respectively.

The low innovation levels in the manufacturing sector have put immense pressure on locally produced goods emanating from forces of globalization. This has resulted in the closing down of several manufacturing firms and others relocating to different countries due to unfavorable and uncoordinated innovation ecosystems. This has denied the country the much-needed job opportunities and multiplier effect in the economy since one job created in the manufacturing sector is likely to create between 6 to 16 jobs outside the industry. The government had envisioned creating two million jobs from the manufacturing sector in 2018, but there has been a decline of jobs created from 114,400 in 2017 to 78,400 in 2018 which is a 31% decline despite an accelerated economic growth of 6.3% in 2018 from 4.9% in 2017 (Economic Survey, 2019).

Despite the importance of IP in driving competitiveness, empirical review indicates a lack of an IP measurement model. Birchall, Chanaron, Tovstiga and Hillenbrand (2011) found that there is need to align innovation with the profitability of a firm while at the same time address contextual factors. This is further made worse by the prevailing weak linkages in the contextual factors within the innovation system which has resulted in high rate of innovation activity abandonment in the manufacturing sector. Ongwae, Mukulu & Odhiambo (2013) in their attempt to determine the influence of innovation activities and enterprise growth in Kenya based on the matrix for Economic Co-operation and

Development found that manufacturing sector has the highest abandoned innovation activities at about 40%. Sambuli and Whitt (2017) in their examination of latent and potential of innovation hubs in Africa and Asia found that there has been the failure of incorporating local knowledge in the innovation process. The study therefore sought to investigate the relationship of KE, IE and IP in manufacturing firms in Kenya while at the same time develop a new IP measurement model.

1.3. The General Objective

The purpose of this study was to investigate the influence of Innovation Ecosystem on Knowledge Entrepreneurship and Innovation Performance in manufacturing firms in Kenya.

1.3.1. The Specific Objectives

The study was guided by the following specific objectives;

1.3.1.1. To determine the influence of Knowledge Entrepreneurship on Innovation Performance in manufacturing firms in Kenya.

1.3.1.2. To investigate the influence of Innovation Ecosystem on Innovation Performance in manufacturing firms in Kenya.

1.3.1.3. To examine the extent of influence of Innovation Ecosystem on Knowledge Entrepreneurship and Innovation Performance in manufacturing firms in Kenya.

1.4. Research Hypotheses

H_{01}: Knowledge entrepreneurship does not have a significant influence on innovation performance in manufacturing firms in Kenya

H_{02}: Innovation ecosystem has no significant influence on innovation performance in manufacturing firms Kenya.

H_{03}: There is no significant influence of IE on KE and IP in Kenya manufacturing firms.

1.5. Significance of the Study in Kenyan Manufacturing Enterprises.

The manufacturing sector is crucial in the provision of employment and has strong linkage with other sectors which has huge potential for stimulating economic activities in the entire country. Innovation in this sector leads to value addition, increase in the volume of exports and improve the terms of trade of the country. Innovativeness is also likely to bring about knowledge spillovers which are necessary for promoting a structural transformation of other sectors leading to diversification of the economy which can cushion against volatility.

The study provided insight to both potential and existing entrepreneurs and researchers in the manufacturing sector on knowledge management, collaboration and how to enhance enterprise competitiveness through innovation. It also provides insight into the formulation of strategies and policies for propelling the sector to higher heights of growth and development.

The findings informed on the mechanism that needs to be put in place to reignite the sector to achieve the set targets of contribution to Gross Domestic Product in vision 2030. The findings also provided valuable insight in the efforts of realization of the big four agenda especially the forth one that aims at providing employment opportunities through transformation of the manufacturing sector.

The findings also provided better view on how the country can meet the Sustainable Development Goals number 8 on sustainable economic growth and decent employment for all. The findings demonstrate how the country can accelerate the economic growth to the desired levels for attaining a high middle-income status as well as improve the living standards of the citizens.

High levels of innovation performance lead to efficient utilization of scarce resources to bring about greater economic growth, environmental conservation and improved levels of human development index without compromising the survival of future generation. This forms the basis for attaining the sustainable development goals in Kenya especially goal number nine that focuses on industry, innovation and infrastructure.

1.6. Scope of the Study

The study involved firms registered by the Kenya Association of Manufacturers (KAM) in the major industrial counties in the country which includes: Nairobi, Mombasa, Kisumu, Nakuru Kiambu, Machakos and Uasin Gishu. This is because the Kenya association of manufacturers is the most established and recognized body that registers firms engaged in manufacturing across the country and has a wide membership.

The major industrial counties have the highest concentration of established manufacturing firms and continue to attract significantly more new entrant. Major counties are instrumental in making knowledge accessible, cultural diversity, access to new communication technologies, wide networks and avails the requirements for development to citizens from other regions (Dvir & Pasher, 2004). They are also viewed as suitable spatial units for knowledge acquisition, accumulation, utilization and innovation transfer because they attract investments and talents (Majava *et al*., 2016). The study cut across several subsectors within the sector to allow for a representation of small, medium and large manufacturing firms within the country.

1.7. Limitation of the Study

The study only involved firms that are registered with KAM which implies that firms not registered with the association were excluded. The study was conducted in the major industrial counties in Kenya because this provides an opportunity to interrogate the shared innovation ecosystem. This means that industries that are isolated in least industrial counties was excluded because they do not share the similar operating environment with others industries which are found in a cluster. However, this was mitigated by capturing firms from various sub-sectors and the different size of manufacturing firms.

The findings cannot be generalized to other sectors of the economy. Nevertheless, all the 12 sub-sectors within sector have been captured. This provided a wide base for generalizing the findings since there are distinct similarities in other sector in terms of the relationship between KE, IE and IP.

1.8. Operationalization of Terms

Knowledge Entrepreneurship

This is the ability to utilize new information acquired through learning to identify and seize up opportunities that address a yawning gap in the society. Senges and Duart (2007) are of the opinion that it is the skill of utilizing the intellectual capital in an enterprise. It is a type of intellectual entrepreneurship that focuses on improving research through the input of knowledge (Abosede &Onakaya, 2013).

Organization Learning

Organization Learning is the manner in which entities acquire, absorb, share and transfer knowledge for greater prosperity. It is a process of creating awareness of new ways of operations improvements. It is acquiring knowledge and transferring it within an entity (Desai, 2010). Organization Learning was used to measure Knowledge entrepreneurship through indicators such as; experimentation, knowledge transfer integration and openness.

Organization Culture

Organization culture is the values, norms, beliefs, traits, practices and behaviour shared by people within an entity. The aspects of organizational culture that was used to measure Knowledge entrepreneurship included; team decision making, knowledge sharing, organizational change and innovation atmosphere.

Innovation Ecosystem

These are the prevailing circumstances in an operating system at a particular time which is shaped by key players in an industry and influences firm performance. It is a local condition that is conducive to the creation of novel products through new business models (Majava *et al*., 2016). The study examined the environment in which manufacturing firms operate and the interaction of the available networks within the sector. The parameters for measuring Innovation ecosystem in this study were; accelerators, incubators, business services and trade organization support which provides channel for static agglomeration economies, technology spillover, dynamic agglomeration economies and infrastructural economies.

Innovation Performance

This is the level of increase in novel products, creative processes, development of new ventures and discovery of new markets that all contribute to the sustainable growth of an enterprise. It is the degree and the rate at which enterprises innovate in terms of new products, processes, management and market (Andreeva & Kianto, 2011) in comparison with the competitors (Zelaya-Zamora & Senoo, 2013). The study was investigating the rate of new products, new innovative processes, patents acquired within the last three years, new enterprises and the percentage increase in sales growth rate brought about by innovation activities. Innovation performance was, therefore measured as the summation of patents acquired, new innovation process and increase in sales growth rate brought about by innovation.

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

This section systematically focused on theoretical and empirical review on Innovation Performance (IP), Knowledge Entrepreneurship (KE) and Innovation Ecosystem (IE) in manufacturing firms bringing out the appropriate parameters for measuring each variable. The conceptualization of the study variable KE, IE and IP is then demonstrated in the conceptual framework and the summary of the chapter is provided.

2.2. Theoretical Review

This part evaluated the appropriate theories for which the study was anchored. The theories are based on KE, IE and IP. Three theories were evaluated bringing out the appropriateness to the study and the gaps in the theories which the study sought to address. The theories evaluated included; Schumpeter’s (1934) theory of innovation, the Gleick (1989) complexity theory and Roger’s (1995) innovation and diffusion theory.

2.2.1. Schumpeter's (1934) Theory of Innovation

The theory is of the view that the characteristics of an entrepreneur are innovation, foresight and creativity. This augurs well with the variables in this study. Innovation activities are the outputs of IP and therefore one cannot debate about IP without reference to innovation. Schumpeter's (1934) view on foresight has a bearing of having comprehension of the dynamics involved in innovation which is well within the realm of KE. The concept of creativity is anchored on OL and OC which are constructs of KE.

The theory postulates that the transformation of the economy comes through innovations that bring about creative destructions which lead to improved performance. This assertion is true because innovation destabilizes the status quo by availing new products, experiences, processes, markets and enterprise that addresses the needs of the society in a unique way. Furthermore, innovation brings about new competitive advantage thus bringing about economic growth and development. This is well demonstrated in IP which encompasses innovation efficiency and growth in market value which has an overall contribution on not only economic growth, but also sustainable development.

However, the theory failed to address the inputs required in the innovation process and the organizational capacity to innovate. The entrepreneur could have the requisite foresight and creativity, but until these elements are fully comprehended and applied by the entire team within the firm, it will be a daunting task to business owner thus the importance of promoting KE so that every member of the team is cognitively empowered, individually and collectively to seize up innovation opportunities. It does not also recognize the importance of break-even points which is crucial in addressing the sustainability of projects and firms. It also ignores the environment in which innovation takes place. Innovation is influenced by external factors such as shortage of capital, infrastructure, government policy and networking among the stakeholders.

This necessitates the adoption of a theory that has a more holistic approach. It is imperative to recognise the value of revenue generated in innovation activity in relation to both fixed and variable costs. It is also important to take cognizant of the environment in which innovation takes place. The shortcomings especially operating environment can be addressed by interrogation of complexity theory.

2.2.2. The Gleick (1989) Complexity Theory

The theory contends that micro and macro factors in complex natural and human systems are inseparable. The proponents of the theory argue that the spontaneous bottom-up process leads to the formation of path dependence which comes in handy to translate innovation in a different context (Nishiguchi, 2001). The theory reinforces the importance of leadership in learning, co-creating, creativity and adaptability. It further expounds that leadership should provide management entanglement between behaviours, adaptive and administrative structures that provides effectiveness and flexibility in a firm (Uhl-Bein, Marion and Mckelvey, 2007). Espinosa and Porter (2011) believe that the complex nature of IP requires leadership that should move from dominating innovation strategy to the facilitation of knowledge assimilation.

The theory envisions that an organization should influence the operating context and channel the flow of learning to value networks. It advocates for emergent learning that transcends from the industrial era to the knowledge era that produces ideas that provide complex interplay of different interactions (Uhl-Bein *et al*, 2007). The theory also underscores the importance of technology. It acknowledges the enabling role of technology in providing interactions that accelerates creativity (Desai, 2010).

The theory contends that a firm should have a symbiotic relationship with the society and ecosystem such as the government, business community and civil society which need to be managed carefully. It postulates that knowledge exchange between a firm, its subsystems and the external environment constitutes the ecosystem (Espinosa & Porter, 2011). The theory is appropriate because IP is characterized by dynamism developed through knowledge acquisition, sharing, transfer and utilization. The theory is also applicable because it is difficult to model complex knowledge and to acquire it thorough a formalized approach (Granerud & Rocha, 2011). Innovation performance also requires collaborative networks that replace the single-minded myopia view on performance. The interdependence and interaction of the various components and key players brings about the concept of a system. However, the theory is limited in several ways.

Excessive complexity can arise in a system that can be detrimental to firm performance. This is because complexity does not necessarily lead to innovation (Espinosa & Porter, 2011). Systems are also not necessarily complex and firms are an autonomous entity that can make decisions independently although not entirely separate from the ecosystem. The theory also views innovation as the outcome of technical and social coevolution rather than the efforts and inputs of an entrepreneur (Beinhocker, 2007). Individual champions have a greater impact on IP and cannot be ignored. These limitations led to interrogation of the Roger's (1995) innovation diffusion theory.

2.2.3. Roger's (1995) Innovation Diffusion Theory

The theory suggests that innovations that resonate well with the end users by having the right attributes such as compatibility, higher relative advantage, ability to observe and try is adopted faster than the complex ones. The theory's prior conditions are felt needs, previous practice, norms and innovativeness. Rogers (1995) developed a model that shows the role of individual behaviour in the innovation adoption process. The model depicts choices and actions that determine the decisions taken by a consumer in embracing innovations (Migiro, 2006).

The model has a path process of knowledge, persuasion, decision implementation and confirmation. The knowledge phase depicts the traits of the decision-making unit. The social-economic characteristics, personality and communication are taken into account at this stage. These aspects related well to the study since this stage identifies with KE and the antecedents therein which are organizational learning, organization culture, leadership and ICT.

Persuasion is the other step that is perceived as the characteristics of innovation. It entails the compatibility, relative advantage, complexity, ability to try and observe. The success of this phase can be attributed to the prevailing infrastructure in IE. The more suitable the infrastructure is, the higher the chances of developing competitive new products that are appealing to consumers. The right infrastructure also provides appropriate channels for interacting with the public thus providing a forum for sensitizing the potential users of innovation. The third stage is the decision-making process. The innovative product is either rejected or accepted at this phase. Social networking at this stage provides an opportunity for new information flow that empowers individuals to make informed decisions (Knippernberg, Prooijen & Sleebos, 2015).

The other stage is implementation. This is where the commercialization of innovation takes place if it is viable. The essential competencies for the success of innovation emanating from networking are discovery, acceleration, incubation and commercialization (Storey, Hart & O'malley, 2009). The final stage in the model is confirmation which can be done by ascertaining the contribution of innovation activity to the overall firm's performance. This relates well with IP because it is determined by the level of innovation output and commercialization. The stages of the innovation-decision process are illustrated in figure 2.1.

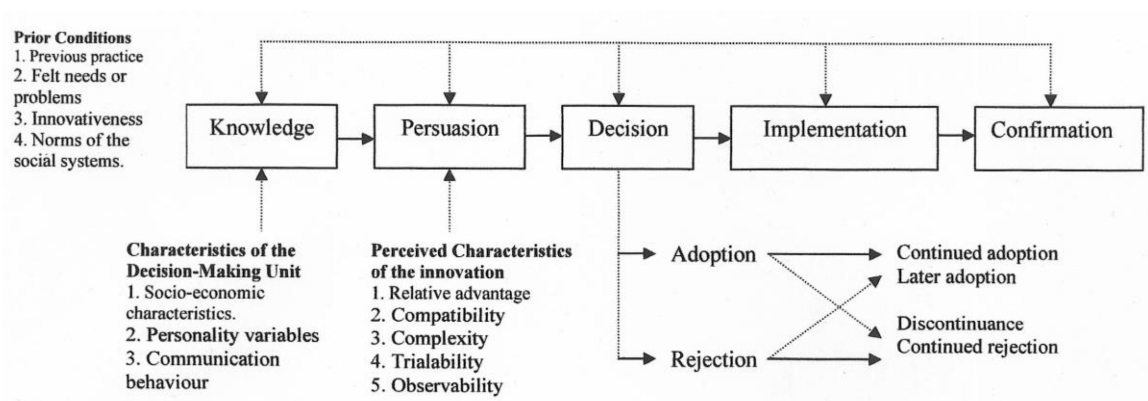

Figure 2. 1: Stages of Innovation-Decision Process Source; Roger (1995)

The model depicts characteristics that facilitate or hinder adoption of innovations. It shows a person's awareness of innovation, the formation of attitude, engagement in innovation activities and utilization of innovation and evaluation of IP. The model shows the attributes that influence the rate of innovation adoption and efficiency thus improving IP.

The three theories were therefore anchored on the interlinkages of KE, IE and IP which were the study variables. Schumpeter's (1934) theory addresses the innovation output which is one of the key components in measuring IP in this study. Complexity theory helped in understanding how KE can be enhanced by a mix of application of internal knowledge and utilization of external information derived from collaborative networks in the IE to bring about IP. Roger's (1995) innovation diffusion theory conceptualized the commercialization of innovative activities which brings about innovation efficiency which is also captured as a measure of IP in the study.

2.3. Empirical Review

This section entailed a review of literature on IP, KE and IE. It involved a discourse on what has been done by other researcher including the methodologies they used in a chronological order. The section also brought out the gaps in the literature and how those gaps will be addressed in this study.

2.3.1. Innovation Performance in Manufacturing Firms

Innovation performance (IP) has different definitions. Many scholars agree that it entails efforts to improve product reputation, technological aspects, market response, profitability and increase in market share. Andreeva and Kianto (2011) believe that it is the degree to which enterprises develop novelty in terms of processes, management and marketing with a comparison to competitors. Innovation performance is the degree to which firms develop new products, processes, markets and enterprises to increase their competitiveness. It results in the reduction of lead times, risk, cost and adoption of appropriate technology thus increased profitability (Secundo, Beer, Schutte & Passiante 2017). It also enables firms to raise their market share, gain competitive advantage and enhance their sustainable development (Babalola, Amiolemen, Adegbite & Ojo-Emmanuel, 2015). It can, therefore, be defined as the level of increase in novel products, creative processes, development of new ventures and discovery of new markets that all contribute to the sustainable growth of an enterprise.

The major contribution of IP to firms is the improvement of competitiveness which enhances their survival and propels them to soar up beyond the turbulence brought about by the ever-changing dynamics in the business environment. However, innovation is a herculean task that requires diverse mastery of several approaches and interactions with different parties. The effectiveness of innovation activities can be evaluated through IP. Different scholars have approached innovation performance from different perspectives. The first school of thought has scholars concerned with innovation outcomes instead of innovation capacity such as patenting (Belussi, Sammarra & Sedita, 2010; Schwartz, Reglow, Fritsch & Gunter, 2012). Other scholars have focused on the generation of novelty (Hervas-Oliver, Albors-Garrigos & Gil-Pechuan, 2011; Howells, Ramlogan & Cheng, 2012). Spithoven, Frantzen and Charysse (2010) and Arvanities (2012) looked at the amount of turnover improvement brought about by innovation IP. It is, therefore, noted that past studies have been involved in innovation inputs, outputs and outcomes without paying much attention to innovation capacity and processes at a firm’s level. The study sought to address this gap by linking knowledge entrepreneurship (which consolidate and capitalize on internal and external capacity) to innovation performance.

Innovation capacity is paramount in realizing and identifying the need for change, thus leading to new ideas. It provides the capability of seizing up opportunities (Teece, 2009) leading into a new business configuration that helps in attaining and maintaining high competitive levels (Saenz & Perez-Bouvier, 2014). This leads to continuous improvement in firm performance particularly in the manufacturing sector which is paramount for sustainability. Manufacturing firms all over the world face myriad challenges which keep stifling their performance such as; the ever-changing taste and preferences of customers, rapid change in technology, increasing competition, dynamic operating environment and changing global trends.

The scenario requires manufacturing firms to keep their performance afloat amid the turbulence to ensure their continued existence. Innovation performance in this sub-sector has been acknowledged as the main driver of competitive advantage (Lemon & Sahota, 2004; Wijnberg, 2004). The IP thus improves the overall performance of the firm. Innovation is the key pillar of competitive advantage that leads to robust and dynamic manufacturing firms to compete favorably in local and international markets (Laosirihongthong, & Dangayach, 2005). Competitiveness has, therefore, become the key battleground where IP rein supremacy.

Traditional approaches to addressing competitiveness in the manufacturing sector such as pricing have not always born fruits. Researchers in the past have focused on factors that influence the development of successful firm performance (Aragon, Garcia & Cordon, 2007; Jimenez & Sanz, 2011). However in the recent past, efforts on enhancing firm competitiveness are anchored on innovation performance (Vinit, Mats, & Joham, 2012; Yung-Lung, Maw-Shin, Yi-Min & Yi-Hsin, 2013; Lau & Lo, 2015; Oliver, Ripoll & Moll, 2014; Ritala, Olander, Michailova & Husted, 2014; Christian, Wolfgang & Chistoph, 2016).The effectiveness of innovation can be gauged through innovation performance. The study provided more insight into the elements that enhance innovation processes leading to IP and hence the improvement of the firm's competitiveness.

There have been several attempts to measure IP by different scholars across the globe. Thomas and Tom (2009) recommended the use of multiple approaches that include output, efficiency, attraction and selected facilitation impact where each of the measurements can be selected with justification. Birchall, *et, al.,* (2011) focused their study in six developed countries where they recognized that the approaches applied in measuring IP yielded little impact and recommended firms the inclusion of overall performance, effectiveness of R&D investment, change management and availability of innovation enablers. However, the measures are not associated with enterprise success.

Some efforts have been made in developing countries to measure IP. Wang and Chien (2006) conducted their study in the Taiwanese manufacturing industry and measured IP through increased new processes, the percentage increase in sales as a result of new products, the number of research development by employees and the number of patents acquired. However, there is a need to focus on different input variables rather than technical informational resources and innovation objectives. Lau and Lo (2015) conducted their study in a developing country in the Republic of Korea and measured IP in terms of innovation rates, sales growth rate, market impact and financial success. Nevertheless, the measures failed to capture the external environment. There is no evidence of an attempt to measure IP in the least developed countries.

2.3.2. Determinants of Innovation Performance

Several factors influence Innovation Performance (IP). Human resource management is viewed as an effective determinant of IP when applied with other organizational complementarities such as leadership and is more suitable in the knowledge-intensive sector was productivity and profitability is paramount (Laursen, 2001). Gloet & Terziovski (2004) found that human resource factors are a concrete predictor of the association between Knowledge Management (KM) practices and IP while at the same time KM positively influences IP thus manufacturing firms should place a premium on employee’s capacity when developing innovative strategies. Laosirihongthong and Dangayach (2005) also found that improvement in human capacities is crucial concerning IP. Liao and Liu (2008); Zerenler, Hasiloglu and Zezgin (2008) found that intellectual capital which comprises of the employee, structural and customer capital influences IP. Intangible resources have also been found to be the driver of IP in Malaysia (Abu, & Hartini 2010).

Furthermore, leaders, managers and other staff can form entrepreneurial teams that contribute to IP (Petra & Dirk, 2012).

The study sought to find out how manufacturing firms capacity can be enhanced to achieve higher levels of IP. However, for human resources to be effective in innovation activities, leadership is crucial to harness the right environment and provide the facilitation required. It is also important to use a broader set of the variable in interrogating IP rather than just human resource involvement and particularly the prevailing internal conditions and collaboration with the external environment in which they operate.

Research and Development (R&D) also plays a role in IP. Internal R&D once combined with the right market-oriented search is effective in promoting IP (Wolfgang & Chrisoph, 2009). Nevertheless, the appropriate Information Communication and Technology (ICT) platform should be put in place to facilitate R&D.

Organization learning, culture and structures are part of the other determinants of IP. It has been found that team culture also moderates the relationship between knowledge sharing and IP (Hu, Horng, & Sun, 2009). Functional organization structures also influence incremental innovation while cross-functional structures are associated with radical innovation hence it is imperative that firms should not only be adaptable to current but also future business (structural ambidexterity) to improve their IP which should be linked to financial performance (Visser, Weerd-Nederhof, Faems, Song, Looy & Vischer, 2010).

The other determinants of IP are networking, partnership and collaborations. Trading partners' relationship has been found to have a positive influence on IP (Prajogo, Power & Sohal, 2004). Competence in networking also significantly influences IP (Chiu, 2008). Collaboration ties within the manufacturing firms have also been confirmed in Turkey although they were found to have a weak impact on IP (Cetindamar & Ulosoy, 2008). The study replicated the association between the two variables in major industrial counties in Kenya to determine whether the situation is different.

The operating environment is also crucial in determining the success of networking, partnership and collaborations. The trade-off between incremental and radical innovation depends on the environmental conditions in the manufacturing sector and therefore firms in this industry should strive to strike a balance between the two (since their relationship with the financial position is curvilinear) to optimize their IP and (Uotila, Maula, Keil, & Zahra, 2009). The operating environmental conditions in this study were captured through the innovation ecosystem within the locality of the study. Furthermore, openness to outside stakeholders such as universities, suppliers, customers and firms within the sector have a significant influence on IP, but negatively related to cross-sector enterprises (Inauen, & Schenker-Wicki 2011). Firms that put trust in networking, partnership and collaboration benefits by allowing for the transfer of risks and tactical knowledge, however trusting too much may be detrimental in the misallocation of resources and may result in huge risks that have a negative relationship with IP. Mazzola, Bruccoleri and Perrone (2012) found that manufacturing alliances are negatively related to financial performance. The work sought to find out how manufacturing firms can leverage collaborations within the innovation ecosystem to optimize their IP.

Market-related activities are other determinants of IP. Market generation, intelligence and market-oriented strategies were found to be relevant in enhancing IP (Erdil, Erdil & Keskin, 2004). Market orientation also has a positive influence on IP (Zhang, 2010). Customer knowledge and investment decisions are also related to IP as long as a firm employs an appropriate engagement strategy. However, there is a need to investigate the financial consequences (Arnold, Fang & Palmatier, 2011). Financial implications were factored as a measure of IP. Supply chain management in Malaysia was also found to be positively related to IP and overall performance in both manufacturing firms and the service sector (Chong, Chain, Ooi & Sim, 2011). Tang, Pee and Iijima (2013) found that business process orientation has a significant influence on organizational IP, but noted that cross-functional integration requires being carefully managed. The study sought to find out how knowledge developed internally and externally can be optimized.

International trade has also a bearing on IP. Internationalization has a positive influence on enterprise capacity to enhance performance through IP but, this is only true if a firm's international activities are above the required threshold level (Kafouros, Buckley, Sharp & Chengqi, 2008). Positive relationship, therefore, exists between offshoring and innovation performance implying that firms involved in international trade stand a better chance of improving their IP (Nieto & Rodriquez, 2011). The locality of the study provides a mix of importing and exporting manufacturing firms which is ideal for the study. Knowledge is the other key determinant of IP. Several researchers have realized strong links between the knowledge sharing process, innovation performance and firms performance (Alavi, Keyworth & Leidner, 2005; Fang, Wade, Delios, & Beamish, 2007; Aulawi, Sudirman, Suryadik, & Govindaraju, 2009).

Innovation performance can, therefore, determined by several factors, but the prime mover is knowledge acquisition, absorption, sharing and transfer. Costa and Monteiro (2016) found that in order to improve IP, firms require gaining knowledge of the processes that contribute to innovation capacity and into factors that may help to improve it such as collaboration networks. It can be concluded that knowledge and innovation ecosystem are the key drivers of IP. The study therefore focused on the ways of developing innovative capacity by utilizing and enhancing both internal and external knowledge in consideration of the operating environment.

2.3.3. Parameters for Measuring Innovation Performance

Previous researchers have attempted to use different parameters for measuring IP. Hagedoorn (2003) utilized R&D inputs, a range of new products, number of patents and their citations as the indicators of measuring IP and found a strong statistical overlap. Innovation studies have also shown that IP can be measured through sales performance, sales growth rates and innovation rates (Wan, Ong & Lee, 2003; Yam, Guan, Pun & Tam, 2004). Wang and Chien (2006) measured IP through increased new processes, the percentage increase in sales as a result of new products, the number of research development by employees and the number of patents acquired. The concept is useful for benchmarking, but it does not illuminate on the broad aspect of innovation performance.

It would also be prudent to link the measurement scale with patents and number of new products. Innovations rates are measured as a percentage of new products commercialized with all products of a firm over a period of three years and are highly regarded because it depicts a firm's relative strength in IP while sales growth rate and performance indicate the level of market impact, advantage and financial success (Lau & Lo, 2015). It is therefore evident that there is a need to develop an integrated parameter to measure IP.

The study captured the broad spectrum of IP and includes new products and patents in the measuring scale instrument. Thomas and Tom (2009) recommended the use of multiple approaches that include output, efficiency, attraction and selected facilitation impact where each of the measurements can be selected with justification. Other researchers used the scale of sales performance, innovation rate and sales growth rate (Guan, & Chen 2010; Yam, Lo, Tang & Lau, 2011). The dimensions of IP measures include; firm's overall performance, the effectiveness of R&D investment, change management and availability of innovation enablers (Birchall *et, al.,* 2011). Zeng, Xie and Tang (2010); Xie *et, al.,* (2016) measured IP through new products index, modified product index and annual proportion of new product turnover. Costa and Monteiro (2016) opined that the measurements of IP are; new products, processes, management, markets and enterprises. Nevertheless, the empirical review reveals a gap in the lack of an IP measurement model (Birchall et, al., 2011). The study entailed a discourse, comparative analysis of the previous attempt to measure IP, processes and critical success factors within the manufacturing sub-sector to develop an appropriate model.

The approach of measuring IP captured both Innovation Output (IO) and innovation efficiency because IO depicts the result of an innovation effort while efficiency shows the economic value derived from innovation activities. The IO is the end product of innovation activity. The end products of IO are; new products, new processes, new enterprise and new markets. Andreeva and Kianto (2011) believe that IO is the degree to which enterprises develop novelty in terms of processes, management and marketing. Innovation output can, therefore, be defined as the increase in novel products, creative processes, and the development of new ventures and the discovery of new markets.

The IO depicts the result of an innovation effort. It can be measured as the summation of increased new products as a result of innovation, patents acquired, innovation process and unique enterprises created to cater for innovation activities. Innovation output can be enhanced by improving the innovation capacity of a firm.

Innovation capacity is paramount in realizing and identifying the need for change, thus leading to new ideas. It provides the capability of seizing up opportunities (Teece, 2009) leading into a new business configuration that helps in attaining and maintaining high competitive levels (Saenz & Perez-Bouvier, 2014). Innovation capacity can be optimized through continuous improvement in firm performance particularly in the manufacturing sector. Manufacturing firms are faced with a myriad of challenges such as; the ever-changing taste and preferences of customers, rapid change in technology, increasing competition, dynamic operating environment and changing global trends which calls for improvement in innovation capacity. Innovation capacity leads to increased innovation output which brings about sustained growth.

Sustained growth can be addressed by firms aligning themselves with the changing market trends. Sustained growth can be enhanced by improved Innovation efficiency. Innovation efficiency has been defined as the capacity for transforming innovation inputs into outputs and thus it is the ratio between education investment in innovation and output (Hollanders & Esser, 2007). Innovation efficiency can, therefore, be defined as the effectiveness of converting innovation inputs into outputs.

Innovation efficiency is important in several ways. It helps in identifying the best innovation practices which can be used for benchmarking. It is also important in developing innovation policy (Hollanders & Esser, 2007). This is crucial in evaluating the value of the key players in the innovation systems. It also focusses on the commercialization and the economic benefits of innovation activity (Wang, Hang, Sun & Zhao, 2016). Commercialization help firms to develop a new approach of consolidating the local markets while at the same time regionalizing and globalizing the market niche to gain access to the larger customer base for greater sales. Innovation efficiency, therefore, enables a firm to value the economic importance of innovation activities.

There are several methods of measuring IE. They include Stochastic Frontier Analysis (SFA), Data Envelopment Analysis (DEA) and Two-stage IE non-radial DEA model. The SFA is a parametric analysis which assumes a particular relationship between innovation inputs and outputs, but not suitable when dealing with multiple outputs (Wang, Hang, Sun & Zhao, 2016). The outputs for innovation are numerous because they include new products, patents acquired, innovation process and new enterprises and new markets thus this approach of measuring IE is not suitable in this study.

The second method is DEA which is an improvement of SFA. It utilizes data from multiple inputs and outputs with no prior specification format (Guan & Chen, 2012). However, it does not capture the operations, internal systems and processes involved in IE (Wang, Zhao, Zhou & Zhou, 2013b). This study utilized the operations, internal systems and processes hence DEA is not appropriate in this case.

The third approach which is the two-stage DEA model builds on the second method. The approach involves the optimization of resources (Wang, Hang, Sun & Zhao, 2016) and has been used in the manufacturing sector (Bian, Liang & Xu, 2015). The method is of two types; radial DEA and non-radial. Radial DEA does not account for inefficiencies in inputs and output (Wang, Hang, Sun & Zhao, 2016). The study accounted for those inefficiencies thus this approach is not appropriate in this case. Non-radial DEA provides for optimization of strategies and is therefore relevant to this study. The approach recognizes innovation input as comprising of human, finances and material resources while the output is the commercialization of innovation in terms of the market value and profits (Wang, Hang, Sun & Zhao, 2016). The model, therefore, captures the resources at the disposal a firm as the input of determining the IE

Innovation performance was, therefore, measured as the summation increased new products as a result of innovation, patents acquired, new innovation process and new enterprise multiplied by sales growth rate brought about by innovation. This can be illustrated mathematically as;

$IP = \sum_{n=1}^{t=3}\{(\text{Output})\ (\text{Efficiency})\}$ This can also be expressed as;

$$IP = \sum_{n=1}^{t=3}\{(\text{Inp} + \text{Pa} + \text{Nip} + \text{Ne})\ \ (SGR)\}$$

Where IP is innovation performance, Inp is the sum of the Increased New Product as a result of innovation, Pa is patents acquired, Nip is the new innovation process, Ne is the new enterprises as a result of innovation and SGR is the percentage sales growth rate brought about by innovation.

2.3.4. Knowledge Entrepreneurship

The definitions of Knowledge Entrepreneurship (KE) abound from different scholarly work. Senges and Duart (2007) defined KE as the ability to recognize viable opportunities in intellectual resources and exploit them innovatively through the development of an intellectual venture. It is also a type of intellectual entrepreneurship that focuses on improving research through the input of knowledge (Abosede &Onakaya, 2013). Knowledge entrepreneurship is, therefore, the ability to utilize new information acquired through learning to identify and seize up opportunities that address the needs of the society.

Knowledge entrepreneurship affects firms in several ways. It affects the perceptions of capabilities individuals have to develop new ventures (Christian & Ulrich, 2005). It also affects the analytical diligence, persuasions, risk tolerance, commitment to new projects, human and knowledge capital (Senges & Duart, 2007). Abosede and Onakoya (2013) believe that it affects environmental awareness, values and strategy. It can, therefore, be deduced from the foregoing that KE is a paramount input in determining the successful operation of a firm.

Different approaches have been used to measure KE. Block, Thurik and Zhou (2012) measured KE using the rate of knowledge-intensive firms depicted through the web presence and entrepreneurship rate which is the business ownership rate and a number of new firms. However, the approach did not consider the role of technology clusters and government policy and did not link KE to innovation. Abosede and Onakoya (2013) measured KE through entrepreneurial rate and rate of knowledge intensity but did not address the commercialization of the output. It is noted that the latter is an improvement of the earlier approach but still not an adequate measure.

Knowledge entrepreneurship models have also been developed by different scholars. Fuller (2006) developed a KE model for universities that captured education, research and dissemination as the key pillars linked together with human and knowledge capital. However, the model is best suited for universities and may not apply to the manufacturing sector. The other KE model was developed by McDonald (2002) and later improved by Senges and Duart (2007). The model depicts the organization setting factors which include; leadership, culture, communication and organization learning that influences KE and ultimately innovation. The model is suitable for this study because it links KE to innovation and can be applied in the manufacturing sector. The model was adapted to derive the antecedents of KE with a few modifications. The model is depicted in figure 2.2.

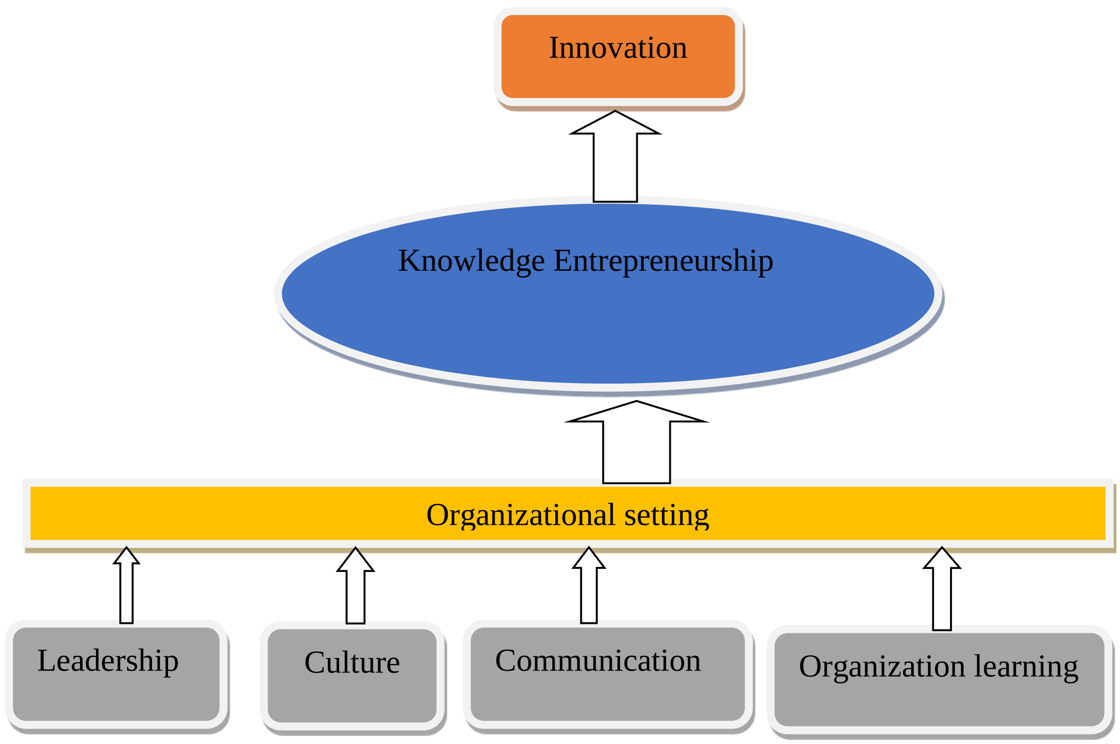

Figure 2. 2: Knowledge entrepreneurship model   Source: Senges and Duart (2007)

The model is also supported by Calabrese (2005) who came up with the key pillars of building a framework of innovative enterprise which includes; leadership that drives strategies and business ecosystems, organization learning that promotes collaboration and system thinking and technology infrastructure that provides the architecture, integration and performance. Wears the study adopted organization learning, culture, leadership as the antecedents of KE, communication was expanded to include Information and Technology (IT).

2.3.5. Organization Learning

The context in which OL is used in this study is viewed as a mechanism for discovering new ways of improving operations through knowledge acquisition, absorption, sharing and transfer for improved performance. The salient feature that distinguishes OL from the learning organization is its diversity and extensiveness. The phases of OL include; intuition, interpretations, integration and institutionalizing (Crossan & Berdrow, 2003). It involves knowledge codification and transformation to sustain operations in a dynamic environment (Albino, Garavelli & Schiuma, 2001).

It emanates from the complexity of individual learning (Liao, Fei and Chen, 2007) while at the same time requires collective input and knowledge sharing (Granerud & Rocha, 2011). The strategic elements of OL are experimentation, knowledge transfer, developing learning capacity, teamwork and problem-solving (Tohidi and Jabbari, 2012). It also involves several organizations and sectors thus require corroboration.

Organization Learning (OL) has several definitions from different scholars. Murray (2002) is the view that OL is a reawakening of behaviour change to bring about the growth of a firm. Lopez, Peon and Ordas (2005) defined OL as dynamic processes of knowledge acquisition, creation and integration to empower the human capital with the efficacy to improve performance. It is also the process of acquiring, modifying and transferring knowledge within an entity. It can, therefore, be concluded that OL is a mechanism for discovering new ways of improving operations through knowledge acquisition, absorption, sharing and transfer for improved performance.

There are numerous benefits of OL in a firm. Murray and Chapman (2003) opined that OL enhances adaptability and behaviour change, continuous improvement, improved productivity and manufacturing efficiency. Othman and Hashim (2004) think that OL entails a re-evaluation of fundamental values and assumptions that lead to value addition and adaptation. Liao *et, al.,* (2007) posited that OL is relevant to activities in entrepreneurial firms. It is also the foundation from which the base of improved practices is laid (Granerud & Rocha, 2011). However, OL is affected by the capacity to learn, changing paradigm shifts from both individuals and organizations and leadership to optimize learning (Murray, 2002).

The capacity to learn is affected by the absorptive capacity of a firm which determines the level of OL. The absorptive capacity is important in OL because it improves the ability of the human resource within the firm to acquire and assimilate new and external knowledge for improved performance. Nevertheless, absorptive capacity is influenced by a Supportive Learning Environment (SLE).

The SLE encompasses the context in which OL takes place. Cohen and Levinthal (1990) found that SLE increases the absorptive capacity of the firm thus enhancing OL while a turbulent learning environment lowers the OL. The SLE, therefore, moderates the influence of OL on IP. The SLE provides a conducive atmosphere for an employee to engage each other and with the management freely and constructively which may lead to a review of the firm's operations and processes (Garvin, Edmondson & Gino, 2008). The appropriate SLE promotes OL and enhances the innovative ability of a firm. The parameters for measuring SLE are the availability of accelerators and incubators, trade organization support and business services (Majava *et al*., 2016). These parameters facilitate dynamic networking within an economy and accelerate technological spillover which is important in bolstering innovation. The parameters of SLE were included in developing the measure of innovation ecosystem which is a moderating variable in this study.

The relationship between OL and IP has been demonstrated by different scholars. High propensity for organization learning equips a firm with triple bottom line integration which is a systematic way of managing the economic, environmental and social responsibility leading to higher IP and sustainability (Jamali, 2006). It has been found that firms with an organizational practice that promote a learning organization have a higher level of IP than those that do not (Lundvall & Nielsen, 2007). It has also been realized that there is a mutual dependency between organizational learning and business processes which influences IP (Capuano, Gaeta, Ritrovato & Salerno, 2008). Chen and Huang (2009) found that IP is a dual model that comprises administrative and technical innovations. These observations underscore the value of OL in IP.

The suitability of OL in determining IP has also been explored. An analysis of OL and IP models showed goodness of fit and a significant positive relationship, thus promoting a culture of sharing and trust which is crucial for enterprise success (Hung, Lien, Yang, Wu

& Kuo, 2011). However, there is a gap in linking the learning process and IP in empirical studies (Lau & Lo, 2015) yet the OL theory underscores the relevance of new knowledge in value creation (Todorova & Durisin, 2007).

Organization learning is supported by several key pillars. The tenets of a learning organization are a continuous acquisition of knowledge in the business ecosystem forum where leaders who can navigate keeps competition at bay (O'keeffe, 2005). Lifelong, deep learning capacity provides a connection with the larger sub-systems, validate individual and organization’s contribution and influence the understanding of interconnectivity (Richter, 2009). Johannessen and Skaalsvik (2015) found that enterprises require nurturing creative energy to enhance IP and that there is a need to appreciate knowledge workers as a crucial element in critical thinking and in identifying new opportunities. Passila, Owens and Pulkki (2016) explored the alternatives of learning without deferring to conventional authority, but organizing to learn from new ideas, however, the research did not fully articulate the capacities of learning. Organizational and entrepreneurship learning process phases include backward-looking ignorance, the opportunity for innovation, adaptive learning cycle, adaptive management, experimenting adaptation and legitimizing the change, however, more research is required to transform the model (Cantino, Devalle, Cortese & Longo, 2017). Entrepreneurial learning which is consisted, situated and adaptive has a great impact on IP, however, more research in ecosystems that exists in the manufacturing communities is required (Cannavacciuolu, Landoli, Ponsinglione & Zollo, 2017).

Several factors can accelerate OL. Rae (2017) found that rebalancing the multidirectional flow of talent and knowledge between an enterprise and other firms/players in the industry can enhance learning, the value of entrepreneurship and IP, but there is a need for more research in transformational entrepreneurial learning. Transformational entrepreneurial ability in the study was examined through the lens of leadership type that exists in manufacturing firms.

There are several ways of identifying the parameters for measuring OL. The Global Innovation Index (GII) utilizes Knowledge absorption, creation, impact and diffusion which can be measured by the level of royalties, patents, number of new firms, royalties and license fees receipts or web presence respectively in measuring OL (Cornell University, INSEAD & WIPO, 2016). The study adopted Tohidi and Jabbari (2012) measures of OL which include experimentation, knowledge transfer, integration and openness. This is because the parameters are comprehensive in measuring OL capacity.

2.3.6. Organization Culture

Organization culture is one of the elements that can be influenced by OL. Several definitions have been advanced on Organization Culture (OC). It has been defined as the social knowledge and practices in an organization (Colquitt, Lepine & Wesson, 2009). It is also defined as the shared values, norms, attitude and behaviour among the employees (Webster & White, 2010). Other scholars have defined OC as the integration of shared assumptions within an organization (Sharifirad & Ataei, 2012). It can, therefore, be concluded that OC is the shared social norms and values that influence the behaviour and practices of an entity.

There are several factors that affect the OC. The determinants of OC are; shared values, norms beliefs, structure, support mechanism communication and strategy (Martins, Terblanche, 2003). The types of corporate cultures that constitute OC include; competitive, entrepreneurial, bureaucratic and consensual culture (Rashid, Sambasivan & Johari 2003). There are therefore diverse cultures that can exist within an organization some of which can be retrogressive while others are progressive thus providing a climate for high performance. Progressive OC is those that nurture the spirit of innovation. Innovative climate can be maintained by; encouraging horizontal communication, establishing heroes, providing incentives, considering mistakes as an opportunity to learn and encouraging feedback (Harbi, Anderson & Amamou, 2014). Xie *et, al.*, (2016) posit that the characteristics of organization innovation culture are support and cooperation, power-sharing, carrier development and involvement in decision making. Innovation culture is likely to bring about higher levels of IP.

Several researchers have attempted to link OC and IP. Prabhu (2010) observed that shared practices, attitudes and behaviours within an organization are likely to enhance IP by adopting a proactive and risk-taking culture. Valencia, Valle and Jimenez (2010) found that ad-hoc culture has a positive influence on IP while hierarchical culture has a negative relationship with IP but observed that there is a need to introduce moderating variables. Sharifirad and Ataei (2012) also pointed out the relevancy of the moderating variable between OC and IP. Uzkurt, Kumar, Kimzan and Eminoglu (2013) found there is a need to include the environmental context.

The study incorporated the innovation ecosystem as the moderating variable. Furthermore, Bakovic Lazibat and Sutic (2013) confirmed the influence of OC on IP by segmenting the Croatian manufacturing industry. The same was done in major industrial counties in Kenya with the addition of several other variables to interrogate the relationship. Organization culture has an immense influence on firm performance (Hofstetter & Harpez, 2015). Laforet (2016), found that an entrepreneurial-like culture that is externally oriented, flexible and long-term focus has a positive influence on innovation performance. Anning-Dorson (2017) opined that OC is shaped by the operating environment and hence it is important to consider the contexts in which a firm is operating. The operating environment in the study was looked at through the lens of the ecosystem.

There are several parameters for measuring OC as propounded by different scholars. According to Shneider, Brief and Guzzo (1996), the parameters of culture that enhance innovation performance are; nature of the interpersonal relationship at the workplace, nature of hierarchy in the firm, nature of work and support and reward systems all of which can be measured differently. The nature of the interpersonal relationship can be measured by the level of trust or mistrust, reciprocal relationship and collaboration or competition, socialization and support of new customers or assimilation by independent effort and individual feeling of being valued. The nature of hierarchy is measured according to the decision-making process (centrally, consensus or participation), the spirit of teamwork or individualism and special privileges accorded to certain individuals.

The nature of work is measured in terms of whether the job is challenging or boring, work tightly defined (routine) or flexible and whether sufficient resources and responsibilities are provided. Support and reward can be measured through aspects of performance appraisal or reward, projects, actions, behaviour supported and the basis for hiring new staff. Valencia, Valle and Jimenez (2010) measured OC through organizational glue, dominant characteristics, criteria for success and management of employees. Sarros, Cooper and Santora (2011) used a good reputation, being reflective, social responsibility, guiding philosophy, emphasis on quality and achievement orientation to measure OC. The study adopt the parameters used by Xie, Wu & Zeng (2016) which include, team decision making, knowledge sharing, organizational change and innovation atmosphere. These parameters were adopted because they measure an innovative OC.

2.3.7. Leadership

Leadership is one of the core drivers of knowledge entrepreneurship. The appropriate leadership fosters well-thought decisions and strategic alliances that promote robust plans development and execution, business intelligence and value creation leading to an improved IP (Murray & Greenes, 2006). The right leadership can, therefore, transform how an organization is governed leading to high levels of IP. Creative leadership develops human and social capital while operational leadership explores new growth paths (Makri & Scandura, 2010). Vaccaro, Jansen, Bosh and Volberda (2012) found that transactional leadership is more beneficial to small firms while transformational leadership is beneficial to large firms. Transformative leadership enhances creativity, adaptability and interactive technologies that can derive value from networking, however further clarity and refinement are required (Desai, 2010). The study interrogated this assertion to verify it and possibly develop a new model. Green and McCann (2011) proposed a different leadership model to combat uncertainties and address the new economic revolution.

Nevertheless, transformational leadership can inspire an organization to greater heights of IP. Leadership that transforms the mindset directly related to OL and innovation culture which ultimately influences IP in manufacturing firms, but the complexity of collecting data from a set of multiple information should be re-examined (Sattayaraksa & Boon-itt, 2018). The concept of complexity theory was used to depict the relationship that exists between the various elements within an innovation ecosystem. The steps of transformational leadership include; re-imagining customer experience, reducing business ecosystems, promotion of networking and revitalizing the innovation governance which can be achieved through accelerating new opportunities, breaking cultural barriers, embracing innovative behaviors and adopting a global mindset (Ikeda, Marshall & Okmura, 2016). Leadership is therefore crucial in creating an environment that promotes innovation performance by harnessing knowledge creation, flow and utilization.

There are various approaches for measuring leadership that have been advanced by different scholars. The key set of actions that determine effective innovation leadership are; re-imagining customer experience, redefining the business ecosystem, promoting ecosystem connectivity and revitalization of innovation governance (Ikeda *et, al.*, 2016). Re-imagining customer experience can be measured through; production of definitive blueprints, piloting and building foundations of capabilities, programs for innovation and launches, new expertise, new focus and new ways of working.

Redefining the business ecosystem can be measured by; identifying opportunities to collaborate and participate in an ecosystem and also the development of the capacity to create value for the ecosystem. Promotion of ecosystem connectivity can be measured by; the belief that boundaries between traditional industries are blurring, ecosystems are driving innovation, displacement of value chains, value creation within firms shifting to ecosystems and value allocation around economic activities transitioning into ecosystem environments.

Revitalization of innovation governance can be measured by; structures that are open for new ideas, dedicated teams to prioritize agility and secure stable innovation funding and quantitative evaluation of innovation initiatives. Kuratko, Morris and Covin (2011) measured leadership in terms of nourishing entrepreneurial capacity and linking entrepreneurship to strategy. The study improved on these parameters to measure the leadership variable by incorporating; the extent of nourishment of entrepreneurial capacity, linking entrepreneurship to strategy, protection of disruptive innovations, the opportunity for developing creativity, questioning of the dominant logic and the level of inspiration provided by leaders. This criterion is more comprehensive because it is anchored on the premises of the entrepreneurial mindset that is crucial in driving IE.

2.3.8. Information, Communication and Technology

Communication is one of the antecedents of KE as per the KE model. However, information and technology aspects are not captured in the model yet they are interrelated with communication. Whereas information sharing has a positive effect on IP, this depends on the technology intensity of a firm (Saenz, Aramburu & Rivera, 2009). Technology also has an impact on R&D which ultimately significantly influences IP (Sohal & Prajogo, 2006). The emergence of disruptive technology has redefined customer needs in terms of their taste and preferences. The manufacturing sector, therefore, requires relinquishing of the old business model of finding new customer segments and focus on the right technology adoption for them to be innovative in satisfying the customer's ever-changing taste and preferences.

Moreover, information transfer and cross-learning greatly impact R&D and alliances which can be enhanced by the adoption of the appropriate technology and therefore these aspects should be regarded as complementary and not substitutes to communication (Lin, Wu, Chang, Wang, & Lee 2012). Nevertheless, the knowledge entrepreneurship model triggers enterprise growth and value addition in a dynamic environment leading to innovation (Aboelmaged, 2012). The inclusion of information and technology can only enrich the model.

Information, Communication and Technology (ICT) is crucial in promoting knowledge entrepreneurship. Knowledge generation, sharing, storage and transfer requires an infrastructure that comprises internet and intranets which utilizes wide-area communication, world access, provides an enabling software, high-speed communication network and facilitates for publication of information (Goh, 2005). Furthermore, scientific knowledge requires a technologically advanced environment to access topnotch information from within and without to enhance IP (Wolfgang & Chrisoph, 2009). This type of information requires being communicated and shared widely both internally and externally for it to gain value. Communication was, therefore, captured in ICT under the independent variable because it is more broad-based thus likely to provide more insight into the other salient features such as technology, the power of information and their influence on IP. The model was, therefore, be modified by expanding communication to capture information and technology because they are equally important inputs in IP.

Longitudinal study by Ahuja and Katila (2001) demonstrated that technology acquisition enhances IP. Technology sourcing is positively related to radical IP while technology scouting has a significant influence on incremental IP and thus it is necessary to build on the limited knowledge (Parida, Westerberg & Frishammer 2012). The level of research, science and technology is the key determinant of the IP of firms in an economy. It is difficult for firms to innovate in isolation and hence the need to collaborate with research institutes and institutions of higher learning (Greco, Gimaldi & Cricelli, 2015). Lazzorotti, Manzini, Pellegrini and Pizzurno (2013) assert that manufacturing firms that have established research collaborations improve their IP. The competitiveness of a firm is pegged on its ability to absolve technology and apply it to create value (Garcia-Montijo & Perez-Soltero, 2018). Technology transfer can, therefore, promote IP by increasing the competitiveness of firms. However, there are impediments in ICT that require solutions for enhanced competitiveness.

The manufacturing firms are faced with obstacles that obscure the flow of technology transfer. There exists the challenge of knowledge absorption capacity in manufacturing firms. Cruz-Gonzalez, Lopez-Saez, Navas- Lopez & Delgado-Verde (2014) pointed out the cognitive dissonance in the acquisition of external knowledge and its assimilation in the industry. The situation has been contributed to by low activities in Research and Development (R&D) departments. Esquinas, Hermandez and Andia (2016) observed that there are few firms with robust R & D and sometimes the task of formalizing the linkage between private investors and universities is difficult. These challenges can be overcome by the removal of impediments, increased interaction in the National Innovation System (NIS), provision of resources and development of infrastructure.

The study addressed the challenges by focusing on IP in manufacturing sector. The process of acquisition, dissemination and exploitation of knowledge can be supported by ICT tools which are paramount in employee-driven IP (Gressgard, Amundsen, Aasen & Hansen, 2014). The measure of ICT was adopted from technological infrastructure as articulated by Cheruiyot, Jagongo and Owino (2012) which includes management information system, customer relationship management, computers, network connectivity, intranets, internet and use of social media and levels of automation.

2.3.9. The Relationship between Knowledge Entrepreneurship and Innovation Performance

Several scholars have emphasized on the role of new information in developing innovation capacity to improve IP. Knowledge of project risk planning and goal stability has also been confirmed to be influencing innovation positively (Salomo, Weise & Gemunden, 2007). There are also organizational factors such as top management support that significantly influence employee willingness to share knowledge which improves IP (Lin, 2007).

However, further insight is required on how such parties can leverage technology diffusion for mutual benefit. Svetina and Prodan (2008) further recognized that internally developed knowledge has an immense influence on the firm's IP, but ignored the role of the local environment they operate in.

The attempt to address this gap was made by Christoph and Katrin (2008) who found that a complementary relationship between different partners such as universities is crucial for technology transfer and the firm's IP. The study addressed this gap by finding out how knowledge entrepreneurship external environment, partnerships, collaboration and networking which comprises the innovation ecosystem influence IP. The innovation ecosystem was treated as a moderating variable between entrepreneurship knowledge and IP.

2.3. 10. Innovation Ecosystem

There are several definitions that have been advanced in an attempt to understand the Innovation Ecosystem (IE). Poikola, Kola and Hintikka (2011) believe that it is the functioning interdependency among partners with the dynamic interaction between different actors within a given locality. Leavy (2012) urges that it is the integration of solutions from the combined efforts of multiple partners. The innovation ecosystem is, therefore, the operating environment in which firms have collaborative networks with the different players in the industry to cooperate to improve their IP. It is a term used as a metaphor to describe the co-creation and relations that exist within a cluster or a spatial unit.

The IE has received immense interest across the globe. Firms are finding it increasingly important to manage their innovation within a complex environment that requires collaborations. The dynamics, particularly in the manufacturing sector such as the ever-changing technology and market sophistication, necessitate firms to seek collaborators to remain competitive (Engler & Kusiak, 2011). The manufacturing sector has a complex flow of information, materials and diversity of players thus firms in the sector cannot operate in isolation but rather on a comprehensive systematic collaboration (Barile, Lusch, Reynoso, Saviano & Spohrer, 2016).

The complexity, uncertainty and ambiguity in the manufacturing sector require a well-coordinated IE. The key success factors of an IE are government policy, innovation output, skills and competitiveness (Jena, Fulzele, Gupta, Sherwani, Shankar & Sidharth, 2016). The benefits of IE are that it allows other sector players, firms and citizens to add value to an existing product whose manufacturers cannot do it alone (Zuiderwijk, Janssen & Davis, 2014). However, IE in developing countries is faced with numerous challenges such as the informal economy, high poverty levels, unsupportive infrastructure and low conceptual insights (Toivanen, Mutafungwa, Hyvonen & Ngogo, 2012).

The concept of IE in Kenya is being embraced by various stakeholders but its conceptualization is still in the initial stages yet it is faced with challenges of low networking. Innovation ecosystem involves the infrastructure, policy and social-economic diversion, but in Kenya, it is fragmented, undifferentiated and unsustainable with less coordination and collaboration (Cunningham, Cunningham & Ekenberg, 2016).

Several parameters have been used to measure IE. They include collaboration among the different stakeholders, integration and transformations (Koontz, & Bodine, 2008). These can be measured by the level of networking among participants, universities, research institutions and government agencies (Zuiderwijk, *et, al.,* 2014). The parameters for IE as propounded by Majava *et al*., (2016) are accelerators, incubators, business services and trade organization support which provides a channel for static agglomeration economies, technology spillover, dynamic agglomeration economies and infrastructural economies. These parameters were adopted in the study because they capture the essential ties within entities in the manufacturing innovation ecosystem such as the role of government, financial institutions, innovation and technology markets, Universities, research and innovation institutions.

The operating environment is crucial to the success of enterprises because it leads to open innovation which ultimately results in IP. Johan & Sven-Ake (2005) found that scanning the operational environment positively influences IP. This implies that IE counts when it comes to the evaluation of determinants IP, but it's not the only factor. Padula (2008) found that portfolios that are linked to several alliances have greater levels of IP, but there is a need to further examine the relationship between network structures and IP. The study evaluated the existing networking structures between the various actors and their level of influence in manufacturing firms in major industrial counties in Kenya.

Knowledge entrepreneurship is a prime mover of IP as depicted by the KE model. However, the Innovation climate has a positive influence on IP and has a moderating effect on interaction mix and IP (Oke, 2011). Furthermore, collaboration with the relevant agents facilitates the conversion of creativity from intellectual assets to IP (Abosede & Onakoya, 2013). Innovation has thus become increasingly more open and ecosystems are defining innovation types and levels thus influencing IP (Ikeda & Marshall, 2016). It is important to build structures that facilitate ecosystem connectivity by monitoring emerging technology and establishing a mutual relationship with high-value partners to redefine traditional industries and gain competitive advantage (Ikeda, Marshall & Okmura, 2016). The study therefore, captures the existing alliances, collaborations and network systems by investigating the prevailing IE as the moderator.

2.3.11. Relationship between Knowledge Entrepreneurship, Innovation Ecosystem and Innovation Performance

There is plenty of work linking KE and IP. McDonald (2002) found that KE has a positive relationship with IP. Coulson-Thomas (2004) observed that KE leads to knowledge generation and exploitation which creates a culture that stimulates knowledge-based ventures thus providing workers with pragmatic skills and tactics required to harness IP. New scientific knowledge also requires KE to enhance commercialization which in turn enhances IP (Christian & Ulrich, 2005). The required components to nurture the capacity to improve IP flourishes through KE, but there is a need to utilize quantitative data and apply the concept in a different context (Senges and Duart, 2007). It was also realized that relationship learning coupled with high absorptive capacity significantly influences IP and the competitive advantage of a firm (Chen, Lin & Chang, 2009).

Furthermore, intra-firms, own generated, external sources of knowledge, internal networks and their interactions increase the IP of an enterprise (Frenz & Letto-Gillies, 2009). Organization ability to; learn, rely on KE, respond and seize up opportunities leads to IP in manufacturing industries (Jusoh, Asimiran & Ziyae. 2010). The commercialization of novelty is also greatly shaped by KE which increases the level IP, but it is necessary to identify, attract and support the human resource to transform knowledge into innovation output that leads to competitiveness and improved performance (Sotarauta & Pulkinen, 2011). It is for this purpose that leadership is crucial in harnessing the human resource capacity to innovation.

Knowledge properties are also positively related to IP where a firm has a high absorptive capacity (Wang & Han, 2011). Tseng and Hung (2011) found that the following attributes of knowledge; input, spillover and absorptive capacity are all positively related to IP. Idris and Tey, (2011) found that knowledge transfer is a mediating variable between strategic fit and innovation in international joint ventures. Madhoushi, Sadati, Delavari, Mehdivand and Mihandost (2011) found that the mediator between entrepreneurship orientation and IP is knowledge management, but pointed out the need of more research on entrepreneurship processes, organizational knowledge and their influence on IP. The study addressed this gap by linking knowledge entrepreneurship with IP while moderating the relationship with the IE.

Industrial clustering, knowledge acquisition, creation, dissemination and storage reinforces internal innovativeness capacity and influences IP positively (Lai, Hsu, Lin, Chen, & Lin, 2014). Connecting new and existing knowledge domains also leads to higher levels of IP, but only when the degree of complexity is low (Wiley, 2015). The study was anchored on investigating how the cognitive capacity of human resources can be enhanced through organization learning, leadership, ICT and their influence on IP taking into consideration the external collaborations and networks. Internal and external knowledge search depth is closely related to incremental IP while search breath is linked to radical IP (Hung & Yun, 2010). It is therefore evident from the discourse that there is a need to further interrogate other variables such as IE.

The relationship between KE, IE and IP can be traced from several researchers. Shrader (2001) found that scanning the external information, cross-functional integration through collaboration and decisions made based on information from industry in manufacturing firms are all significantly collated to IP, but internal information generated from suppliers, customers and competitors is negatively collated to IP. Goh (2005) found that knowledge-centered principles, initiatives and infrastructure enhance IP although creativity, imagination, intuition and an enabling environment is required. Furthermore,
Knowledge and open collaboration influence IP through knowledge integration (Luca & Atuahene-Gima, 2007).

The rate of growth for the supplier industry has been regarded as a moderator between intellectual capital and IP (Zerenler *et, al.,* 2008). Dirk and Hanna (2008) found that locational factors influence innovation systems, IP, knowledge transfer and spillovers which emanates from universities, research institutions, experts in specific industries, suppliers, competitors, customers and collaborating partners which all generate positive knowledge externalities.

The integration of collaboration between different partners and networking among the various alliances bring about open innovation. This is a broad-based and collective approach that has a significant influence on IP, however, this activity should not substitute internal knowledge development which is crucial in generating innovation capacity (Ebersberger, Bloch, Herstad & Velde, 2010). On the other hand, absorptive capacity significantly influences the relationship between collaboration with competitors, suppliers, and research organizations with IP however it has a negative influence on collaboration with customers (Tsai, 2009). Examining the moderating role of the various collaborations and partnerships in manufacturing firms between KE and IP could demonstrate the value of the operating environment on IP. Zhang, Benedetto and Hoenig (2009) found that knowledge utilization is a strong predictor of IP because it hedges off against the challenges of breakthroughs, but also realized that there is a need to validate this relationship in details, examine other moderating factors and the network effects. The gap was addressed by investigating the moderating effect of IE between KE and IP.

Trust in collaborations moderates the influence of contracts on IP in a situation of environmental uncertainty (Wang, Yeung & Zhang, 2011). Knowledge capacity dynamics mediate between KM and IP, but it is necessary to differentiate between radical and incremental innovation which requires both adaptive and generative learning (Alegre, Sengupta & Lapriedra, 2011). The aspect of adaptive learning in this study was examined through an investigation of how manufacturing firms utilize external information and collaborations to improve their IP while developing and capitalizing on their internal capacities to reconfigure available knowledge leading to IP. The complex adaptive system empowers the bottom-up organization learning process and viable systems model enables a learning context that embraces networking which improves IP and sustainability, however, further research is required to find out the complementarity of the two approaches (Espinosa & Porter, 2011). The study was anchored on complexity theory to examine how knowledge entrepreneurship can be blended with interactions within the operating ecosystem to bring about open innovation and its influence on IP in manufacturing firms.

Furthermore, multiple regressions have shown that openness, autonomy, integration and experimentation capacities have a significant influence on IP (Chang, Chang, Chi, Chen & Deng, 2012). These aspects were refined by investigating the influence of KE, IE and IP. Moderately high cooperation and competition have a positive influence on IP, but there is a need to investigate the nature and effects of tension, balancing and IP (Park, Srivastava & Gnyawali, 2014). Ritala *et al*., (2014) found that sharing knowledge with external players has a positive influence on IP, but cautioned that knowledge leakage hurts IP.

Open innovation can lead to regional innovation. It can also foster consistent learning which helps in accelerating growth and allows knowledge-intensive enterprises to engage in innovation activities thus improving IP, but further research is required to expand the understanding and perspective in which these can happen in a different context (Secundo, Schiuma & Passiante, 2017). The study addressed this gap by focusing on the broad spectrum of the sector from the small, medium and large firms while at the same time conducting a comparative analysis across the various subsectors.

2.4. Summary of Literature Review and Research Gap

There are several gaps that have been identified in the process of reviewing literature. Svetina and Prodan (2008) recognized that internally developed knowledge has an immense influence on the firm's IP, but ignored the role of the local environment in which manufacturing firms operate in. Externally generated knowledge is also important in providing foresight and creativity and hence it is paramount to blend internally and externally generated knowledge for optimization of IP. The external knowledge can be generated through the interaction of networks within the different stakeholders in the industry. Zhang *et al*., (2009) pointed out that there is a need to validate the relationship of KE and IP in details by examine other moderating factors and the network effects. The moderating factor is captured as IE in this study.

The empirical review also indicates a lack of an appropriate IP measurement model. Birchall *et, al.*, (2011) found that there is need to align innovation with the profitability of a firm while at the same time address contextual factors. This points out to the importance of developing an appropriate model for measuring IP. The situation is further aggravated of by the prevailing weak linkages within the IE which leads to high rate of innovation abandonment. Ongwae *et, al.*, (2013) found that manufacturing sector in Kenya has the highest abandoned innovation activities at about 40%, but used desk review from generic data in Economic Co-operation and Development manual. Sambuli and Whitt (2017) found that there has also been failure of incorporating local knowledge in the innovation process, but their study was conducted in Africa and Asia Continent, thus there is need to replicate the study in Kenya. The study therefore conceptualized how KE, IE and IP can be aligned to improve the competitiveness of manufacturing firms in Kenya.

2.5. The Conceptual Framework

This section illustrates the interrelationship between KE, IE and IP. Previous studies have indicated that knowledge-centered principles, initiatives and infrastructure enhance IP (Goh, 2005) although an enabling environment is equally important. Furthermore, Knowledge and open collaboration influence IP through knowledge integration (Luca & Atuahene-Gima, 2007). Dirk and Hanna (2008) found that locational factors influence innovation systems, IP, knowledge transfer and spillovers which emanates from universities, research institutions, experts in specific industries, suppliers, competitors, customers and collaborating partners which all generate positive knowledge externalities. These aspects were refined by investigating the influence of KE, IE and IP.

The independent variable was KE, IE was the moderating variable and IP was the dependent variable. Moderately high cooperation and competition have a positive influence on IP, but there is a need to investigate the nature and effects of tension, balancing and IP (Park *et al*., 2014). Ritala *et al*., (2014) found that sharing knowledge with external players has a positive influence on IP, but cautioned that knowledge leakage harms IP.

The relationship between KE, IE and IP can be illustrated through a conceptual framework. The conceptual framework is an improvement of the knowledge entrepreneurship model as propounded by McDonald (2002), Senges and Duart (2007). The study introduces the important aspects of information and technology in communication which is crucial in knowledge-gathering, sharing, transfer, utilization, absorptive capacity and storage. The study also brings in the concept of IP rather than just focusing on innovation alone. This is because manufacturing firms do not seek innovation for its own sake but to improve competitiveness and this can be well captured in IP. Knowledge entrepreneurship is linked to IP with an acknowledgment of the influence of IE as a moderating variable. This is shown in figure 2.3.

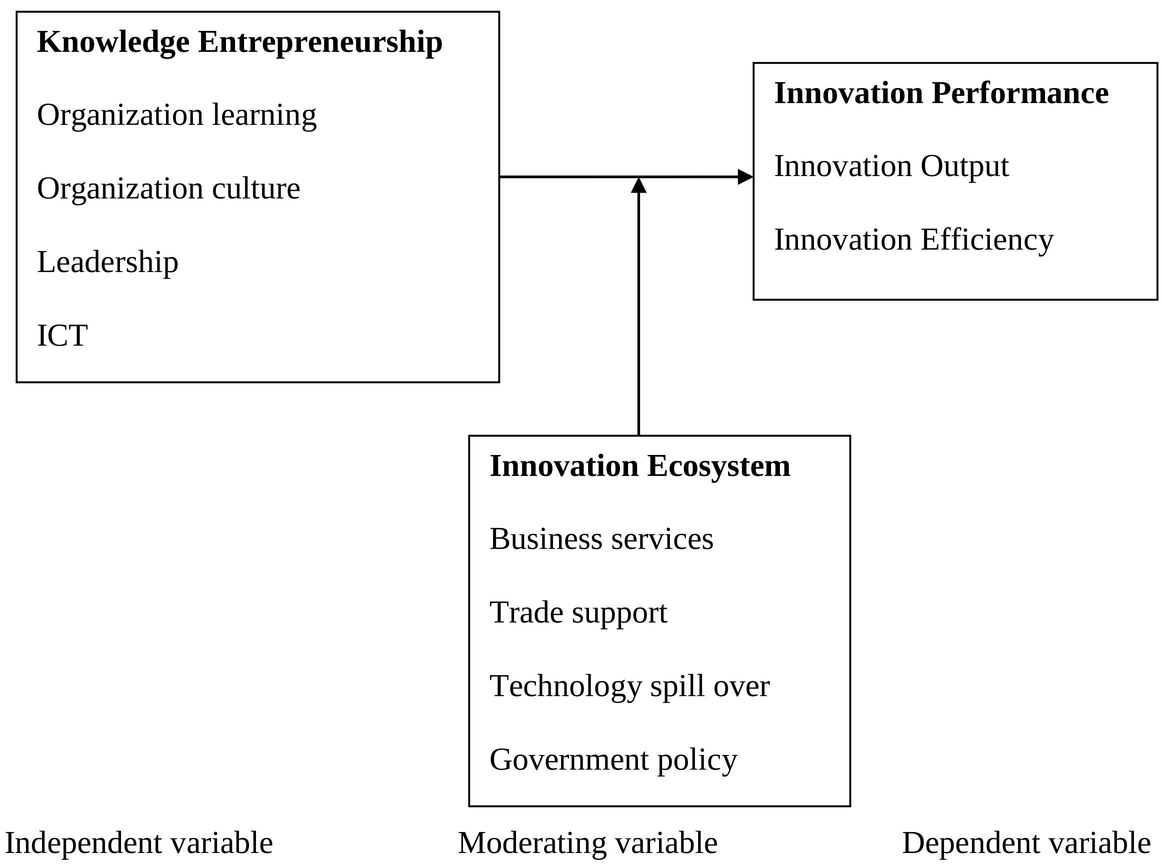

Figure 2. 3: The Moderating Role of IE on KE and IP

The conceptual framework was used to anchor the study by indicating the interrelationship between KE, IE and IP. The gap of omitting contextual factors in the previous studies was addressed by incorporating IE as a moderator between KE and IP. The aspects of KE were captured through organization learning, organization culture, leadership and ICT while a mathematical model developed from the literature review captured the key aspects in IP. The framework sought to determine the influence of how business services, trade organisation, technology spillover and government policy influence the relationship between KE and IP.

2.6. Chapter Summary

The existing body of knowledge is not sufficient enough to explain the influence of IE on KE and IP. The empirical review has indicated that KE has a direct relationship with IP, but also points out the need to consider the context, which is an area that is under researched. The study therefore incorporates the context by considering the IE as a moderating variable between KE and IP in manufacturing firms in Kenya. The relationship between the KE, IE and IP has been illustrated through a conceptual framework.

The Schumpeter (1934) theory formed the basis for articulating innovation activities. The Gleick (1989) complexity theory brought out the importance of incorporating the context in which KE influences IP. Roger's innovation diffusion theory brought out the process of commercializing innovation outputs in an efficient manner which is the whole mark of IP. The empirical and theoretical review therefore formed the basis for hypothesis testing of the study which is discoursed in the proceeding chapter.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

This section entails an explanation of the research steps and choice of methods that were followed in order to test the hypothesis in the proceeding chapter. It involves the description of Philosophy, research design, target population, sampling design and sample size determination, data collection procedures and instruments, validity and reliability, data analysis and presentation as well as ethical considerations.

3.2. Research Philosophy

The philosophical ideology that guided this study was pragmatism. This is because mixed research method was used to compliment and supplement the strengths and weaknesses of both quantitative and qualitative data in capturing the phenomenon surrounding KE, IE and IP. Creswell (2014) argue that pragmatism is more appropriate for mixed methods because it focuses on research problem. Furthermore, it provides for triangulation.

Triangulation is an approach of combining several perspectives in research to depict reality. It allows for various theoretical interrogation, observation, methodologies and different sets of data. The approach is beneficial in this study because it provided completeness in terms of complementary strength, confirmation in terms of generating higher-level frameworks and contingency mitigation by attending to divergent inferences (Jack and Raturi, 2006). Multiple triangulations were done by reviewing three different theories, using qualitative quantitative data, using different research instrument which were; questionnaires, interview schedule and check list. Triangulation was also applied by utilizing different methods of testing for validity and reliability as well as different methods of data analysis. The research design was therefore guided by pragmatism philosophy.

3.3. Research Design

Mixed method design was used because multiple types of data were used. The study utilized both quantitative and qualitative data to complement each other. Creswell (2014) postulated that each type of data has its weakness and strengths which can be leveraged upon to provide a comprehensive understanding of the research problem. The two forms of data were collected simultaneously to provide deeper understanding of the relationship between KE, IE and IP. The design is appropriate for this study because the opinions of respondents were important on KE and IE which are largely in qualitative form while the actual counts are important in determining the IP and thus the importance of quantitative data.

3.4. The Target Population

The sampling frame was the membership list for manufacturing firms in Kenya as contained in Kenya Association of Manufacturers' (KAM) directory of the year 2017/2018 which at the time of the study had a total of 828 manufacturing firms. The association is the widely and officially recognized body that registers manufacturing firms in the country and eligibility is being involved in manufacturing activities. The association (KAM) is a relevant category for this study because it advocates for competitiveness, cooperation and policy intervention. It does this by promoting trade and investment, facilitating an enabling environment, reducing the cost of doing business through encouraging innovation and inclusivity (Kenya Association of Manufacturers, 2018). Inclusivity and cooperation strengthen internal and external knowledge, policy advocacy and facilitation of an enabling environment that addresses the innovation ecosystem while promoting trade, investment, cost reduction and innovation addresses innovation performance which is interrelated in improving competitiveness.

The unit of analysis was manufacturing firms. This is because pertinent data was collected about manufacturing firms. The respondents were drawn from the heads of operations, innovation and marketing because these are the key personnel who have the responsibility of steering innovation performance in their respective firms. The use of three different sets of respondents within a firm allowed for data triangulation. The average score on the respondents within an organisation was derived to represent the overall score because the unit of analysis was the firm and yet some firms did not have three respondents. Furthermore, the small, medium and large firms had equal chances of selection because of proportionate representation of each sector. The distribution of manufacturing firms in counties within different counties across the country is indicated in table 3.1.

Table 3. 1: Distribution of Manufacturing Firms across the Country

Serial number	County	Number of manufacturing firms	Serial number	County	Number of manufacturing firms
1	Nairobi	493	12	Kilifi	4
2	Mombasa	99	13	Kisii	3
3	Nakuru	50	14	Taita Taveta	1

4	Kiambu	51	15	Kakamega	5
5	Uasin Ngishu	27	16	Kirinyaga	1
6	Machakos	34	17	Kajiado	2
7	Kisumu	26	18	Laikipia	1
8	Meru	7	19	Nyandarua	1
9	Kericho	5	20	Kwale	4
10	Bungoma	4	21	Tranzoia	4
11	Nyeri	4	22	Muranga	2
TOTAL					**828**

Source: Kenya Association of Manufacturers' (KAM) directory for year 2017/2018

The target population was, therefore, be the product of the number of firms in the counties and three respondents per firm (828*3) which are 2484.

3.5. Sampling Design and Sample Size Determination

A multi-stage sampling strategy was used. Purposive sampling was used to select the major industrial counties in the country. This is because geographical area concentration of manufacturing firms provides an ecosystem for accessing knowledge, diversity in organization culture, high rate of new technology adoption and wide networks for collaboration (Dvir & Pasher, 2004). These regions are also suitable spatial units for knowledge acquisition, accumulation, utilization and innovation transfer because they attract investments and talents (Majava *et al*., 2016). The major industrial counties which were sampled are 7 and they include; Nairobi, Mombasa, Kisumu, Nakuru, Kiambu, Machakos and Uasin Ngishu because they have the largest number of manufacturing firms in the country as captured in table 3.2.

Stratified random sampling was then used to sample firms in selected Counties. This is because it provides for proportionate representation from the different subgroups in a population and allows for the inclusion of specific characteristics in a sample (Creswell, 2014). The sampling design, therefore, allowed for firms to be sampled from not only from different sizes (small, medium and large), but also from the various manufacturing sub-sector according to the relative numeric strength as indicated in table 3.3.

Purposive sampling was then used to sample the respondents. This enabled the researcher to select the key respondents who were in a position to provide the required information concerning KE, IE and IP. The respondents were the heads of operations, innovation and marketing because these are the key personnel who have the responsibility of knowledge management, contextual adaptability and promotion of innovation performance in their firms. The average score of the respondent was tabulating to form the firm's score to mitigate for cases where some respondents did not respond or where a firm did not have some of the position holders.

In this study, the sample size was determined by applying the Yamane (1967) formula which states that; $n = \frac{N}{1+N(e)^2}$ where n is the sample size, N is the target population and e the level of precision which in this case is 5% which is the acceptable level of significance in social science research. Calculating the sample size using the formula gave a value of; $n = \frac{2484}{1+2484(0.05)^2} = 344.5$ which was rounded off to the nearest whole number of 345. The formula was appropriate to this study because it provided a sample size that was sufficient to construct a Structural Equation Model (SEM). Hair, Black, Babin and Anderson, (2010) argues that the required threshold for constructing a Structural SEM is at least 200. The sample size of 345 is above the required threshold of 200.

Proportionate representation from each county was provided to eliminate bias in selecting firms from the same area. This was done by dividing the sample size of 345 by the 3 respondents per firm to determine the number of firms to be sampled which was115. The number of firms to be sampled per county was the total number of firms in the county divided by the total number of firms in the sampled counties and then multiplied by the required total sample size of the firm derived from the Yamane (1967) formula. The corresponding number of firms to be sampled per County is illustrated in table 3.2.

Table 3. 2. The Number of Manufacturing Firms Sampled per County

Serial	**Town**	**Number of firms**	**Number of firms to be sampled**	**Respondents**
1	Nairobi	493	(493/780) 115 = 73	73*3 = 219
2	Mombasa	99	(99/780) 115 = 14	14*3 = 42
3	Kiambu	51	(51/780) 115 = 8	8*3 = 24
4	Nakuru	50	(50/780) 115 = 7	7*3 = 21
5	Uasin Ngishu	27	(27/780) 115 = 4	4*3 =12

6	Machakos	34	(34/780) 115 = 5	5*3 = 15
7	Kisumu	26	(26/780) 115 = 4	4*3 = 12
Total		**780**	**115**	**345**

The inclusion of all manufacturing sub-sectors was a form of data triangulation. Simple random sampling from the different manufacturing sub-sectors was then used to obtain the number of firms per sector and kept proportional to the sizes of the sub-sector as indicated in table 3.3

Table 3. 3. Distribution of Manufacturing Sub-sectors in Major Industrial Counties

Sub sector		Nairobi		Mombasa		Kisumu		Nakuru		Kiambu		Machakos		Uasin Ngishu		Sum
		No of firms	Sample	No of firms	Sample	No of firms	Sample	No of firms	Sample	No of firms	Sample	No of firms	Sample	No of firms	Sample	
1	Building, mining & construction	17	3	8	1	4	1	2	0	1	0	3	1	1	0	6
2	Chemical and allied	65	10	5	1	1	0	2	0	3	0	3	1	2	0	12

3	Energy, electrical & electronics	41	6	3	0	2	0	2	0	0	0	0	0	1	0	6
4	Food and beverages	104	15	25	4	10	2	22	3	22	4	5	1	11	2	31
5	Leather & footwear	5	1	3	0	0	0	2	0	2	0	2	0	0	0	1
6	Metal and allied sector	52	8	16	2	3	0	4	1	5	1	3	1	1	0	13
7	Vehicle assemblers and accessories	37	5	3	0	2	0	3	1	1	0	1	0	4	1	7
8	Paper and board	58	9	5	1	2	0	2	0	6	1	0	0	0	0	11
9	Pharmacy & medical equipment	18	3	2	0	0	0	0	0	3	0	1	0	0	0	3
10	Plastics and rubber	54	8	8	1	3	0	1	0	4	1	3	1	2	0	11
11	Textile and apparels	25	4	19	3	1	0	6	1	3	0	7	1	4	1	10
12	Timber, wood and furniture	17	3	2	0	0	0	4	1	1	0	0	0	2	0	4
	Total	**493**	**73**	**99**	**14**	**26**	**4**	**50**	**7**	**51**	**8**	**34**	**5**	**27**	**4**	115

3.6 Data Collection Procedure and Instruments

This section describes the procedures to be used in data collection as well as the instruments to be used. The data collection procedures and the instruments for analysis are explained in the ensuing discussions.

3.6.1. Data Collection Procedure

The researcher utilized primary and secondary data using quantitative and qualitative methods which is a form of methodological triangulation referred to as mixed-method research. Researchers use both quantitative and qualitative data to improve accuracy, produce a holistic view and to hedge off against the biases of single methods (Denscombe, 2008). A combined approach also bridges the gap between the two methods (Rod, 2009) and allows for compensation of weakness of one approach with the strength of the other to achieve the best results (Creswell, 2014). Utilization of both approaches, therefore, broadens the rigors of research. The researcher administered the questionnaire and the interview schedule with the help of research assistants.

The quantitative method of data collection provides information based on quantified measures and enables researchers to investigate a large number of cases and can be generalized to the wider population. It also provides for more responses from a variety of wider respondents (Greeff, 2015). This was achieved by selecting different groups of respondents in a firm while at the same time including the different sub-sectors within the manufacturing sector. However, it ignores the fact that human beings behave and interpret the world around them differently and may restrict participant's responses and may not facilitate a detailed description of a social phenomenon (Bryman, 2008).

Qualitative method, on the other hand, is appropriate for studying and gaining a deeper understanding of the participant's personal experience which provides a rich and complex description of subjects being investigated. It also enhances closer collaboration with participants and ensured data credibility (Creswell, 2014). However, once the approach is used alone, it is difficult to generalize findings.

The researcher attempted to reconcile these two methods of data collection by use of a Likert scale because it converts qualitative responses into quantitative data. Likert scales are widely accepted as a way of converting qualitative responses to quantitative data that can be used to test relationships (Boone & Boone, 2012). Wilits, Theodori and Luloff (2016) observed that analyzing qualitative data using the Likert scale leads to the development of new knowledge in different areas of study. Open-ended qualitative responses were also used to capture a wider variety of information than what was contained in the closed type of questions and then converted into quantitative data through proportioning. This was done by developing the main themes from the responses through tabulation of the frequencies. The frequencies were then converted into percentages to rank the main themes.

3.6.2. Data Collection Instruments

Semi-structured questionnaires, structured interview schedules and checklists were utilized to collect data. Questionnaires were developed according to the constructs and parameters of each of the variable as established literature review and knowledge entrepreneurship model. Interview schedules were used to collect data from key informants who were the contact persons in the sampled firms, officials of KAM and the Ministry of Industrialization and Enterprise Development.

The questionnaires and interview schedules complemented each other for more comprehensive data. The observation checklist was used to identify clear signs of KE, IE and IP in a firm. Cases were also prepared in firms where IE was exemplary and KE conspicuously lead to enhanced IP. The cases were presented as narratives and strengthened the interpretations of findings. The use of different instruments is another form of data triangulation. The data collection instruments were piloted in one firm per sector which constituted 10% of the sample size. This was done to identify any questions that may be unclear and ambiguous to the respondents.

3.7. Validity and Reliability

Validity and reliability were addressed using different approaches. Validity is the criteria used to access quality regarding the procedure and results that enhance credibility, transferability, dependability and conformability (Bryman, 2008). Construct validity which includes convergent and discriminant validity was applied.

Convergent validity of the parameters that were used to measure KE, IE and IP was tested using the confirmatory factor analysis. The alpha coefficient was equal to or more than 0.7, it depicted the credibility of the measure (Alegre *et al*., 2006).

Content and criterion-related validity were also used to ascertain the credibility of the research procedure. Content validity was addressed by constructing the measuring scale in line with the literature and pre-testing the research instruments during piloting. The questionnaire was designed in line with the constructs and parameters of KE, IE and IP as brought out in the literature review.

Criterion-related validity of instrument was also applied by demonstrating the accuracy of the measure by comparing the data in the questionnaires with the interview schedules. This is another form of triangulation. The interview schedule for the key informant was adopted from sections of the Company of the Year Award (COYA) assessment tool used by Kenya Institute of Management which assesses knowledge management, leadership, information technology, environmental focus and innovation which coincides with the study variable of KE, IE and IP. The two instruments were used to predict whether the responses are in concurrence thus confirming the validity of the questionnaire which is the main data collection instrument.

Reliability, on the other hand, ensures stability in providing similar outcomes in repeated trials. The internal consistency technique was used which shows the extent to which the procedures assess the same characteristics. Different respondents from the same firm provided for data triangulation which enabled assessment of both individual reliability of each parameter and the composite reliability of each variable. The threshold for the individual coefficient should be greater than 0.5, the composite coefficient should be higher than 0.7 and Cronbach alpha should be more than 0.7 (Alegre *et al.*, 2006). These thresholds were met and thus the data collection instruments were proved to be reliable. The various diagnostics tests were conducted to establish the suitability of the data before the inferences could be made on the study variables.

3.7. Pilot Study

The pilot study was conducted in 12 out of the sampled 101 manufacturing firms representing all the subsectors. The firms involved represented 10% of the sampled firms. The pilot study provided an opportunity to fine tune the questionnaire and the interview schedule so that a concurrence of understanding between what was asked and the responses given. The pilot study also helped in affirming the validity and reliability of the data collection instruments as well as the procedure used.

3.8. Data Analysis and Presentation.

Descriptive statistics were used to analyze demographic information about the respondents. The types of data collected for KE and IE were qualitative in the form of open-ended questions and categorical data obtained from closed-ended questions through a Likert scale which was transformed into quantitative data. The data obtained on IP was qualitative in the form of open-ended questions and quantitative in the form of continuous data. The Likert scale items were converted from qualitative responses to quantitative data. The open-ended responses were converted into quantitative data through proportioning by way of presenting the information in percentages.

The type of analysis for the first objective of determining the extent of influence of KE on IP was correlation and linear regression the tools used were Stata and Statistical Package of Social Scientist (SPSS). The same analysis, tool and tests were used for objectives two and the hypothesis respectively because the data sets are similar. The hieratical multiple moderated regression, Structural Equation Model (SEM) and Partial Least Square (PLS) were used to analyze the third objective and hypothesis. The tools used were Smart-PLS, algorithm and bootstrapping. The tests that were conducted included; moderating effects, normality, linearity, multicollinearity, construct and discriminant validity, unavailability of outliers, convergent, Confirmatory Factor Analysis (CFA), path analysis, Comparative Fix Index (CFI), Composite Reliability (CR), Average Variance Extracted (AVE), R square and the F square using the analysis summarized in table 3.4.

Table 3. 4: Operationalization of the Variables

Hypothesis	variable	Data type	Collection instrument	Scale of measure	Type of analysis	Tool

Hypothesis 1	KE and IP	Qualitative and ordinal	Questionnaire, interview schedule and checklist	Likert	Correlation and linear regression	Stata and SPSS
Hypothesis 2	IE and IP	Qualitative and ordinal	Questionnaire, interview schedule and checklist	Likert	Correlation and linear regression	Stata and SPSS
Hypothesis 3	KE,IE and IP	Qualitative, ordinal and continuous	Questionnaire, interview schedule and checklist	Counts	Hieratical multiple moderated and Multivariate regression, SEM and PLS	Stata SPSS and Smart -PLS

Comparison of hieratical multiple moderated regression and Structural Equation Model-Partial Least Square (SEM-PLS) was done to provide a comparative analysis of the two approaches. Multicollinearity among and between items was tested through a linear regression analysis by regressing each item of the study against each other. The items whose Variance Inflation Factor (VIF) was more than 10 were deleted since that is the recommended upper limit (Creswell, 2014). These tests were important in authenticating the findings.

The combined aggregate score of organizational learning, leadership, organization culture and Information Technology and Communication (ICT) formed a composite scale of KE. The interrelationship among KE, IE and IP was captured using a logarithmic transformation. This is because a logarithmic specification not only mitigates against the risk of autocorrelation, outliers and heteroscedasticity but also allows for interpretation of coefficients (Wang & Kafouros, 2009). The relationship among the variables was expressed in the form of:

i). $y = \beta o + \beta_1 X + \varepsilon$ which is the relationship between of IP and KE without IE

ii). $y = \beta o + \beta_2 Z + \varepsilon$ which is the relationship between IP and IE

iii). $y = \beta o + \beta_3 XZ + \varepsilon$ which is the interaction effect of IE between IP and KE.

The influence of moderation was determined by the interaction effect of KE and IE on IP. Linear regression was used to determine the interrelationship. Tables were used to present the findings. The data analysis matrix is captured in table 3.4

3.9. Ethical Consideration

The relevant authority's approval was sought before embarking on data collection. University approval was obtained before data collection, research permit was sought from the National Commission for Science, Technology and Innovation (NACOSTI) and consent to collect data from employees was obtained from the employer of the sampled firms. The researcher identified himself accordingly to the firm selected for the study.

Work disruptions were avoided by making prior arrangements and appointments. Timeliness in scheduled appointments was observed to avoid keeping the respondents waiting. The respondents were explained about the purpose and the importance of participating in the exercise. Sufficient disclosure of the items in the research instrument and the extent of involvements were also made to the firms and respondents.

The researcher was not offensive or stressful to the respondents. The respondents were not coerced to answer questions and no pressure was induced to participate in the research and thus voluntary participation was encouraged. It is only the firms and respondents who give consent to participate in the study were involved. Respondents were assured of their free withdrawal from participating in the exercise at any time they deemed fit to do so.

Respondents' confidentiality and anonymity were guaranteed, respected and protected. This was done by blinding of participants by use of codes to maintain anonymity. Workplace code of ethics, charters and norms was adhered to in the process of collecting data. The participant's privacy was also respected.

Raw data and materials such as filled data collection instruments will be kept safely for at least a period of five years for the purpose of future reference. Unbiased data analysis was also conducted to eliminate subjectivity. Proper citations and references was also adhered to. The researcher provided contacts for channeling any issue related to the study that may arise in the future.

CHAPTER FOUR

RESEARCH FINDINGS, INTERPRETATIONS AND DISCUSSIONS

4.1. Introduction

The chapter consists of the findings, analysis, interpretation and discussion of Innovation Performance (IP), Knowledge Entrepreneurship (KE) and Innovation Ecosystem (IE) and how the variables interact in manufacturing firms in Kenya. This section begins with the descriptions of general information about the respondents. The chapter then proceeds to analyse and discuss the findings on each of the objectives and end up with the testing of hypothesis and interpretations. The results were organized in forms of tables and graphs. Comparative analysis of hieratical multiple regression and structural equation model was also done.

4.2. Response Rate

The completed questionnaires that were filled up and received were 295 against 345 issued representing a response rate of 86% from 101 firms out 115 firms representing 88% of the firms sampled. The sample size of respondents of 295 was above the required threshold of 200 to construct a Structural Equation Model (SEM) (Hair, Black, Babin & Anderson, 2010).

4.3. Descriptive Analysis of General Information

Findings on the general information about the respondents which included the age, gender, and educational level and work experience are presented and discussed in this section. The descriptive statistics and their implications are then explained.

4.3.1. Education Levels of Respondents

The respondents were asked to indicate their highest academic qualifications. The diploma holders constituted 21.7%, bachelor's degrees 45.1% and masters 33.2%, thus the highest frequency of respondents were bachelor's degree holders as indicated in figure 4.1.

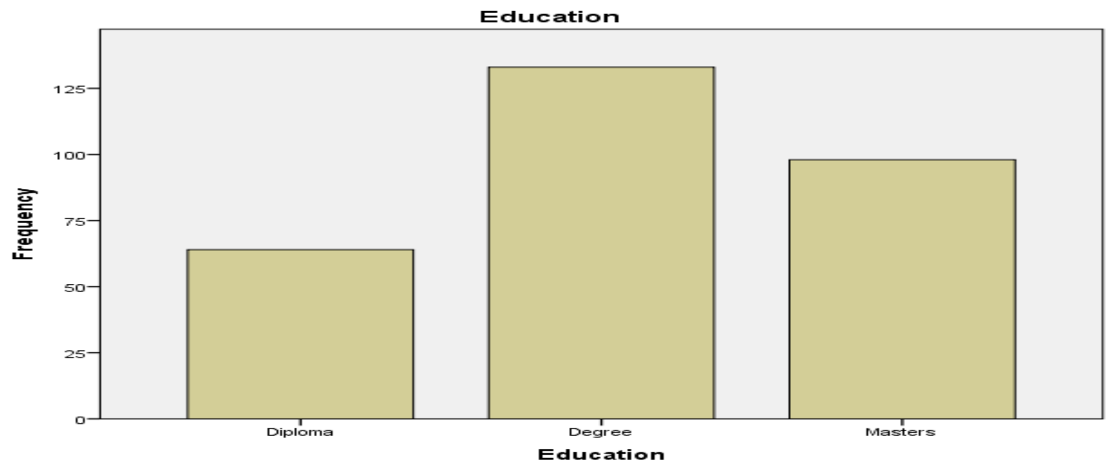

Figure 4. 1: Education Levels of Respondents

It was observed that bachelor's holders constituted substantial number of management in the manufacturing sector. This implies that manufacturing firms draw their heads of operations, innovation and marketing from bachelor's degree holders from the universities or encourages the management team to pursue degree programs. It means that manufacturing firms' value educated employees since universities are the apex of knowledge creation.

The finding that substantial number of heads of operations, innovation and marketing had high level of education is in tandem with other researchers. This is consistent with Cabrilo, Nesic and Mitrovic (2014) who found that high knowledge levels are great contributors to human capital that promote innovation performance. Manufacturing firms in Kenya, therefore, value leadership that is well educated for knowledge creation and sharing.

4.3.2. The Gender of Respondents

The respondents were asked to indicate their gender. The male respondents constituted 58% while 41.7% were female. The majority of the respondents were therefore male. This implies that the sampled respondents constituted more of the male's view than female perspectives, thus more men than women work as head of operations or production, innovation and marketing in manufacturing firms within the country.

The finding that the majority of respondents were male in the position of head of operations or production, innovation and marketing in manufacturing firms in Kenya is in line with other previous researchers. The finding concurs with Foss, Woll and Moilanen (2013) who found that more males are employed in management and operations while female are mostly placed at accounting, customer care and internal services although gender innovative behaviour does not differ in a similar environment and those male-dominated firms may suppress women-driven innovation. The findings are also in tandem with Wikhamn and Knights (2013) who found that open innovation is likely to sustain masculinity normalization which promotes rational control and congest thus inhibiting the innate potential of female creativity that can transform the performance of firms. Manufacturing firms should, therefore, cultivate the culture of openness to optimize on gender diversity through engagement to enhance greater creativity and innovation performance.

4.3.3. Age of Respondents

The respondents were also requested to indicate their age set which was grouped into five categories. The age group that had the largest respondents is 25 - 35 at 45.8% as indicated in figure 4.2.

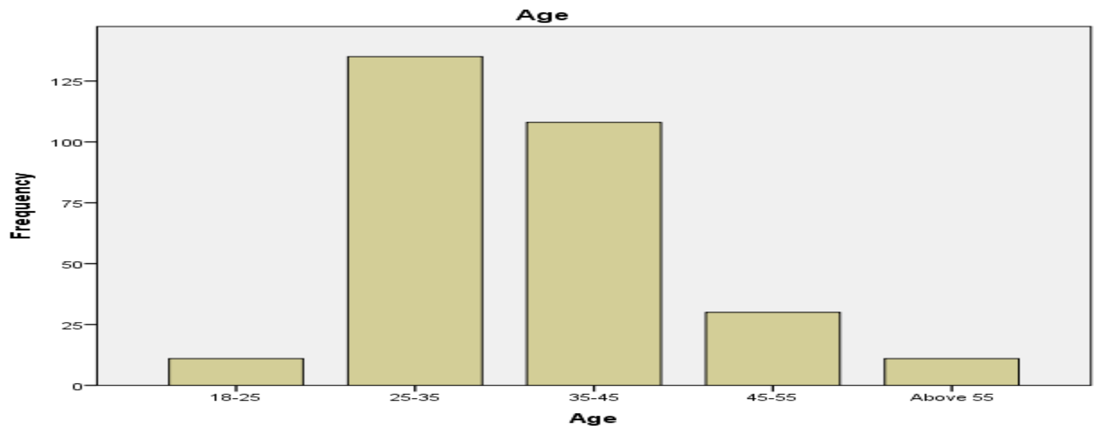

Figure 4. 2: Age of Respondents

The highest proportion of respondents were in the age bracket of between 25 to 35 years, thus a significant portion of responses were youth. This means that the younger have been accorded the opportunity to provide leadership in the form of section heads in operations, production, innovation and marketing in manufacturing firms in Kenya.

The finding that the majority of respondents were less than 35 years is important because youth play an important role in innovation processes. This is in tandem with Frosch (2011) who propounded that youth have the capacity to propel innovation activities in organizations. The findings are also consistent with Agnieszka (2018) who posit that the youthful generation is crucial in IP because they develop in the midst of a rapidly dynamic technological advancement which can lead to radical innovations. The high composition of youth in manufacturing firms in Kenya presents an immense opportunity to harness and tap their ideas and creativity that can lead to the development of IP which can enhance the competitiveness of the manufacturing sector.

4.3.4. The Working Experience of Respondents

The respondents' working experience was also captured in terms of years worked in the firm and grouped into four categories which were; less than 1, 1-5, 5-10 and over ten years. The majority of the respondents had over ten years of experience. Manufacturing firms therefore consider work experience before one is promoted to a section head thus work experience is valued in the sector.

The findings on work experience which indicate that work experience is valued in the manufacturing sector concur with other previous researchers. It is in tandem with Vasconcelos (2015) who found that it is less expensive to invest in innovation input for firms with employees who have substantial work experience and that longer work experience does not hinder IP. This is also consistent with Smith (2017) who found that work experience provides learning that enhances innovation. Substantial work experience is therefore important in enhancing IP.

4.4. Knowledge Entrepreneurship and Innovation Performance

The first specific objective was to determine the extent of influence of Knowledge Entrepreneurship (KE) on Innovation Performance (IP) in manufacturing enterprises in Kenya. A discourse on how IP was measured ensued followed by a description of how KE was derived.

4.4.1. Innovation Performance

The dependent variable of the study was Innovation Performance (IP) which was derived from the product of innovation output and innovation efficiency. The innovation output was measured as the sum of new products, processes and enterprises developed as a result of innovation. Innovation efficiency was measured by the level of sales growth rate attributed to innovation.

The respondents were requested to indicate the number of the increased new product, patents acquired, new innovation process and new enterprises as a result of innovation in the last three years. There were a total of 485 new products manufactured in the 101 firms under review and the new products manufactured per firm ranged between 0 and 13 as indicated in appendix vi. This implies that on average each firm had produced at least 4 new products for the last three years. The firms which had produced seven new products had the highest frequency at 21.9% followed by two new products at a frequency of 17.8 as indicated in figure 4.3

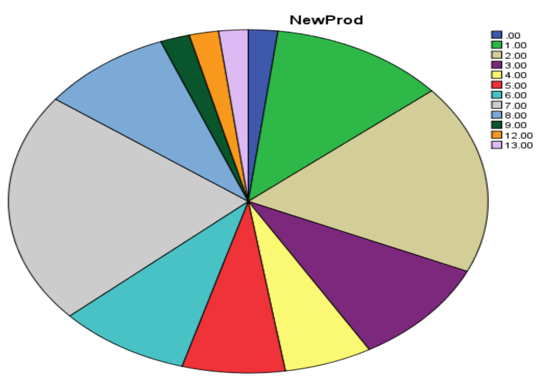

Figure 4. 3: **The Frequency of the Number of New Products Manufactured in the Last Three Years.**

This means that majority of firms had manufactured seven or two new products in the last three years. Further inquiry was done to find out the number of new products that were patented within a similar period. There was a total of 217 patents that were applied for out of the 485 new products manufactured as indicated in appendix vi. The number of the patent with the highest frequency was 1 as indicated in figure 4.4.

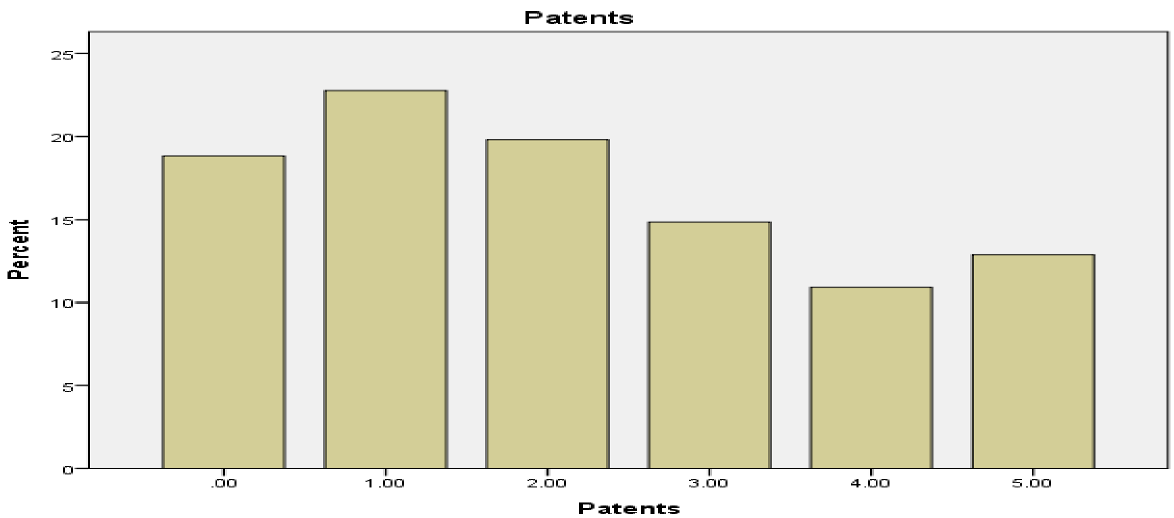

Figure 4. 4: The Frequency of Number of Patents Applied for in the Last Three Years

This implies that the majority of the firms had only one new product that was patented. It means that the rate of patenting is much lower than that of manufacturing new products. The mean of patents per firm was 2 against the 4 produced and the number of patents ranged between 0 to 5 against 0 to 13 for new products as indicated in table 4.1.

Table 4. 1. The Distribution of Patents across Manufacturing Firms

		Statistics	Bias	Std. Error	95% Confidence Interval	
					Lower	Upper
N	Valid	292	0	0	292	292
	Missing	0	0	0	0	0
Mean		2.1815	.0088	.0938	2.0068	2.3733
Std. Deviation		1.65741	-.00032	.04826	1.56106	1.74925
Variance		2.747	.001	.160	2.437	3.060
Skewness		.337	-.008	.081	.172	.487
Std. Error of Skewness		.143				
Range		5.00				
Minimum		.00				
Maximum		5.00				
Sum		217.00				

There was only 217 patents applied out of 485 new products generated for the three years. This translates to only 45% of the new products whose patent had been applied. The standard deviation of about 1.65 indicates that there was a relatively small spread of patents applied for within the manufacturing firms. This means that there was a relatively high level of uniformity in terms of the few numbers of patents applied across manufacturing firms.

Majority of new products manufactured had therefore not been patented. Manufacturing firms should be encouraged to patent their new products to protect imitiation and protect their copyright. The kenya intellectual property institute should also ease the process of acquiring the patents. The notable new products brought about by innovation were; nitrocellulose paints, hydro-pool, computerized painting machines, nova legs, sodium hypo-chloride, Clorox bleach, adjustable pallet racking and castellated beam for constructing cranes.

The other measure of innovation output was the new process. There was a total of 157 new processes that were initiated in manufacturing firms that were involved in the study as indicated in appendix vi. The highest frequency of the new process was one as indicated in figure 4.5.

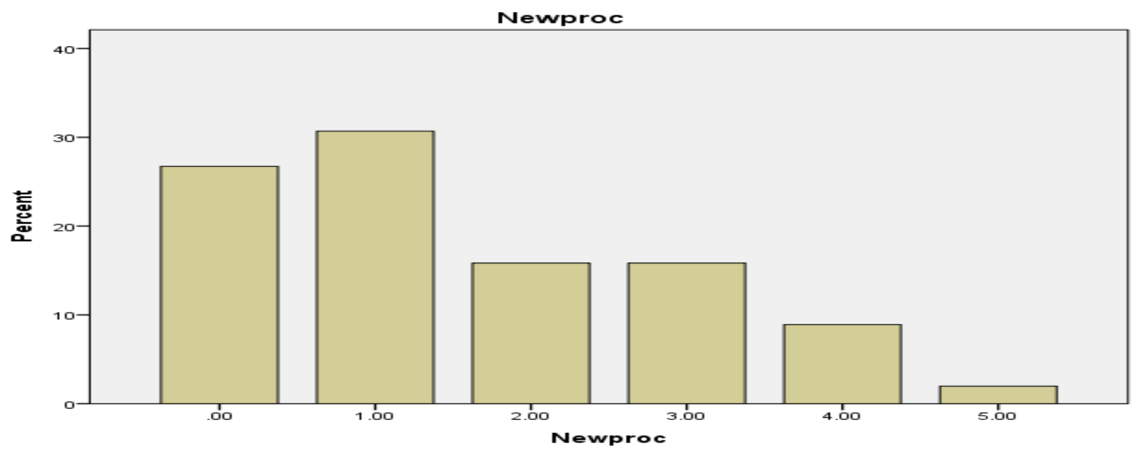

Figure 4. 5: The Frequency of Number of New Processe Initiated in the Last Three Years

This implies that the highest number of new process occurrences in a manufacturing firm was one. This means that there were few new processes initiated in the last three years in manufacturing firms. This was further collaborated with the observation of mean.

The mean new processes initiated per firm was 1 and the range was between 0 and 5 as indicated in table 4.2

Table 4. 2. The Distribution New Processes Initiated in Manufacturing Firms in the Last Three Years

N	Valid	101
	Missing	0
Mean		1.5545
Std. Deviation		1.37459
Variance		1.890
Range		5.00
Sum		157.00

This implies that on average each of the firms generated only 1 new process in the last 3years. This means that there was little incremental innovation in manufacturing firms. The standard deviation of about 1.4 implies that there was a small spread within the manufacturing firms. This means that there was a high level of uniformity in new processes across manufacturing firms and thus a high degree of homogeneity in the sample.

The most common form of process innovation observed was incremental innovation as opposed to radical innovation. Process innovation took the form of the production model and architectural improvement emanating from new technology adoption. Production model improvement involved redesigning the production process while architectural improvement entailed production system reconfiguration. The notable innovation processes was klorigen system which is a process of producing bio fix. The new processes were observed through a documented incremental improvement which led to a shift from a manual process, mechanical and then state of the art laboratory which led to increased outputs, efficiency and improved performance.

The checklist identified documented information on old performance based on the initial process and the new performance-based on the superior technology process illustrates a clear improved performance. The rate of production improved by 155.2% as a result of process innovation as indicated in table 4.3.

Table 4. 3. Production Improvement as a Result of New Process Innovation

	Package of produced biofix in grams	Units of Packets produced using low mechanised process	Units of Packets produced using new technology process	Rate of production improvement in percentage
i	150	800	2200	175
ii	100	1600	3640	127.5
iii	50	2000	5460	173
iv	20	3200	7280	127.5
v	10	4000	10920	173
	Average improvement			155.2

The average improvement in the production of 155.2% shows that new process innovation leads to significant improvement in quantity produced. This means that manufacturing firms that generate or adopt new and advanced production processes have a high potential of improving their production hence improved performance.

New processes also improved production efficiency. The time spent on production reduced significantly with the improved new process. There was a significant reduction in time spent on production with a new process as the speed of carrying out the mixing of raw material was high. This means that new processes enhanced production efficiency by saving on time spent.

The other measure of innovation output was new enterprises created. There was a total of 228 new enterprises that were created for the last 3 years as indicated in appendix vi. The highest frequency of new enterprises created were zero as indicated in figure 4.6.

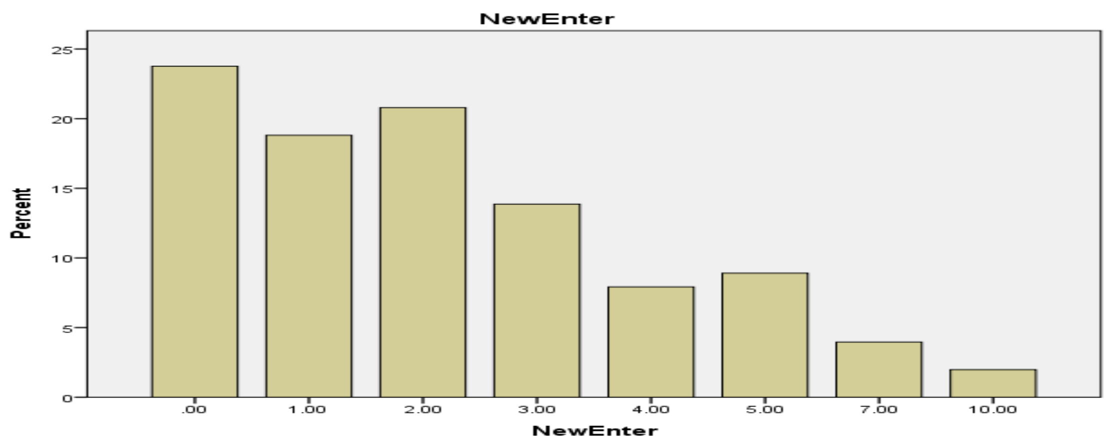

Figure 4. 6: The Frequency of Number of New Enterprises Created from 2015 to 2017

This implies that the highest response to the number of new enterprises was zero. This means that a substantial number of firms had not created any new enterprise in the last 3 years. The range of new enterprises created in the last three years was between zero and ten and a mean of two new enterprises per firm as indicated in table 4.4.

Table 4. 4. The Distribution of New Enterprises Created in Manufacturing Firms from 2015 to 2017

N	Valid	101
	Missing	0
Mean		2.2574
Std. Deviation		2.15246
Variance		4.633
Range		10.00
Sum		228.00

This implies that there was a wide difference in the distribution of new enterprises created in the manufacturing sector. This means that despite several firms having not created any new enterprise, there were few that had created up ten new enterprises to nurture innovations. The standard deviation of 2 implies that there was a moderately narrow spread within the manufacturing firms. This means that there was a relatively high level of uniformity in new enterprises across manufacturing firms and thus a relatively high degree of homogeneity.

The aspect of novelty across the manufacturing firms was compared by observing the mean, variance and standard deviation of the new products, patents, new process and new enterprises. There was a wide range of 13 and a high level of variance in new products at 8.82 than any other form of novelty as indicated in table 4.5.

Table 4. 5. Comparison of Variance in Novelty across the Manufacturing Firm

	N	Range	Minimum	Maximum	Mean	Std. Deviation	Variance
New Products	101	13.00	.00	13.00	4.8020	2.96992	8.820
Patents	101	5.00	.00	5.00	2.1485	1.65158	2.728
New process	101	5.00	.00	5.00	1.5545	1.37459	1.890
New enterprise	101	10.00	.00	10.00	2.2574	2.15246	4.633
Valid N	101						

This implies more new products were manufactured as opposed to other forms of novelty. This means that the general form of innovation in manufacturing firms in Kenya is the creation of new products relative to other forms of innovations such as new processes and enterprises. However, the maximum number of the new product was 13 while those that were patented were only 5. It means that majority of new products were not patented. Manufacturing firms should, therefore, strive to register their patent rights to avoid the escalation of counterfeits.

The new products had also a higher standard deviation as compared to other forms of novelty. This implies that there was a widespread new products created within the manufacturing firms. This means that there was a low level of uniformity in new products created and thus a low degree of homogeneity across the firms.

The aggregation of new products, patents, new processes and new enterprises constituted the innovation output. The sum of the total innovation output was 1071, mean of 10 and a range of between 1to19 as indicated in table 4.6.

Table 4. 6. Innovation Output Distribution across the Manufacturing Firms for the Last Three Years

N	Valid	101
	Missing	0
Mean		10.6040
Std. Deviation		6.21624
Variance		38.642
Range		19.00
Sum		1071.00

This implies that there were innovation activities that generated innovation output. This means that the outcome of innovation activities was observable and can be quantified. The standard deviation of 6.2 implies that there was widespread within the manufacturing firms. This means that there was a low level of uniformity in innovation output across manufacturing firms and thus a low degree of homogeneity in the sample.

The innovation output within the various sub-sectors was also examined. This was done through a comparison of means and the standard deviation. The highest mean was in plastics and rubber at 15 while the highest standard deviation was 7.25029 in motor vehicle assemblers and accessories as indicated in table 4.7.

Table 4. 7. Innovation Output within the various Sub Sectors in Manufacturing Sector

	Sub sector	Mean	Standard deviation
1	Building mining and construction	12.0000	5.43139
2	Chemical and allied	9.8000	5.86515
3	Energy, electrical and electronics	13.4000	6.46529
4	Food and beverages	13.0909	6.10907
5	Leather and footwear	4.0000	0.0000
6	Metal and allied	13.5000	5.71282
7	Vehicle assemblers and accessories	10.1667	7.25029
8	Paper and board	10.8182	5.68890
9	Pharmacy and medical equipment	4.0000	2.82843
10	Plastics and rubber	15.0000	6.42580
11	Timber, wood and furniture	6.5000	6.68581
12	Textile and apparels	4.0000	7.07107

This implies that there were more novelties created in the plastics and rubber sub-sector than any other. It means that on average, there were more new products, patents, new process and new enterprises created in the textile and apparel sub-sector. The highest standard deviation of 7.25029 was recorded in vehicle assemblers and accessories sub-sector. This implies that the spread of novelties was the widest in-vehicle assemblers and accessories sub-sector. This means that there was a low level of uniformity in novelties in-vehicle assemblers and accessories sub-sector and thus a low degree of homogeneity.

The comparison of innovation output and innovation intensity across the various subsectors in the manufacturing sector was also done. This was done by running explore descriptive statistics. The innovation output was highest in the plastics and rubber sub-sector while the intensity of innovation output is highest in the food and beverages sub-sector as indicated in figure 4.7.

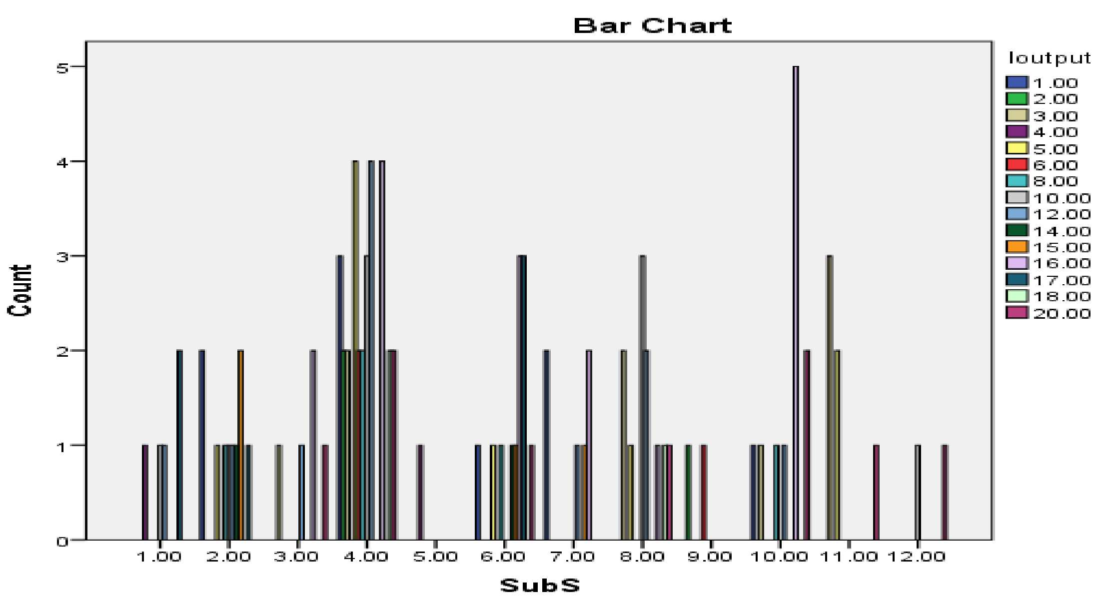

Figure 4. 7: Comparison of Innovation Output and Intensity across the Various Subsectors in Manufacturing Sector

The highest innovation output in the plastics and rubber sub-sector implies that the sector has more innovation activities as compared to other subsectors, but innovation efforts were concentrated more on new products. The highest innovation intensity in the food and beverage sub-sector means that there were concerted innovation efforts that were spread across the four novelties. The comparison of the contribution of innovation output and innovation intensity in the contribution of IP was highlighted in the subsequent findings.

The respondents were also asked to indicate the total sales for each of the past three years. They were also required to indicate the portion of sales attributed to innovation. The proportion of sales attributed to innovation formed the percentage sales growth rate brought about by innovations for the last 3 years as a result of a new product, patents acquired, new process and new enterprises. The sales growth rate brought about by innovations was then computed as sales emanating from innovation activities divided by total sales for a similar period multiplied by 100 to make it a percentage. This constituted the innovation efficiency.

The distribution of innovation efficiency across the manufacturing firms for the last three years was also examined. This was done by use of range and standard deviation. The mean innovation efficiency was 0.297, the range was between zero and 0.54 and the standard deviation was 0.195 as indicated in table 4.8

Table 4. 8. Innovation Efficiency Distribution across the Manufacturing Firms for the Last Three Years

N	Valid	101
	Missing	0

Mean	.297
Std. Deviation	.195
Variance	.038
Range	.54
Sum	30.01

The mean of 0.297 implies that on average, each firm had approximately 30% innovation efficiency. This means that the innovation activities in manufacturing firms contributed to about a third of sales on the average per firm. The range implies that the innovation efficiency across manufacturing firms varied from zero to 0.54. This means that the innovation output which did not have a corresponding increase in sales had no innovation efficiency while the highest sales attributed to innovation was 54%. The standard deviation of 0.19 implies that there was a small spread within the sample. This means that there was a high degree of uniformity in innovation efficiency across manufacturing firms and thus a high level of homogeneity in the sample.

The score on innovation output per firm was then multiplied by the innovation efficiency to form the composite value of IP as indicated in appendix vi. The majority of manufacturing firms had zero IP as indicated in figure 4.8.

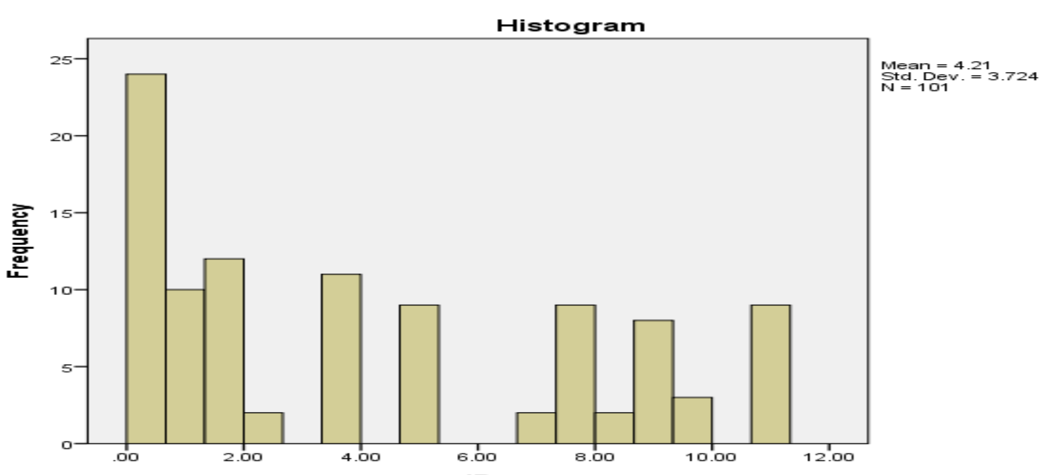

Figure 4. 8: The Distribution of IP in the Manufacturing Firms

This implies that most of the innovation activities in manufacturing firms did not translate into IP. This means that innovation output did not necessarily result in an improvement in sales growth rate as a result of innovation.

The other step was a comparison of IP in the 12 subsectors of the manufacturing sector. Crosstabs descriptive analysis was used to examine the IP levels across the subsectors. The subsector with the highest IP was the food and beverages subsector as indicated in figure 4.9.

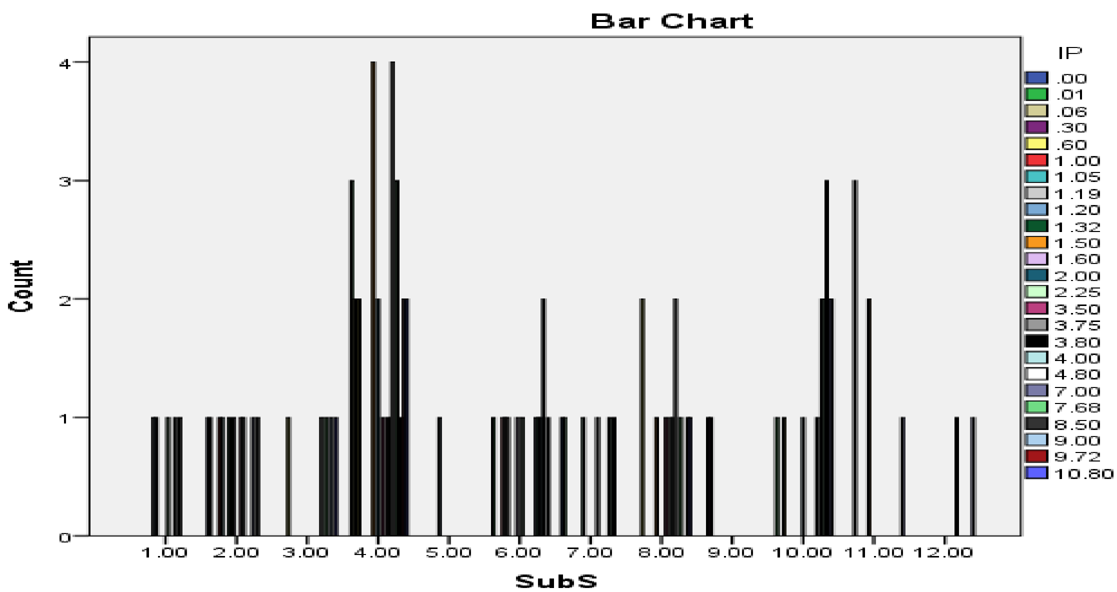

Figure 4. 9: The Comparison of IP in the Manufacturing Subsectors

The highest IP in the food and beverage subsectors implies that innovation intensity is important in raising the overall IP levels. This is because, despite the plastics and rubber subsectors having the highest innovation output, the food and beverages subsector had the highest innovation intensity (figure 4.8) emerged top in IP. Firms should therefore not only focus on raising the innovation output, but also innovation intensity for higher levels of IP. It is therefore important for firms to diversify their innovation activities across the various types of novelties to spread the risks that come with a concentration on a single type of novelty.

The analysis of the interview schedule was done by itemizing each of the responses which were then tabulated and ranked to pick out the main themes. The ranking indicated that the spirit of innovation was highly encouraged by providing work autonomy, resource allocation to support new ideas, reward schemes for new idea generation, having brainstorming sessions, live streaming of events with pre and post analysis, promoting research and development in that order. It, therefore, means that work autonomy, allocation of resources and reward mechanism were the key drivers of creativity which led to innovation activities and eventually improved IP in manufacturing firms in Kenya. This means that leadership plays a crucial role in cultivating a conducive work environment for IP to thrive.

4.4.2. Knowledge Entrepreneurship

Knowledge Entrepreneurship is the independent variable in the study. The constructs of KE were Organisation Learning (OL), Organisation Culture (OC), Leadership and Information, Communication and Technology (ICT). The sum of the observed parameter of each construct was obtained and the sums aggregated to form a composite value of the latent variable KE. The analysis of each of the observed variables in KE is done first before the analysis of the latent variable.

The first observed variable in KE was OL. The parameters for measuring OL were experimentation, knowledge transfer, integration and openness. The responses were captured on a Likert scale which had seven items with a scale of 1 to 5 and therefore the maximum expected score was 35. The score on each of the items was then added up to form the composite value of OL. The scores of OL were ranked in terms of their frequency of occurrence. The highest frequency of OL is a score of 31 as indicated in figure 4.10

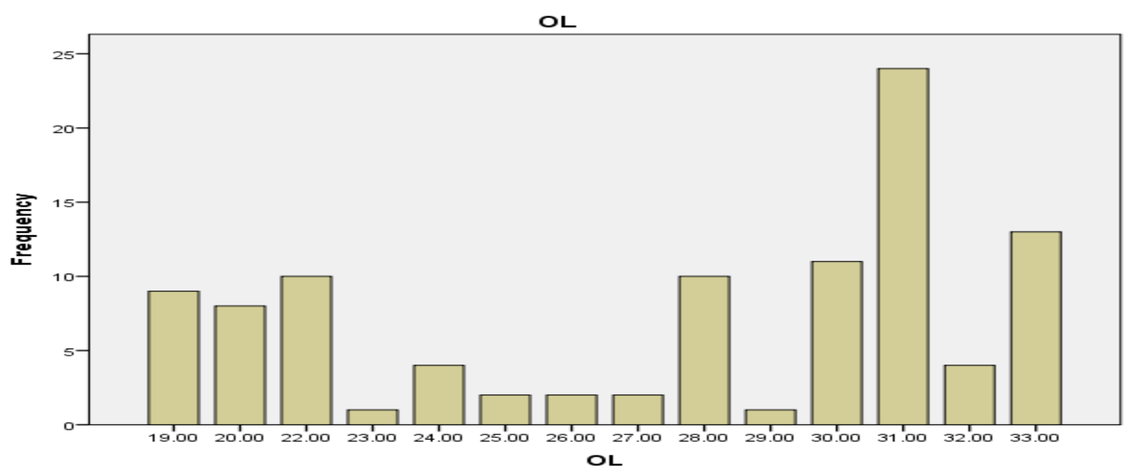

Figure 4. 10: Frequency Distribution of OL Score in Manufacturing Firms

This implies that OL took place in most firms. It means that most of the manufacturing firms have embraced new knowledge acquisition, absorption, sharing and transfer for improved performance.

The analysis of how manufacturing firms faired in terms of OL was conducted through the mean, range and standard deviation. The mean score of OL was 27.3861, the minimum score was 19, the maximum was 33 giving a range of 14 and the standard deviation was 4.82695 as indicated in Table 4.9.

Table 4. 9. The Score of OL in Manufacturing Firms in Kenya

N	Valid	101
	Missing	0
Mean		27.3861
Std. Deviation		4.82695
Variance		23.299
Range		14.00
Minimum		19.00
Maximum		33.00

The mean score of 27 implies that generally, OL took place in the manufacturing sector. However, the minimum score of 19 implies that some firms were indifferent to whether OL took place. The standard deviation of 4.8 implies that there was a wide variance in terms of OL. It means that there was a low degree of uniformity in OL across manufacturing firms and therefore a low level of homogeneity in the sample. This led to a further analysis of how different subsectors performed in terms of OL.

The comparison of how the various subsectors performed were carried out using explores descriptive statistics. The subsectors which portrayed a high variance of OL score were textile and apparels as indicated in figure 4.11.

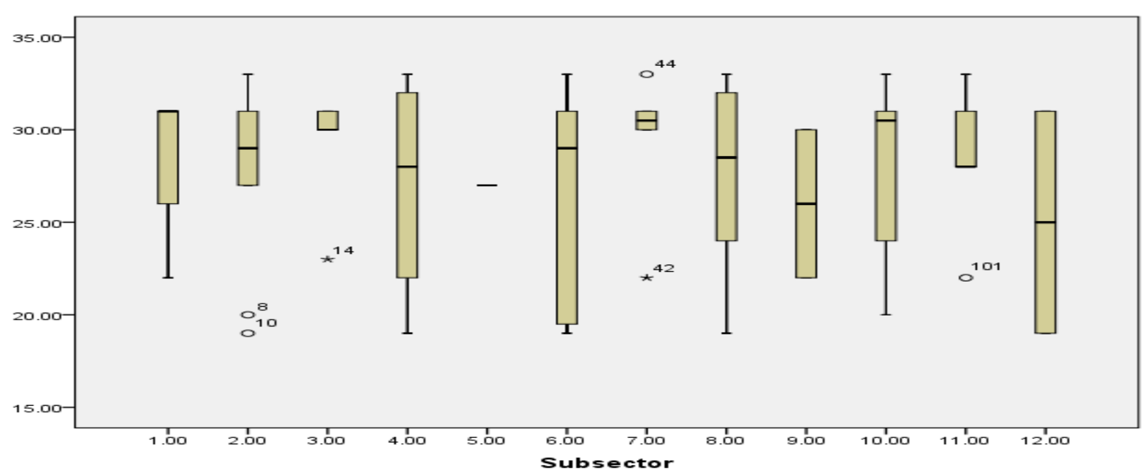

Figure 4. 11: Comparison of Subsectors Scores on OL

This implies that there was indifference about whether OL took place in the firms within the textile and apparels sub-sector. It means that OL took place in some firms while in others within the sector did not take place. However, figure 4.11 indicated that there was a narrow gap in energy, electrical and electronics as well as vehicle assemblers and accessories. This implies a high level of concurrence that OL took place in those two sub-sectors. The two sub-sectors are technology-driven which means that the firms in the sub-sectors have to encourage continuous learning to keep up with the ever-changing technology trends.

The respondents were asked to state the factors that affect OL in their firms concerning IP. The main factors that were given out in descending order are; management support, organization culture, technology, level of manpower skills, availability of resources, continued improvement, exchange of ideas, seminars and workshops, competition and employee attitudes. The other factors that were mentioned are; market trends, induction, mentoring, coaching, remuneration, work experience, teamwork, partnerships and collaborations, networking, knowledge sharing, open forums, product life cycle, organization politics, training, knowledge management, research and development and membership associations. It was observed that firms with high levels of OL had functional customer relations management systems which provided feedback on customers' needs, documented training programs and schedules, robust research and development headed by top management and valued hands-on experience.

There are several other researchers who concur that OL is a key determinant of KE. Jamali (2006) found that OL equips a firm with a systematic way of managing the economic, environmental and social responsibility thus constituting KE which leads to higher IP. Lundvall and Nielsen (2007) found that firms with an organizational practice that promote OL have higher KE levels which influence IP. Capuano *et, al.,* (2008) also found that OL constitutes KE which influences IP. It is therefore observed that OL is a crucial factor that determines the level of KE in the manufacturing sector. The findings are also in line with Cassiman and Veugelers (2006); Chen *et al*., (2016); Radicic and Balavac (2019); Antonelli and Fassion (2016) who found that internal and external learning have a positive influence on IP. The findings are also in tandem with Hofstetter and Harpez (2015) who found that OL has an immense influence on the firm's IP.

The other measure of KE was OC. The parameters for measuring OC were team decision making, knowledge sharing, organizational change and innovation atmosphere. The responses were captured on a Likert scale which had seven items with a scale of 1 to 5 and therefore the maximum expected score was 35. The score on each of the items was then added up to form the composite value of OC per firm. The scores of OC were ranked in terms of their frequency of occurrence. The highest frequency of OC is a score of 31 as indicated in figure 4.12.

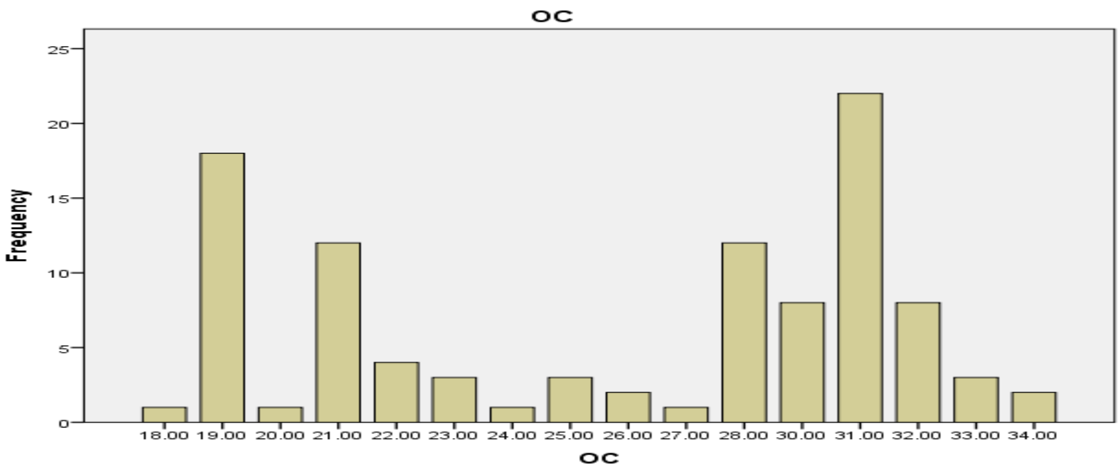

Figure 4. 12: The Distribution of OC Score in Manufacturing Firms

This implies that most firms had inculcated an OC that promotes innovation. It means that values, norms, beliefs, traits, practices and behaviour shared by people within the firms were favorable for innovation to take place.

The mean, range and standard deviation were used to analyze the trend of OC in the manufacturing sector. The mean score of OL was 26.2178, the minimum score was 18, the maximum was 34 giving a range of 16 and the standard deviation was 5.16257 as indicated in table 4.10.

Table 4. 10. The Score of OC in Manufacturing Firms in Kenya

N	Valid	101
	Missing	0
Mean		26.2178
Std. Deviation		5.16257
Range		16.00
Minimum		18.00
Maximum		34.00

The mean score of 26 implies that manufacturing firms on the overall had a conducive OC for promoting innovation. Nevertheless, the minimum score of 18 implies that some firms did not encourage OC that support innovation. The standard deviation of 5 implies that there was a wide variance in terms of OC across the firms. It meant that there was a low degree of uniformity in OC across manufacturing firms and therefore a low level of homogeneity in the selected firms. This led to a further analysis of how the various subsectors performed in terms of OC.

The comparison of how the different subsectors performed were carried out using explores descriptive statistics. The subsectors which showed a high level of variance on OC score were chemical and allied as well as pharmacy and medical equipment subsector as indicated in figure 4.13.

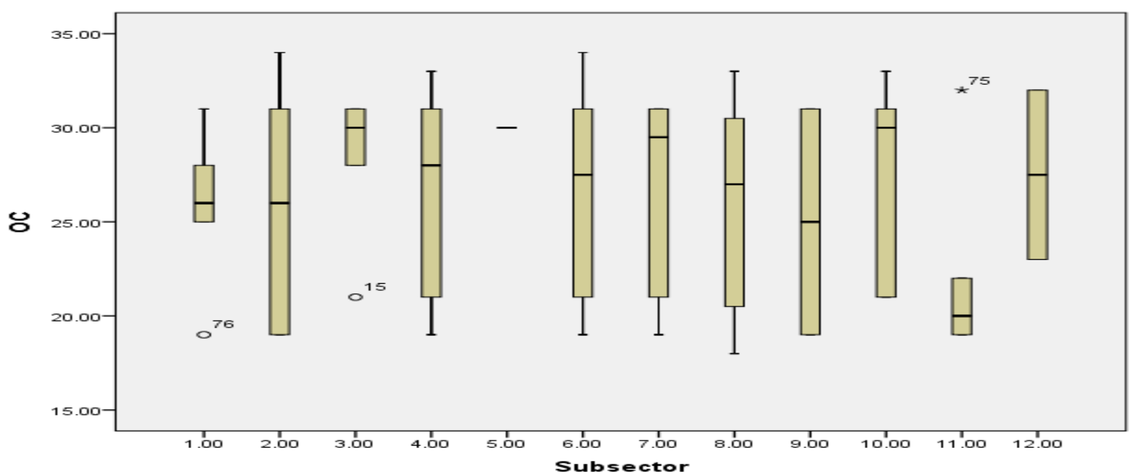

Figure 4. 13: Comparison of Manufacturing Subsectors' Scores on OC in Kenya

This implies that there was indifference as to whether OC that promotes innovation was natured in the firms within the pharmacy and medical equipment subsector. It means that

OC that promotes innovation was encouraged in some firms while it was not the case with others within the subsector.

The respondents listed the following factors concerning OC that affects IP in descending order; leadership, teamwork, encouraged creativity, openness, knowledge management, reward system, employee autonomy, organization values, employee altitude, socialization, fear, internal strife, work environment, change management, professionalism and training. The other factors were; departmental integration, personality, inquisitive minds, ownership of the vision, flexibility, commitment levels, nature of the business, organization structure, meritocracy, group dynamics, experience and security. It was observed that firms that had performance reward systems, sound communication practices and teamwork provided the right culture for innovation.

There are also other researchers who have found concurrence on OC as a composite element in KE. Prabhu (2010) found that aspect of OC such as attitudes and behaviours promotes a proactive and risk-taking culture that enhances KE which influences IP. This is consistent with Valencia et, al. (2010) who found that ad-hoc culture encourages the development of KE which has a positive influence on IP. The findings also concur with Bakovic *et, al.,* (2013) who confirmed the influence of OC on IP by segmenting the Croatian manufacturing industry. The findings are also in tandem with Hofstetter and Harpez (2015) who also found that OC has a bearing on KE which has a significant influence on IP. The findings also concur with Laforet (2016) who found that an entrepreneurial-like culture which promotes KE which has a positive influence on IP.

Nevertheless, Valencia *et, al.,* (2010) found that a hierarchical culture dominated by bureaucracy does not promote KE thus hampering IP. It is therefore observed that a culture that is more open is likely to contribute towards the development of KE which positively influences IP.

The other measure of KE was Leadership. The parameters for measuring leadership variables were; the extent of nourishment of entrepreneurial capacity, linking entrepreneurship to strategy, protection of disruptive innovations, the opportunity for developing creativity, questioning of the dominant logic and the level of inspiration provided by leaders. The responses were captured on a Likert scale which had six items with a scale of 1 to 5 and thus the expected maximum score was 30. The score on each of the items was then added up to form the composite value of leadership in each firm.
The scores of leadership were ranked in terms of their frequency of occurrence. The highest frequency of leadership is a score of 26 as indicated in figure 4.14.

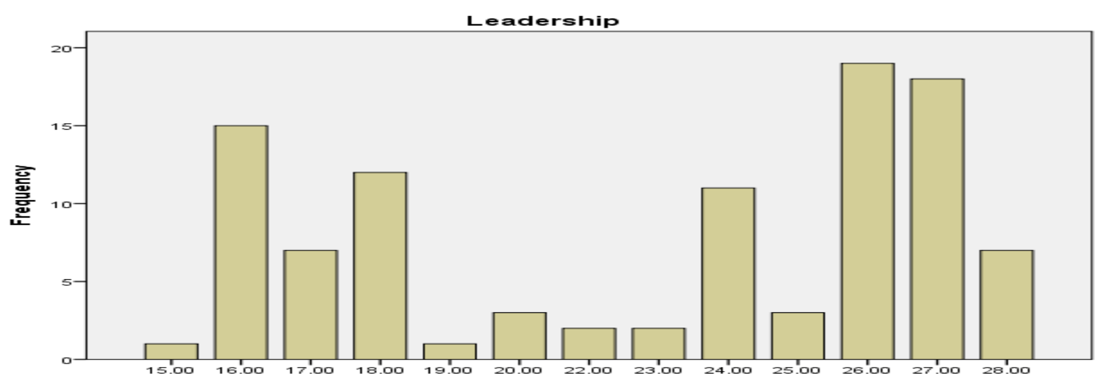

Figure 4. 14: The Distribution of Leadership Score in Manufacturing Firms in Kenya

This implies that most firms had leadership that promotes innovation. It meant that the nourishment of entrepreneurial capacity, linking entrepreneurship to strategy, protection of disruptive innovations, provision of opportunity to develop creativity, questioning of the dominant logic and acceptable level of inspiration was provided by leaders which promoted innovation activities.

The mean, range and standard deviation were used to analyze the trend of leadership in the manufacturing sector. The mean score for leadership was 22.5149, the minimum score was 15, the maximum was 28 giving a range of 13 and the standard deviation was 4.50470 as indicated in table 4.11.

Table 4. 11. The Distribution of Leadership Score in Manufacturing Firms in Kenya

N	Valid	101
	Missing	0
Mean		22.5149
Std. Deviation		4.50470
Variance		20.292
Range		13.00
Minimum		15.00
Maximum		28.00

The mean score of 22 generally implies that manufacturing firms had the right leadership to nurture a culture of innovation. However, the minimum score of 15 implies that some firms did not have the right leadership to encourage innovation. The standard deviation of 4.5 implies that there was a wide variance in terms of leadership across the firms. It meant that there was a low degree of uniformity in leadership across manufacturing firms and therefore a low level of homogeneity in the firms under review. This led to a further analysis of how the various subsectors performed in terms of leadership.

The comparisons of how the different subsectors performed were carried out using explore descriptive statistics. The subsector which showed a high level of variance on leadership score was paper and board as indicated in figure 4.15.

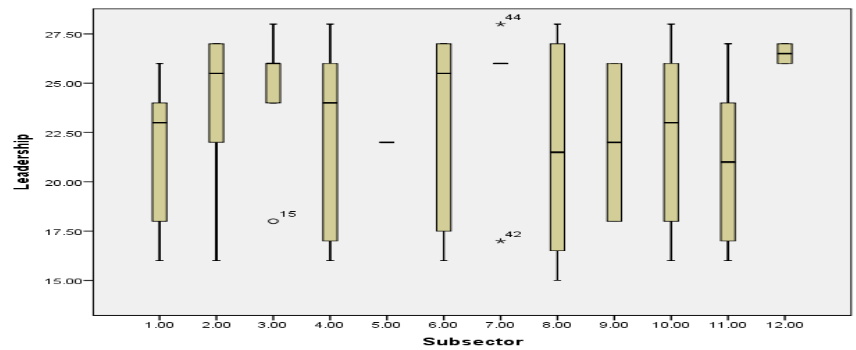

Figure 4. 15: Comparison of Manufacturing Subsectors' Scores on Leadership in Kenya

This implies that there was indifference as to whether leadership promoted innovation in the firms within the paper and board subsector. It means that leadership that promotes innovation was encouraged in some firms while it was not the case with others within the subsector.

The respondents were then invited to list the factors that affect leadership concerning IP. The main factors were training, openness to new ideas, partnership and networking abilities, strategy, management style and resource provision in descending order. The other factors that were raised include; proactiveness, knowledge management, provision of a conducive working environment, communication skills, organization culture, level of experience, working teams, ability to implement agreed issues, staff engagement, flexibility, generation gap, risk management, level of technology savvy, competence, monitoring and evaluation ability. It was observed that firms with clear evidence of corporate learning, open channels of communication and an operation strategic plan had high levels of IP.

It was observed that transformational leadership promotes KE within manufacturing firms. This is in tandem with Xenikou and Simosi (2006) who found that transformational leadership contributes to KE which influences IP. This concurs with Simons and Sower (2012) who found that good leadership is paramount in developing KE which influences IP. The findings also concur with Ikeda et, al., (2016) who found that transformational leadership has significant influence on innovative behaviors thus impacting IP. The findings are also consistent with Jia, Chen, Mei and Wu (2018) who found that transactional leaders inhibit KE while transformational leadership enhances KE which influences IP positively. The findings are consistent with Sattayaraksa and Boon-itt (2018) who found that good leadership transforms the mindset and is directly related to OL and innovation culture which ultimately influences IP in manufacturing firms. This concurs with Naqshbandi et, al. (2019) who found that leadership that empowers employees promotes KE which has a positive influence on IP. However, Prajogo et, al. (2007) found that leadership does not affect KE and therefore has no influence on IP. It is therefore observed that the type of leadership in manufacturing firms matters. It is concluded that transformation leadership natures KE which in turn influences IP. Transformational leadership should, therefore, be encouraged in the manufacturing firm to enhance IP.

The other antecedent of KE was ICT. The parameters for measuring ICT were; use of management information system, customer relationship management, computers, network connectivity, intranets, internet, use of social media and levels of automation. The responses were captured on a Likert scale which had seven items with a scale of 1 to 5 and thus the expected maximum score was 35. The score on each of the items was then added up to form the composite value of ICT in each firm. The scores of ICT were ranked in terms of their frequency of occurrence. The highest frequency in ICT is a score of 31 as indicated in figure 4.16.

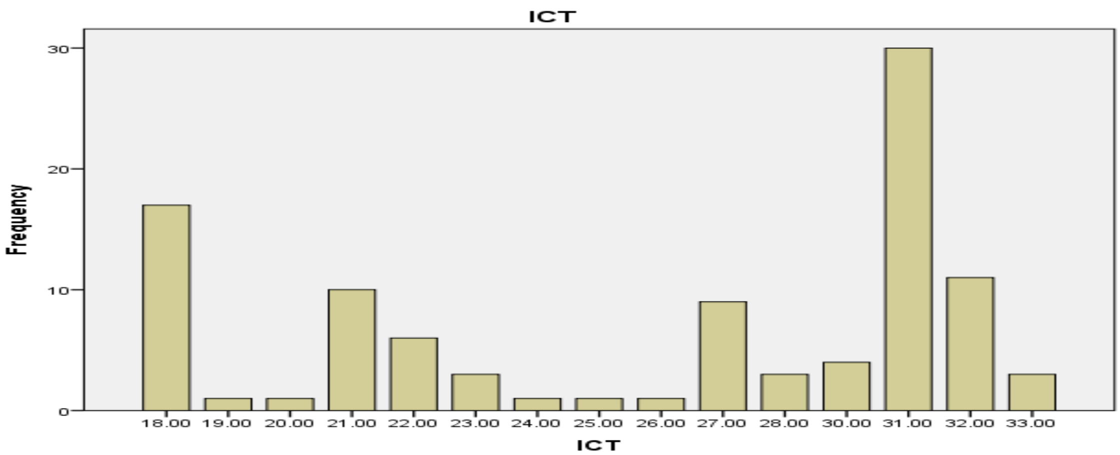

Figure 4. 16: The Distribution of ICT Score in Manufacturing Firms in Kenya

This implies that most firms had ICT that promotes innovation. It meant that the use of management information systems, customer relationship management, computers, network connectivity, intranets, internet, use of social media and levels of automation promoted innovation activities.

The mean, range and standard deviation were used to analyze the trend of ICT in the manufacturing sector. The mean score for leadership was 26.3267, the minimum score was 18, the maximum was 33 giving a range of 15 and the standard deviation was 5.40205 as indicated in table 4.12.

Table 4. 12. The Distribution of ICT Score in Manufacturing Firms in Kenya

N	Valid	101
	Missing	0
Mean		26.3267
Std. Deviation		5.40205
Variance		29.182
Range		15.00
Minimum		18.00
Maximum		33.00

The mean score of 26 implies that manufacturing firms had the right ICT to enhance innovation. However, the minimum score of 18 implies that some firms did not have the right ICT infrastructure to support innovation activities. The standard deviation of 5.4 implies that there was a wide variance in terms of ICT across the manufacturing firms. It meant that there was a low degree of uniformity in ICT across the firms and therefore a low level of homogeneity in the firms included in the study. This led to a further analysis of how the various subsectors performed in terms of ICT.

The comparisons of how the different subsectors performed were carried out using explore descriptive statistics. The subsector which showed a high level of variance on ICT score was food and beverages as indicated in figure 4.17.

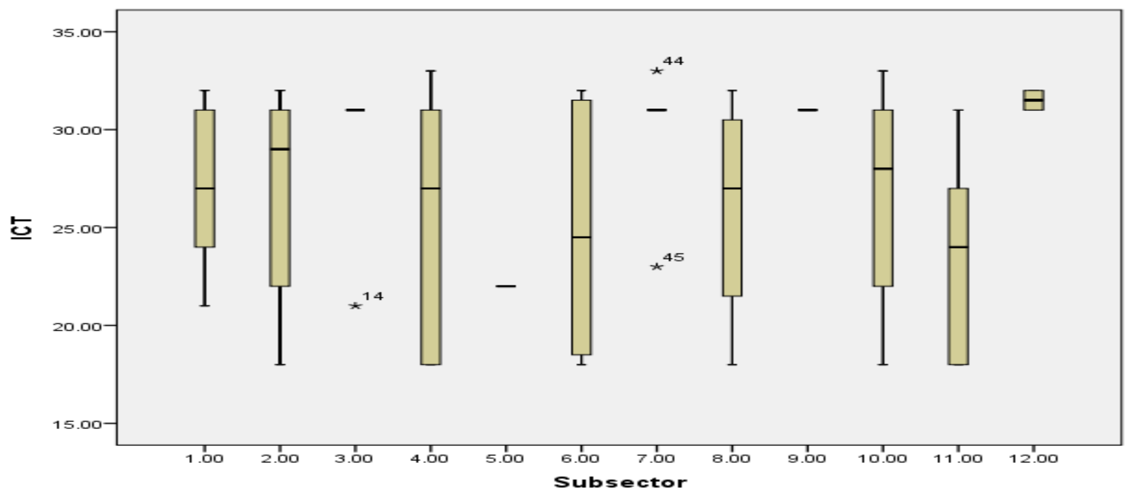

Figure 4. 17: Comparison of Manufacturing Subsectors' Scores on ICT in Kenya

This implies that there was indifference as to whether ICT promoted innovation in the firms within the food and beverages subsector. It means that ICT was enhanced in some firms within the subsector to promote innovation while it was not the case with other firms.

The respondents thought that training, ICT infrastructure, modernization, availability of resources, information systems, research and development, skill levels, organization culture and communication were factors that affect ICT concerning IP in that descending order. The other factors that were identified are; level of technology adoption, need for automation, quality management, competition, information flow, changes in technology and flexibility. It was observed that firms with high levels of automation and appropriate technology had high levels of IP.

The other factor that was found to have contributed to KE that lead to IP was therefore ICT. The findings on ICT concur with those of Ahuja and Katila (2001) who demonstrated that ICT has a positive influence on IP. The findings are also in tandem with Gordon and Tarafdar (2007) who found that ICT is a crucial component of KE in advancing IP. The findings are consistent with those of Parida et, al. (2012) who found that ICT builds on the limited knowledge to bring about radical and incremental innovation thus improving IP. The findings are also consistent with Arvanitis, Loukis and Diamantopoulou (2013) who found that KE leverages on ICT to bring about IP. Gressgard et, al. (2014) also found that ICT supports KE in employee-driven IP. This is in line with Yunis, El-Kassar and Tarhini (2017) who found that ICT is a strategic resource, but its contribution to IP depends on KE. The findings concur with those of Pan, Song and Zhou (2018) who found that ICT exploitation has an influence on IP. The exploitation of ICT depends on the level of KE within a firm. The findings are consistent with Nieves and Osorio (2019) who found that the application of ICT enables the development of KE which enhances IP.

The latent variable of KE was therefore measured by the observed sub-variables of OL, OC, leadership and ICT. The comparison of how the different subsectors performed in terms of KE was also carried out using explore descriptive statistics. The subsector which showed a high level of variance on the KE score was metal and allied as indicated in figure 4.18.

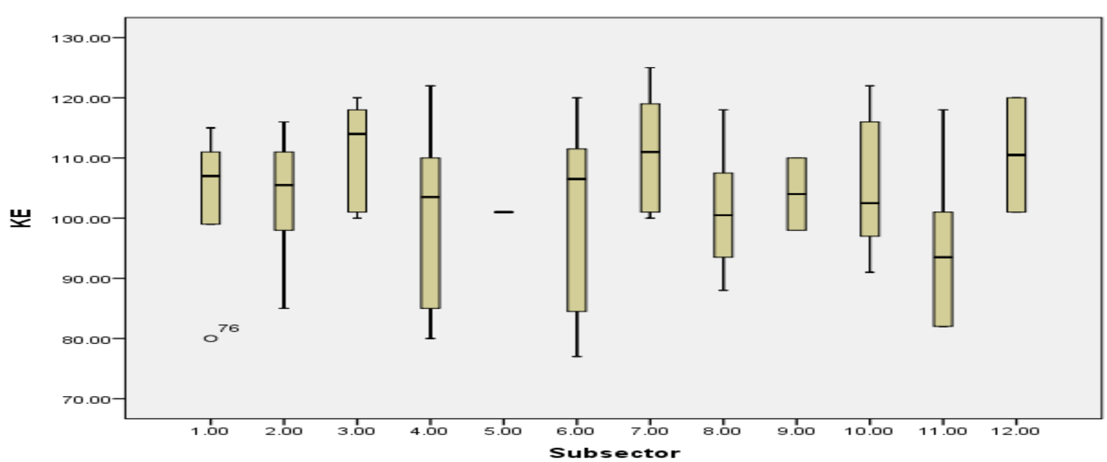

Figure 4. 18: Comparison of Manufacturing Subsectors' Scores on KE in Kenya

There was indifference as to whether KE promoted innovation in the firms within the metal and allied subsector. It was thus observed that KE was enhanced in some firms within the subsector to promote innovation while it was not the case with other firms.

The other factors that were raised that affect KE include; availability of resources, size of the company, quality of information, competition, commercialization, networking, trust levels, communication systems, knowledge management, adaptability, strategy and knowledge levels. Most of these factors are similar to the different parameters for the various antecedents of KE as adopted in the study. The composite value of KE was arrived at adding up the aggregate values of OL, OC, leadership and ICT.

The reliability test was conducted to find the stability of the observed items of each measure in every parameter in providing similar outcomes in repeated trials on latent variable KE. The internal consistency technique was used to show the extent to which the procedure applied assessed the same characteristics. Different respondents from the same firm provided for data triangulation which enabled assessment of both individual reliability of each parameter and the composite reliability of each variable. The reliability test produced Cronbach's Alpha of 0.901, 0.898, 0.905 and 0.901 for OL, OC, leadership and ICT respectively as indicated in table 4.13

Table 4. 13. The Cronbach's Apha values for each of KE Parameters

	Parameter	Cronbach's Alpha	Number of items
i	Organisation Learning	0.901	7

ii	Organisation Culture	0.898	7
iii	Leadership	0.905	6
iv	Information, Communication and Technology	0.901	7

The values were all above the recommended threshold of 0.7. It means that the scale used to measure KE is reliable and can replicate such outcomes in another trial. The finding is consistent with Alegre *et, al.,* (2006) who found that the Cronbach's alpha of the measures of the latent variable should be more than 0.7.

It was observed that there was a close association between the parameters for measuring KE in the questionnaire and the items picked as the key determinant of KE from the interview schedule. The other factors that were raised which affect KE include; availability of resources, size of the company, quality of information, competition, commercialization, networking, trust levels, communication systems, knowledge management, adaptability, strategy and knowledge levels. These factors are similar to the antecedents of KE which formed the composite value of the independent variable. The findings thus indicate Organization Learning (OL), Organization Culture (OC), leadership and Information, Communication and Technology (ICT) are suitable indicators of KE.

4.4.3. The Relationship between Knowledge Entrepreneurship and Innovation Performance

The measures of each of the parameters were first tested for reliability to determine the scale stability in providing similar outcomes in repeated trials. This was done by regressing the parameters of KE with IP and then the aggregate value of KE with IP. The relative strength of each of the parameters was determined in terms of their value of R square. The parameters arranged in terms of great strength to least are OC, leadership, ICT and OL as indicated in table 4.14.

Table 4. 14. The Relative Strength of each of the Parameters of KE on IP

	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
i	Organization learning	.768[a]	.590	.589	2.47322
ii.	Organization Culture	.810[a]	.657	.655	2.26418
iii.	Leadership	.802[a]	.643	.642	2.30788
iv.	ICT	.785[a]	.617	.616	2.39128

The R square for each of the variables is above 0.5 meaning that each one of them had an immense contribution to IP at above 50% although to a different extent. This implies that the construct of KE was properly constituted with regard to their relationship with IP. Further regression analysis was conducted to find the significance of each of the parameters on IP. All the parameters apart had P values of less than 0.05 as indicated in table 4.15.

Table 4. 15. The Significance Level of each of the Parameters of KE on IP

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-11.023	.664		-16.590	.000
	OL	-.164	.074	-.235	-2.227	.027
	OC	.360	.088	.510	4.084	.000
	Leadership	.236	.074	.300	3.186	.002
	ICT	.180	.056	.259	3.219	.001

The P values of less than 0.05 imply that all the constructs of the latent variable KE have significant influence on IP. This means that each of the observable variables of the latent variable KE is important in determining the direction of IP.

The latent value of KE which was derived from the aggregation of the observable parameters was then linked with IP. The association between KE and IP was obtained by conducting bivariate correlation on their aggregate values. There was a strong correlation between each of the parameters of KE and IP as indicated in table 4.16.

Table 4. 16. Correlation between Knowledge Entrepreneurship and Innovation Performance

		KE	IP
KE	Pearson Correlation	1	.803**
	Sig. (2-tailed)		.000
	N	295	295
IP	Pearson Correlation	.803**	1
	Sig. (2-tailed)	.000	
	N	295	295

The Pearson correlation value between KE and IP is 0.803 which is near1 implying that a strong association between the variables exists. The value is also positive implying that KE and IP move in the same direction hence they are correlated. It means that as KE increases so do IP and vice versa among manufacturing firms. The analysis of variance between KE and IP was also conducted to test the hypothesis. The null hypothesis stated that KE does not influence IP in Kenya manufacturing firms. The results showed a significant influence between the two variables exists as indicated in table 4.17.

Table 4. 17. Analysis of Variance between Knowledge Entrepreneurship and Innovation Performance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3677.833	40	91.946	37.631	.000
Within Groups	605.958	248	2.443		
Total	4283.791	288			

The P value is zero which is less than 0.05. This led to the rejection of the null hypothesis and acceptance of the alternative hypothesis. It therefore means that KE has significant influence on IP in Kenya manufacturing firms in Kenya.

Linear regression was also carried out to determine the extent to which KE influences IP of manufacturing firms in Kenya. The coefficient of regression between of KE and IP was then done and the results showed a positive value of 0.154 as indicated in table 4.18.

Table 4. 18. The Coefficients of Regression between of KE and IP

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-11.479	.656		-17.486	.000
	KE	.154	.006	.822	24.426	.000

The positive coefficient value of 0.154 implies that there is a direct relationship between KE and IP. It therefore, means that as KE increases so do IP and vice versa. The results mean that IP is expected to increase by 0.154 when KE increases by a unit holding IE constant. This leads to the development of the first model which can be expressed as; $IP = \beta_0 + \beta_1 KE + \varepsilon_i$, where $\beta_1 = 0.154$ and ε_i is the error term thus $IP = \beta_0 + 0.154 KE + \varepsilon_i$. This means that IP is expected to increase by 0.154 when KE increases by a unit holding IE constant.

Linear regression analysis between of KE and IP was done using Stata software to establish the extent to which KE influences IP. This was done by examining the R-square value. The results produced an R square value of 0 .6454 as shown in table 4.19.

Table 4. 19. Regression analysis between KE and IP

Source	SS	df	MS	
				Number of obs = 295
				F(1, 293) = 533.32
Model	2792.97051	1	2792.97051	Prob > F = 0.0000
Residual	1534.43365	293	5.23697491	R-squared = 0.6454
				Adj R-squared = 0.6442
Total	4327.40416	294	14.7190618	Root MSE = 2.2884

KE	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
IP	.1502193	.0065048	23.09	0.000	.1374172	.1630213
cons	-11.18658	.6790253	-16.47	0.000	-12.52296	-9.850194

The R square value of 0.6454 is equivalent to 64.54%. This implies that a huge proportion of change in IP (64.54%) is brought about by KE. Manufacturing firms in Kenya should, therefore, enhance KE for increased IP.

It was found that KE has a significant influence on IP in Kenya manufacturing firms in Kenya. The findings concur with McDonald (2002) who found that KE has a positive relationship with IP. The findings are also supported by Coulson-Thomas (2004) who found that KE leads to knowledge generation and exploitation which creates a culture that stimulates knowledge-based ventures thus providing workers with pragmatic skills and tactics required to harness IP. This is in line with Christian and Ulrich (2005) who found that new scientific knowledge requires KE to enhance commercialization which in turn enhances IP. Chen et, al. (2009) also found that KE brings about the competitive advantage of a firm thus significantly influencing its IP. Zhang et, al. (2009) also found that knowledge utilization is a strong predictor of IP because it hedges off against the challenges of a breakthrough. The findings are consistent with Jusoh *et, al.*, (2010) who found that KE enables a firm to respond and seize up opportunities leading to IP. Sotarauta and Pulkinen (2011) also found that KE enhances commercialization which increases the level of IP. The findings are consistent with those of Cao and Zhao (2013) who found that KE is paramount in the commercialization of innovation which enhances IP.

The findings are also in tandem with Salomo *et al*. (2007) who found that KE, especially on project risk planning and goal stability, has a significant influence on IP. The finding also concurs with Lin, 2007 who found that willingness to share knowledge improves IP. The finding is also supported by Svetina and Prodan (2008) found that internally developed knowledge has an immense influence on the firm's IP. Wang and Han (2011) also found that KE has a positive influence on IP especially for firms with high absorptive capacity. Wiley (2015) found that connecting new and existing knowledge domains also leads to higher levels of IP. This is in tandem with Kumar and Sundarraj (2016) who found that creative accumulation of KE has a positive influence on IP. It is therefore observed that KE plays a key role in enhancing IP for manufacturing firms in Kenya. It was also observed that KE is attributed to several factors.

The findings unraveled the gap that existed on how to transform knowledge into innovation output that improves competitiveness. It was found that when manufacturing firms simultaneously develop their OL, create an enabling OC, nurtures supportive leadership and embraces ICT, such firms are destined to reap the benefits of IP which includes improvement of their competitiveness. This is because a mix of the four items is likely to improve knowledge absorption which is beneficial to a firm. Manufacturing firms in Kenya should therefore leverage on KE to boost their IP to remain competitive locally, regionally and internationally.

4.4.4. Normality Test of KE and IP

The normality test of data for both KE and IP was done through the Levene's statistics. The p-values were zero as indicated in table 4.20 which is less than 0.05 hence there is a difference between KE and IP.

Table 4. 20. Test of Homogeneity of Variance in KE and IP

		Levene Statistic	df1	df2	Sig.
IP	Based on Mean	12.774	12	125	.000
	Based on Median	5.546	12	125	.000
	Based on Median and with adjusted df	5.546	12	69.841	.000
	Based on trimmed mean	11.798	12	125	.000

This implies that the values of KE and IP are normally distributed meaning that the data collected was homogenous and did not vary much across the sampled firms.

4.5. Innovation Ecosystem and Innovation Performance

The second objective of the study was to investigate the level of influence of the Innovation Ecosystem (IE) and Innovation Performance (IP) in manufacturing firms in Kenya. A discourse on how IE was derived ensured followed by an investigation of the relationship between IE and IP.

4.5.1. Innovation Ecosystem

The moderating variable of the study was IE. The parameters of IE were derived from; a supportive environment, existing alliances, networking, collaborations and network systems. The specific parameters for measuring IE were; the presence of accelerators and incubators within the firm locality, availability of business services, trade organization support, technology spillover in the industry from universities and other research institutions, networking within the firms in the industry and infrastructure that support business operations. The value of IE was obtained by aggregating the sum of the score of each measure. The responses were captured on a Likert scale which had six items with a scale of 1 to 5 and thus the expected maximum score was 30. The score on each of the items was then added up to form the composite value of IE in each firm.

The scores of IE were ranked in terms of their frequency of occurrence. The highest frequency in IE is a score of 28 as indicated in figure 4.19.

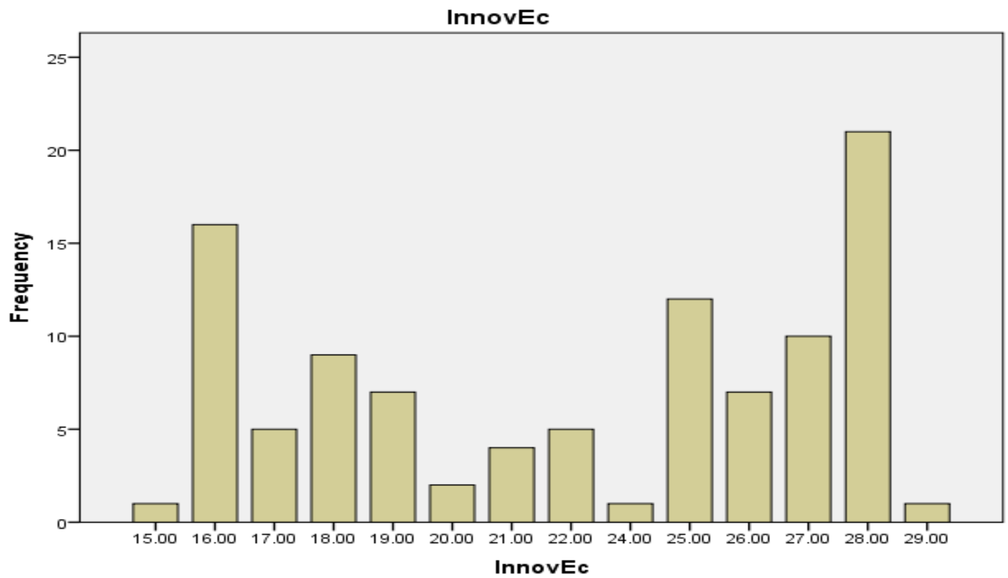

Figure 4. 19: The Distribution of IE Score in Manufacturing Firms in Kenya.

This implies that most firms acknowledged that IE promoted innovation. It meant that the presence of accelerators and incubators within the firm locality, availability of business services, trade organization support, technology spillover in the industry from universities and other research institutions, networking within the firms in the industry and business support services promoted innovation activities.

The mean, range and standard deviation were used to analyze the state of IE for the manufacturing sector. The mean score for leadership was 22.5545, the minimum score was 15, the maximum was 29 giving a range of 14 and the standard deviation was 4.70845 as indicated in table 4.21.

Table 4. 21. The Distribution of Innovation Ecosystem in Manufacturing Firms in Kenya

N	Valid	101
	Missing	0

Mean	22.5545
Std. Deviation	4.70845
Variance	22.170
Range	14.00
Minimum	15.00
Maximum	29.00

The mean score of 22.5 implies that manufacturing firms had the right IE to enhance innovation. The standard deviation of 4.7 implies that there was a wide variance in terms of IE across the manufacturing firms. It meant that the various subsectors require different IE. This led to a further analysis of how the various subsectors performed given the prevailing IE.

The comparisons of how the different subsectors performed were carried out using explore descriptive statistics. The subsector which showed a high level of variance on the IE score was metal and allied as indicated in figure 4.20.

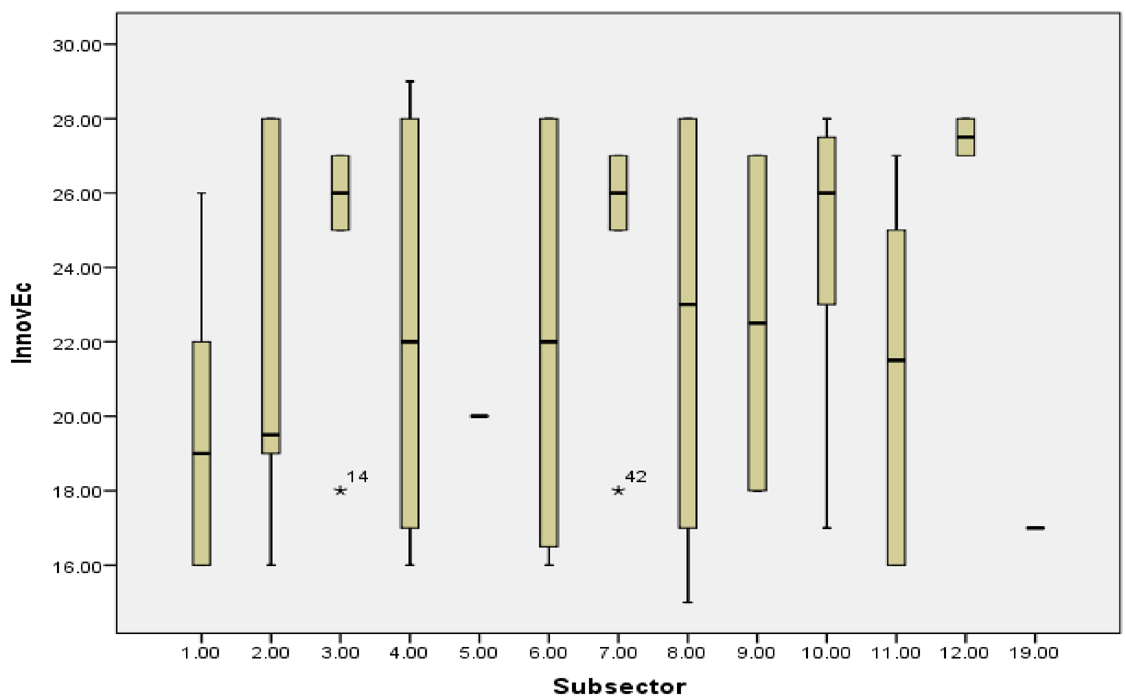

Figure 4. 20: Comparison of Manufacturing Subsectors' Scores on IE in Kenya

It was observed that there was indifference as to whether IE promoted innovation in the firms within the metal and allied subsector, thus IE was enhanced in some firms within the subsector to promote innovation while it was not the case with other firms. This depicts the uniqueness of the firms in the subsector.

The respondents were asked to give the factors they felt affects the operating environment on which innovation occurs. The listed factors in descending order are; networking, statutory and regulatory requirements, infrastructure, government policy, rate of technology adoption, competition, taxation, financing, knowledge-sharing platforms, treaties and barriers of imports, training opportunities, macro-economic stability, accreditation and certification procedures. The other factors that were mentioned include; protection of patents, incubators, customer and supplier relationship, quality of the human resource, university-industry linkages, stakeholder satisfaction, trade fairs, industry leadership, dissemination of research findings, cost of doing business, trade associations and safety. It is therefore observed that there is a wide range of factors that contribute to the innovation ecosystem.

Reliability test was conducted on the measuring scale of IE to determine its stability in providing similar outcomes in repeated trials. The reliability test produced Cronbach's Alpha of 0.896 for the six measures for IE. The value is above the recommended threshold of 0.7. It means that the scale used to measure IE is reliable and can replicate such outcomes in another trial. The finding is consistent with Alegre *et, al.,* (2006) who found that the

Cronbach's alpha of the measures of the latent variable should be more than 0.7. It was therefore concluded that measuring scales were reliable.

4.5.2. The Relationship between Innovation Ecosystem and Innovation Performance

The first step was to run a linear regression between the Parameters of IE and IP without KE. The results indicate that all the parameters of IE had an R square of between 0.610 and 0.711 as shown in Table 4.22.

Table 4. 22. Linear Regression between the Parameters of IE and IP without KE

	Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
i	Presence of accelerators and incubators	.844[a]	.712	.711	2.07287
v.	Availability of trade organization support	.811[a]	.657	.656	2.26236
i	Technology spill over	.809[a]	.654	.653	2.27216
iv	Availability of business services	.786[a]	.618	.617	2.38701
v	Dynamic networking	.782[a]	.611	.610	2.40980
vi	Infrastructural support	.818[a]	.611	.669	2.22004

This implies that all the parameters of IE made a substantial contribution to IP. The association between IE and IP was then obtained by conducting a bivariate correlation on their aggregate values. There was a strong association between IE and IP as shown in table 4.23.

Table 4. 23**. Correlations between Innovation Ecosystem and Innovation Performance**

		Innovation Ecosystem	Innovation Performance
IE	Pearson Correlation	1	.831**

	Sig. (2-tailed)		.000
	N	295	289
IP	Pearson Correlation	.831**	1
	Sig. (2-tailed)	.000	
	N	289	289

The Pearson correlation value between IE and IP is 0.831 which is near one implying that a strong association between the variables exists. The value is also positive implying that IE and IP move in the same direction hence they are correlated. It means that as IE improves so does IP and vice versa among manufacturing firms.

The analysis of variance between IE and IP was also conducted to test the second hypothesis. The null hypothesis stated that IE does not influence IP in Kenya manufacturing firms. The results showed a significant influence between the two variables exists as indicated in table 4.24.

Table 4. 24: Analysis of Variance between Innovation Ecosystem and Innovation Performance

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	3403.085	17	200.181	61.597	.000
Within Groups	880.706	271	3.250		
Total	4283.791	288			

The P-value is zero which is less than 0.05. This led to the rejection of the null hypothesis and acceptance of the alternative hypothesis. It, therefore, means that IE has a significant influence on IP in Kenya manufacturing firms in Kenya. This implies that IE is crucial in determining the levels of IP.

Linear regression was also carried out to determine the extent to which IE influences the IP of manufacturing firms in Kenya. This was done by examining the value of R-square in the relationship between IE and IP. The results indicate an R-square value of 0.6674 as shown in table 4.25.

Table 4. 25: Linear Regression analysis between IE and IP

Source	SS	df	MS	Number of obs = 295
				F(1, 293) = 587.94
Model	2888.10928	1	2888.10928	Prob > F = 0.0000
Residual	1439.29487	293	4.9122692	R-squared = 0.6674
			Adj R-squared = 0.6663	
Total	4327.40416	294	14.7190618	Root MSE = 2.2164

IP	Coef.	Std. Err.	t	P>t	95% Conf. Interval	
IE	.6414974	.0264563	24.25	0.000	.5894289	.6935659
cons	-10.17325	.6062448	-16.78	0.000	-11.3664	-8.980108

The R square value was 0.6674 which is equivalent to 66.74% implies a huge proportion of change in IP is brought about by IE. This means that about 66.74% of IP is influenced by IE. This underscores the importance of the context in which IP occurs. The operating environment should therefore be improved to raise IP in manufacturing firms in Kenya.

4.5.3. Normality Test between IE and IP

The normality test of data for both IE and IP was done through the Levene's statistics. The p-value was zero as indicated in table 4.26 which is less than 0.05.

Table 4. 26: Test of Homogeneity of Variance between IE and IP

		Levene Statistic	df1	df2	Sig.
IP	Based on Mean	8.371	14	261	.000
	Based on Median	4.026	14	261	.000
	Based on Median and with adjusted df	4.026	14	126.825	.000
	Based on trimmed mean	7.778	14	261	.000

This implies that there was no significant difference between the responses across the firms sampled and hence the normality of data is confirmed.

Mann Whitney U test was also used to test for normality. The results indicated P values of 0.610, 0.177 and 0.896 for distribution of KE, IE and IP respectively across the gender as indicated in table 4.27.

Table 4. 27: Mann-Whitney U test Test for Normality

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of KE is the same across categories of Gender.	Independent-Samples Mann-Whitney U Test	.610	Retain the null hypothesis.
2	The distribution of IE is the same across categories of Gender.	Independent-Samples Mann-Whitney U Test	.177	Retain the null hypothesis.
3	The distribution of IP is the same across categories of Gender.	Independent-Samples Mann-Whitney U Test	.886	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

This means that the data collected is homogeneous across the respondents. The Chi-square was also used to test for Homogeneity. The P-value was zero as indicated in the table in table 4.28.

Table 4. 28: Homogeneity Test Statistics

	IE	KE	IP
Chi-Square	227.488[a]	182.376[b]	273.374[c]
df	17	41	25
Asymp. Sig.	.000	.000	.000

This once again confirms the normality of the data collected. This means that there was no significant difference between the respondents across the firms sampled.

The findings indicate that IE which was constituted by business services, trade organization support, technology spillover and government policy influences IP. The findings also concur with those of Ikeda and Marshall (2016) who found that IE is defining innovation types and levels thus influencing IP. It was also observed that the operating environment greatly influences IP. This is consistent with Johan and Sven-Ake (2005) who found that scanning the operational environment positively influences IP. The findings also concur with those of Zuiderwijk *et, al.,* (2014) who found that the benefits of IE allow other firms to add value to an existing product whose one manufacturer cannot do alone.

The findings indicate that an enabling IE provides an opportunity for strategic alliances, networking and collaboration. The findings concur with Padula (2008) who found that firms that are linked to several alliances have greater levels of IP. The findings are also in tandem with Engler and Kusiak (2011) who found that market sophistication, especially in the manufacturing sector, necessitates firms to seek collaborators to remain competitive. The findings are also in tandem with Abosede and Onakoya (2013) who found that collaboration with the relevant agents facilitates the conversion of creativity from intellectual assets to IP. This is in line with Barile *et*, *al*. (2016) who found that the manufacturing sector has a complex flow of information, materials and diversity of players thus firms in the sector cannot operate in isolation but rather on a comprehensive systematic collaboration.

The findings concur with those of Abosede and Onakoya (2013) who found that collaboration with the relevant agents facilitates the conversion of creativity from intellectual assets to IP. These finding addresses the gap that existed on the complexity of blending internal and external knowledge to reconfigure new insights. It means that when manufacturing firms have a network of supportive partners, collaborators and strategic alliances, it reduces the cognitive dissonance that comes with acquisition of external knowledge. This fuses out the mistrust that emanate from competitors interacting within an ecosystem by bringing out the areas of convergence and divergence. This brings about a striking of balance between knowledge sharing, diffusion and leakages which promotes a win-win situation for each of the players in the ecosystem.

4.6. The Moderating Effect of IE between KE and IP

Bivariate correlation between KE and IE was first conducted to determine the closeness of the independent variable and the moderating variable. This was done to demonstrate how a shift in each of the variables is associated to change in the other variable before establishing the moderating effects. The Pearson correlation coefficient (r) value was 0.860 and the P-value was zero in table 4.29.

Table 4. 29: Correlations between Knowledge Entrepreneurship and Innovation Ecosystem

		KE	IE
KE	Pearson Correlation	1	.860**
	Sig. (2-tailed)		.000
	N	295	295

IE	Pearson Correlation	.860**	1
	Sig. (2-tailed)	.000	
	N	295	295

The P-value shows that there is a significant correlation between KE and IE which was confirmed by the positive value of r which is close to one. This implies a strong and positive relationship exists between KE and IE. Strong correlation means that it is difficult to control one variable with a change in the other yet the KE and IE are supposed to be independent. This poses a challenge in modeling an estimate of the relationship between KE, IE and IP because KE and IE tend to move in the same direction. This calls for a further test of Multicollinearity between KE and IE.

4.6.1. Multicollinearity between KE and IE.

The next step was to find the Multicollinearity between KE and IE. This is important because Multicollinearity weakens the precision power of a statistical regression model. The Multicollinearity test was conducted through the application of the Variance Inflation Factor (VIF) and the level of tolerance. The results produced a VIF of 3.98 and a tolerance value of 0.254 as indicated in Table 4.30

Table 4. 30: Multicollinearity Test between KE and IE

		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
	(Constant)	-12.003	.600		-20.009	.000		
1	IE	.376	.048	.477	7.872	.000	.254	3.938
	KE	.077	.011	.409	6.754	.000	.254	3.938

The VIF is 3.98 which is less than the cut-off point of 10 and falls between 1 and 5 implying a moderate Multicollinearity that does not require corrective action. The tolerance value was 0.254 which is greater than the required threshold of 0.10 indicating the absence of Multicollinearity. It therefore means that KE and IE are not linearly predictable thus their statistical significance is not undermined.

The findings are in tandem with Suki and Suki (2015) who found that a VIF of less than 10 and a tolerance value of between 0 and1 does not warrant any action. The next step was to determine the moderating effect of IE between KE and IP. This was done using the hierarchical moderated multiple regression and structural equation model.

4.6.2. Moderation Effect using Hierarchical Multiple Regression

The moderating effect of IE between KE and IP was first tested using a hierarchical moderated multiple regression analysis techniques. This was done through a three steps process while at the same time monitoring the change in the value of R square.

The first step was to observe the relationship between KE and IP without IE. This was done by running a linear regression between KE and IP as indicated earlier in table 4.7 where the R square value was 0.6454. The second step was to observe the relationship between IE and IP without KE. The value of R square was 0.6674 as was indicated in table 4.12 earlier. The two steps imply that both KE and IE contribute to a large proportion of IP by 64.54% and 66.74% respectively. This means that both KE and IE influence IP independently.

The coefficient of IE was then derived by running a linear regression between IE and IP without KE. The results indicated a coefficient value of 0.654 as shown in table 4.31.

Table 4. 31: The Coefficients of IE Linear Regression between IE and IP

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-10.402	.592		-17.561	.000
	IE	.654	.026	.831	25.302	.000

The coefficient value of 0.654 is β_2 which means that IP is expected to increase by 0.654 when IE increases by a unit holding KE constant. This led to the development of the second model which is; $IP = \beta_0 + \beta_2 IE + \varepsilon$.

The third step was to find the interaction term between KE and IE. The interaction term was obtained by multiplying the aggregate value of KE and IE whose product was KEIE. Linear model using multiple equation models through multivariate regression between KEIE and IP was then carried out. This was done to find out whether there was a significant change in the value of R square between the relationship of KE and IP and that of IE and IP. The resultant R square value was 0.7239 as indicated in table 4.32.

Table 4. 32: The Multivariate Regression between KEIE and IP

Equation	Obs	Parms	RMSE	"R-sq"	F	P
IP	295	2	2.019418	0.7239	768.1459	0.0000

IP	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
KEIE	.0036158	.0001305	27.72	0.000	.0033591	.0038726
_cons	-4.407863	.3317447	-13.29	0.000	-5.060767	-3.754958

The value of R square of 0.7239 is equivalent to 72.39%. The value of R square between the relationship of KEIE and IP increased to 72.39% from 64.54% in the relationship between KE and IP and from 66.74% in the relationship between IE and IP. This implies that when both KE and IE are combined, the R square value increased to 72.39%. It, therefore, means that the combined effect of KEIE improved the contribution of IP by (72.39% - 64.54%) 7.85%. This confirms the moderating effect of IE between KE and IP. This was further confirmed by checking the level of significance of the regression between KEIE and IP. P-value was zero as indicated in table 4.33.

Table 4. 33: Regression analysis between KEIE and IP

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	3225.010	1	3225.010	874.192	.000[b]
	Residual	1058.781	287	3.689		
	Total	4283.791	288			

This implies that KEIE has a significant influence on IP since the P-value is less than 0.05. It, therefore, means the interaction effect of KE and IE has a significant influence on IP and thus the moderating effect is confirmed. It also means that the interaction of KE and IE contributes 75.2% of IP while the remaining 24.8 % is explained by other factors not captured in this study. The findings are consistent with those of Malek, Mearns and Flin (2010) who found that hierarchical moderated multiple regressions can be used to find out whether two sets of independent variables contribute to an increase in IP by testing for changes in R square.

The coefficient of KEIE was then derived by running a linear regression between KEIE and IP. The results indicated a value of 0.104 as shown in table 4.34.

Table 4. 34: Linear Regression between KEIE and IP and its Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-4.528	.317		-14.268	.000
	KEIE	.104	.000	.868	29.567	.000

The coefficient value of KEIE was 0.104 implying that IP is expected to increase by 10.4 % when KEIE increases by a unit. This led to the development if the third model which is; $IP = \beta_0 + \beta_1 KE + \beta_2 IE + \beta_3 KEIE + \varepsilon_i$. The estimated regression function is therefore; $IP = 8.970 + 0.154 KE + 0.654 IE + 0.104 KEIE + 3.304$. The sum of the coefficient of KE, IE and KEIE is 0.912 which is greater than 0.900 implying that the model is adequate in measuring the moderating effect of IE on KE and IP. This is consistent with Wahyono (2018) who found that the goodness of fit index greater than 0.900 indicates a good model. This confirms that IE is a quasi-moderator because it relates and interacts with the predictor variable (Nandakumar, Ghobadian & O'Regan, 2010).

4.6.3. Assessment of the Magnitude of Moderating Effect

The magnitude of IE was quantified to determine whether the moderation effect was small, medium or large. This was measured by the effect size formula as propounded by Cohen (1988) which states that effect size; $f^2 = \frac{R^2\ Inclusive - R^2 Exclusive}{1 - R^2\ Inclusive}$, where the benchmark is that if f^2 is 0.02, the effect is small , if f^2 is 0.15 the effect is medium and when f^2 is 0.35 the effect is large. The effect size is therefore $\frac{0.7239 - 0.6454}{1 - 0.7239} = \frac{0.0785}{0.2761} = 0.2843$. The magnitude of IE is between 0.15 and 0.35 but more nearer to 0.35 than 0.15.

This implies that IE has a large moderating effect between KE and IP. The moderating effect was further confirmed by the Structural Equation Model (SEM) and Partial least

Square (PLS). This was done to provide a methodological comparison of the two approaches to analyzing the moderating effect.

4.6.4. Moderating Effect through Structural Equation Model and Partial Least Square

The SEM and PLS were used to confirm the moderating variable analyzed earlier by hieratical multiple regression. These provided a basis for conducting a comparative analysis of the two approaches for more credible and robust findings and thus make a methodological contribution. The SEM is important in this study because they combine different statistical process for various parameters and testing of hypothesis, theories, models as well as their modifications (Valaei, Rezaei & Emami, 2017). The PLS, on the other hand, generates algorithms that show how each item varies and its contribution to the composite score (Chin, Marcolin & Newsted, 2003). The combined SEM and PLS were analyzed using Smart PLS software which is in line with Ringle, Wende and Becker (2014) who found that the software is appropriate in conducting SEM-PLS analysis. Valaei and Baroto (2017) also found that the software allows for assessment of the causal relationship between the constructs and measures of a study.

Several tests were therefore conducted before running the SEM and PLS analysis. The following test was first conducted to satisfy the assumptions of SEM as stipulated by Tirwa, Yadav and Suri (2018); Normality, linearity, multicollinearity, construct validity, unavailability of outliers, convergent and discriminant validity. The other tests that were done included; Confirmatory Factor Analysis (CFA), path analysis, Comparative Fix Index

(CFI), Composite Reliability (CR), Average Variance Extracted (AVE), R square and the F square.

The first test under this technique was linearity and the unavailability of outliers. The association between exogenous variables of KE, IE and KIE and shows a linear relationship as indicated in figure 4.21.

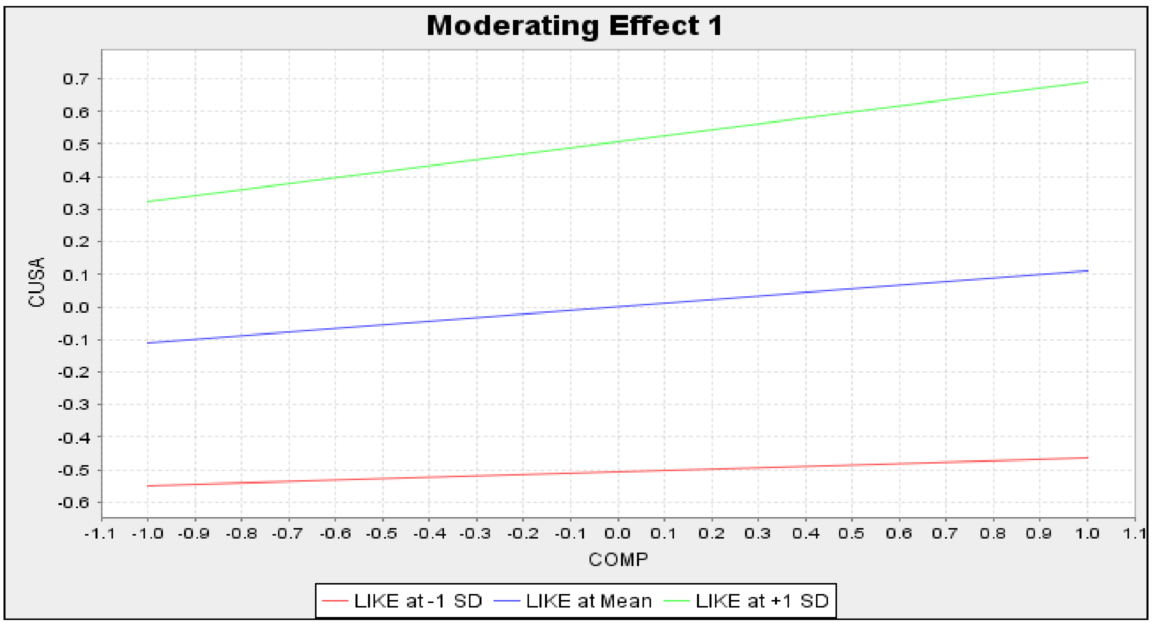

Figure 4. 21: Linearity test between Knowledge Entrepreneurship, Innovation Ecosystem, KEIE and Innovation Performance

The graph indicates a straight line for the relationship between KE, IE, KEIE and IP and unavailability of outliers. This implies a direct relationship between the exogenous variables (KE, IE and KEIE) and endogenous variables (IP). This means that as the KE, IE and KEIE increase so does IP. It is also observed that the interaction of KE and IE (KEIE) has increased values of IP than KE and IE individually. This confirms the moderating effect of IE between KE and IP.

The other test under this technique was that of multicollinearity. The Partial least square algorithm was also used to test for Multicollinearity among the observed parameters in the three latent variables which comprised; KE, IE and IP. The results indicate that the VIF values of each of the parameters ranged from 1 to 2.564 as shown in table 4.35

Table 4. 35: Multicollinearity among KE, IE and IP

	VIF
Government policy	2.000
ICT	1.888
Innovation efficiency	1.933
Leadership	1.787
Newness	1.802
Organisation Learning	1.397
Sales growth	2.564
Technology spill over	1.811
Trade support	1.945
Organisation Culture	1.000

The VIF for all the parameters were less than the required threshold of 10. This implies that there is no Multicollinearity in the observed variable of KE, IE and IP and therefore do not require any action. The findings are consistent with those arrived at using the hieratical multiple regression. This confirms the absence of Multicollinearity using the two approaches.

Construct validity was later conducted to ascertain the concurrence of the theoretical concepts and the measures that were used. Construct validity was tested through its two categories that are convergent and discriminant validity. The first step was to determine the convergent validity. This was conducted using the Smart PLS. Convergent validity was obtained by examining the Composite Reliability (CR) and Average Variance Extracted (AVE). Convergent validity is confirmed when CR is more than AVE (Taghavi & Seyedsalehi, 2015). The CR value of KE, IE, KEIE and IP were 0.865, 0.899, 1 and 0.899 respectively as indicated in figure 4.22.

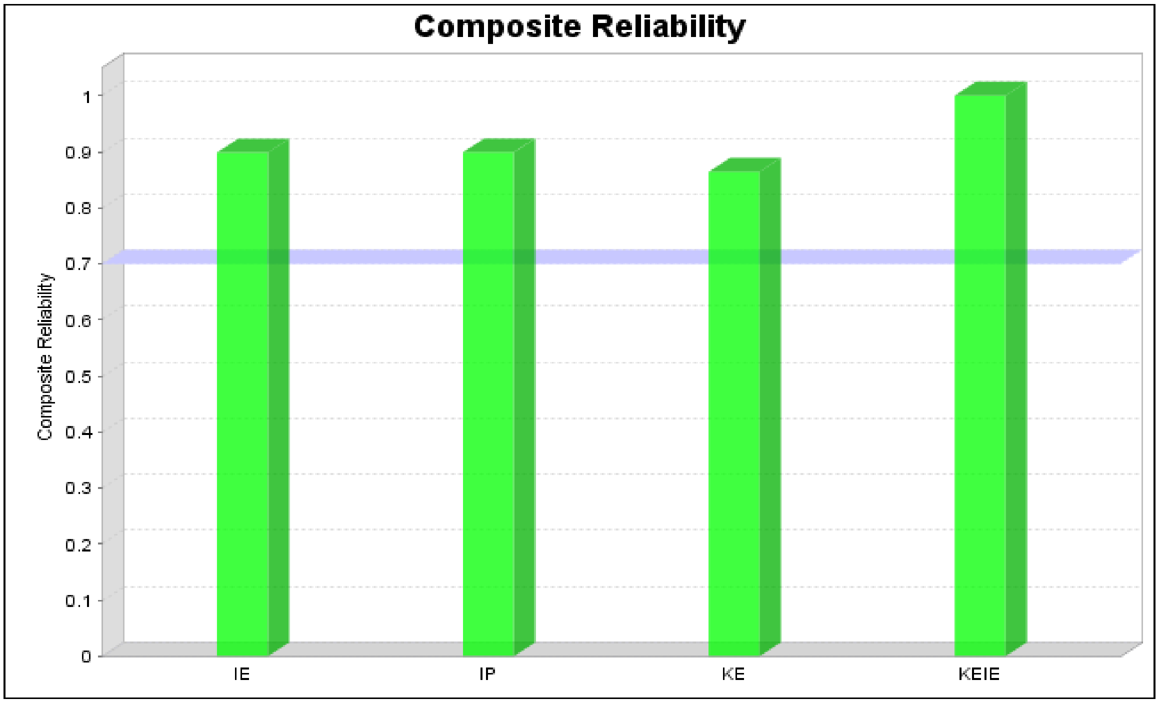

Figure 4. 22: **Composite Reliability of KE, IE, KEIE and IP.**

The results show that each of the variables had a CR value of above 0.7. This implies that the data collected on KE, IE and IP meet the required threshold. These results are consistent with the one arrived earlier using the Statistical Package for Social Scientist (SPSS).

The next step was to examine the values of AVE. This was also done by running the smart PLS. The results indicate AVE values of 0.681, 1.0, 0.748, 0.747 and 1for KE, KEIE, IP, IE as shown in figure 4.22

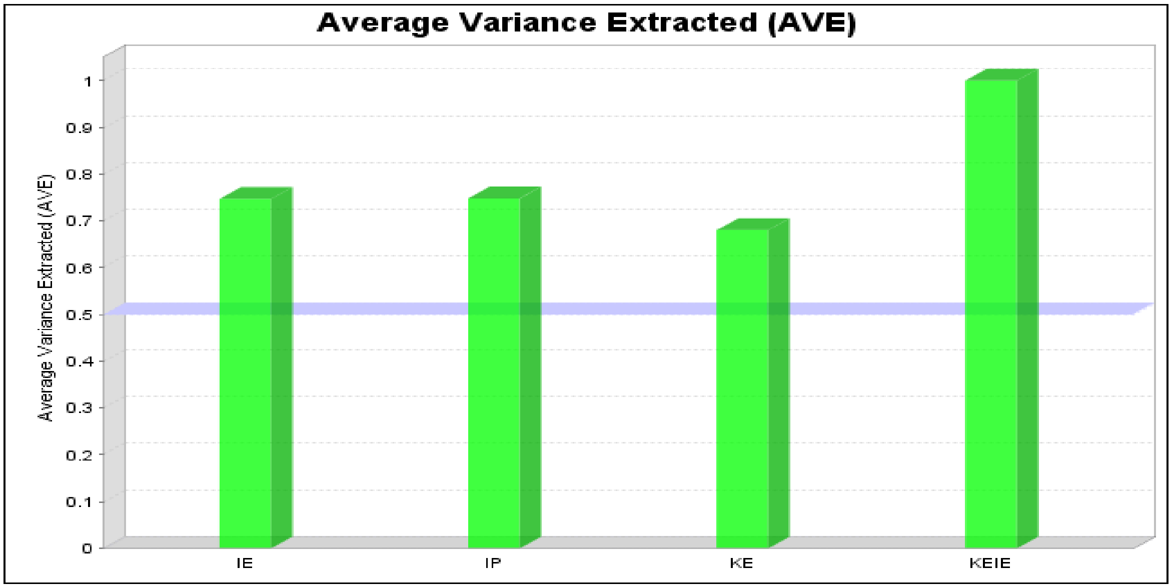

Figure 4. 23: The Average Variance Extracted of KE, IE, KEIE and IP.

The value of AVE for each of the variables was above the required threshold of 0.5. thus the parameters of each of the latent variables were valid. Further analysis for comparison of CR and AVE was done to confirm convergent validity. The results indicate that CR is greater than AVE for KE, IE and IP as shown in table 4.36.

Table 4. 36: Comparison of Composite Reliability and Average Variance Extracted

	Variable	Composite Reliability (CR)	Average Variance tracted (AVE)	Effects of CR and AVE
i	Knowledge Entrepreneurship	0.865	0.681	CR > AVA
ii	Innovation Ecosystem	0.899	0.747	CR > AVA
iii	Innonation Performance	0.899	0.748	CR > AVA

The results imply that CR is more than AVE and thus convergent validity is confirmed. This means that the criteria used in this study to access quality regarding the procedure and results enhanced credibility, transferability, dependability and conformability.

The next test was that of Discriminant Validity (DV). This test is confirmed if AVE is higher than the square root of the correlation of other variables. The fornell Larcher criterion for determining the Square Root of Correlation (SRC) of KE, IE and IP was applied. The square root of correlation of KE and IP is 0.45 wears that of IE andIP was 0.615 as indicated in table 4.38.

Table 4. 37: The Fornell Larcher Square Root of Correlation of KE, IE and IP

		IE	IP	KE	KEIE
i	IE	0.864	0		
ii	IP	0.615	0.863		
iii	KE	0.645	0.450	0.825	

The diagonal values are 0.864, 0.863 and 0.825. These values are larger than the off diagonal values of 0.615, 0.645 and 0.450. Discriminant Validity is therefore established because the diagonal values are larger than the off diagonal values.

The next step was to compare the square root of the correlation of KE, IE and IP with their respective AVE values obtained in figure 4.18. The values of AVE are greater than SRC as indicated in Table 4.38.

Table 4. 38: Comparison of AVE and Square Root of Correlation of KE, IE and IP

	Variable	Square Root of Correlation (SRC)	Average Variance Extracted (AVE)	Effects of CR and AVE
i	KE and IP	0.45	0.681	AVA > SRC
ii	IE and IP	0.615	0.747	AVA > SRC

The results imply that discriminate validity should be confirmed since the values of AVE are higher than the square root of correlation between KE and IP and between IE and IP. This is consistent with those of Taghavi and Seyedsalehi (2015) who found that if the AVE is greater than SRC, then discriminate validity is confirmed. This once again means that the criteria used in this study to access quality regarding the procedure and results enhanced credibility, transferability, dependability and conformability.

Discriminant validity was also tested using the Heterorait-Monitrait ratio. The values of association using the Heterotrait-Monitrait ratio between IE and IP are 0.737, KE and IP is 0.532 and KEIE and IP is 0.755 as indicated in table 4.39.

Table 4. 39: The Heterotrait-Monitrait Ratio

		IE	IP	KE
i	IE			
ii	IP	0.737		
iii	KE	0.780	0.532	
iv	KEIE	0.577	0.755	0.465

The values are all below 0.9 which is in tandem with Heterorait-Monitrait ratio criteria which state that the ratio should be below 0.9 for discriminant validity to be confirmed. Discriminant validity is therefore confirmed because all the values are less than 0.9. This is consistent with those of Teo, Srivastava and Jiang (2008) who found that the Heterorait-Monitrait ratio should be less than 0.9.

The internal consistency reliability was also tested using both the Composite Reliability (CR) and Cronbach's Alpha. The values of CR of KE, IE, KEIE and IP were all above 0.7 as indicated in figure 4.17. This is consistent with Hair, Ringle and Sarstedt (2011) who found that the CR of the variables must be more than 0.7. This was further confirmed by the Cronbach's Alpha. The values of KE, IE, KEIE and IP were all above 0.7 as indicated in figure 4.24.

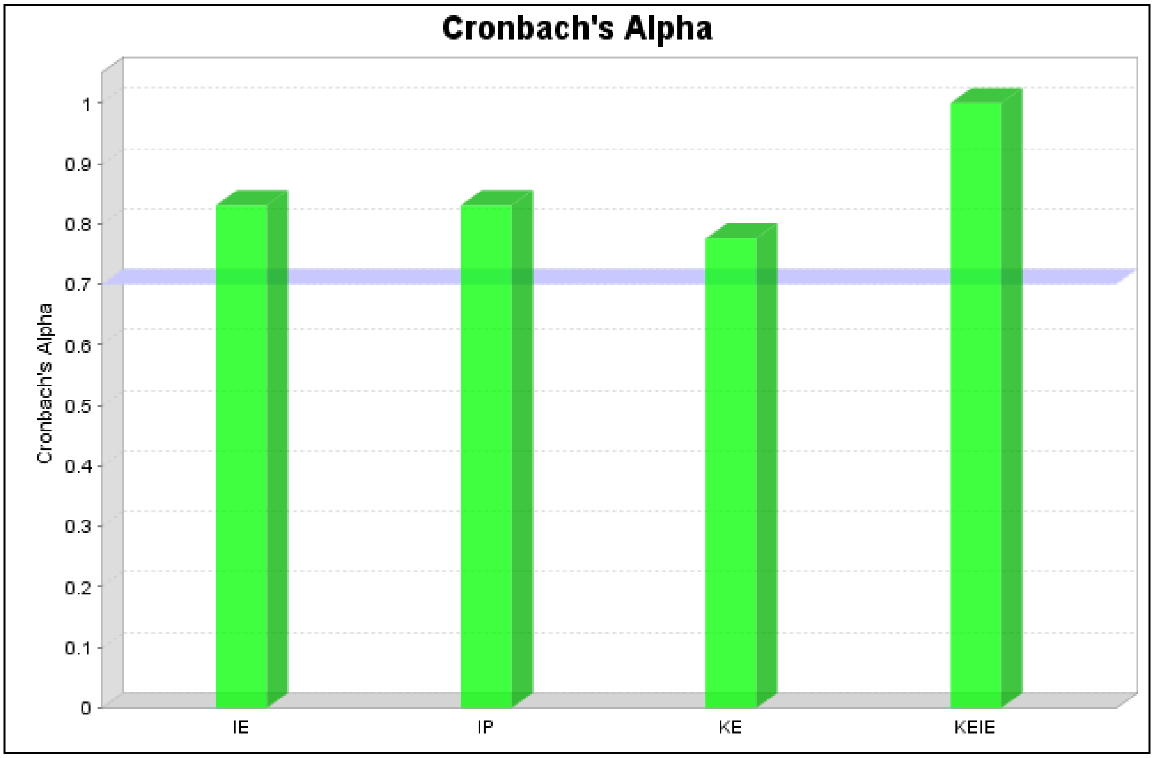

Figure 4. 24: Cronbach's Alpha Coefficients

The values are all above the recommended threshold of 0.7. It means that the scale used to measure IE is reliable and can be replicated in another trial with similar outcomes. This is consistent with Alegre *et, al.,* (2006) who found that the Cronbach's alpha of the measures of the latent variable should be more than 0.7. The internal consistency reliability is therefore confirmed using the two approaches.

The interaction among the various observed items of KE, IE and IP was conducted. This was done to determine the magnitude of the moderating variable. The interaction value among the various items ranged from 3.40 to 4.19 as indicated in table 4.40.

Table 4. 40: The Range of Interaction Terms among the Various Items of KE,IE and IP

	Government policy	ICT	Innovation efficiency	Leadership	Newnes	OL	Sales growth	Technology spill over	Trade support
Iteration 0	0.386	0.401	0.386	0.401	0.386	0.401	0.386	0.386	0.386
Iteration 1	0.378	0.328	0.365	0.341	0.368	0.536	0.421	0.359	0.419
Iteration 2	0.378	0.328	0.365	0.340	0.369	0.536	0.420	0.360	0.418
Iteration 3	0.378	0.328	0.365	0.340	0.369	0.536	0.420	0.360	0.418
Iteration 4	0.378	0.328	0.365	0.340	0.369	0.536	0.420	0.360	0.418
Iteration 5	0.378	0.328	0.365	0.340	0.369	0.536	0.420	0.360	0.418

The range of interaction was well above the minimum required threshold of 0.15. This implies that there was a large moderating effect among the various observed items of KE, IE and IP. This means that there was sufficient moderation between the various observed items.

The magnitude of the moderating variable among the latent variables of KE, IE and IP was also determined. This was done by conducting the F square test. The F square value of combined KE, IE and IP was 0.410 as indicated in figure 4.25.

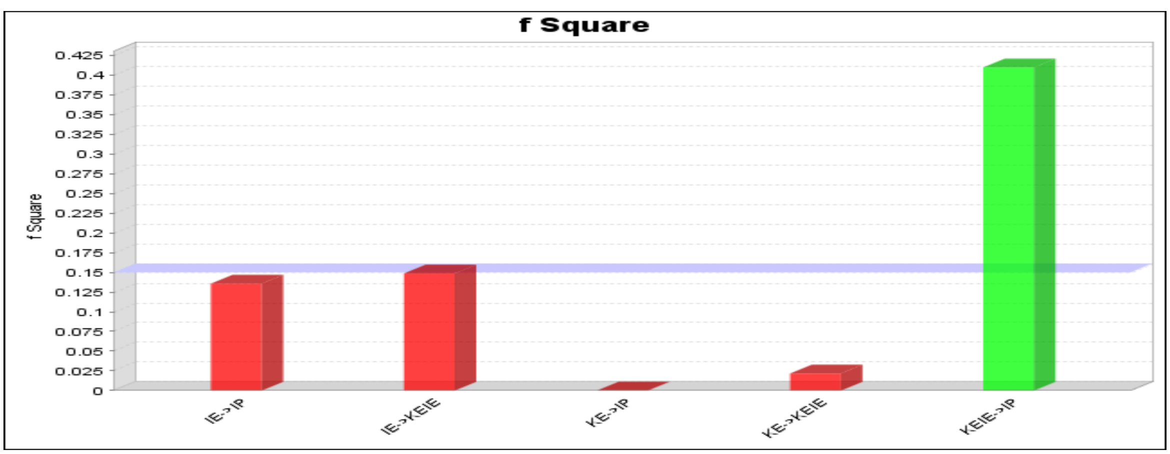

Figure 4. 25: **The F Square Values**

The F square value of the relationship between KEIE and IP of 0.410 is above the required threshold of 0.15. This implies that IE has a large moderating effect between KE and IP. It, therefore, means that the influence of the moderating variable (IE) is not only positive but also has a large moderating effect between KE and IP. This is consistent with Farouk, Idris and Saad (2018) who found that the magnitude of F square of 0.35 is large enough to confirm the presence of moderating variables.

The R square was also tested. The R square value of the relationship between KEIE and IP was 0.295 as indicated in table 4.41

Table 4. 41: The R Square Value of the Relationship between KEIE and IP

	R Square
IP	0.562
KEIE	0.295

The R square value of 0.295 indicates that the moderating effect of IE between KE and IP contributes to 29.5% to IP. This confirms the results of hieratical moderated multiple regressions.

The next stage after conducting the tests was to do an SEM-PLS analysis. The PLS algorithm was used to show inter-relationship among KE, IE, KEIE and IP. The algorithm was also used to measure the model assessment which indicated that all the loading factors were above 0.60 as shown in figure 4.26.

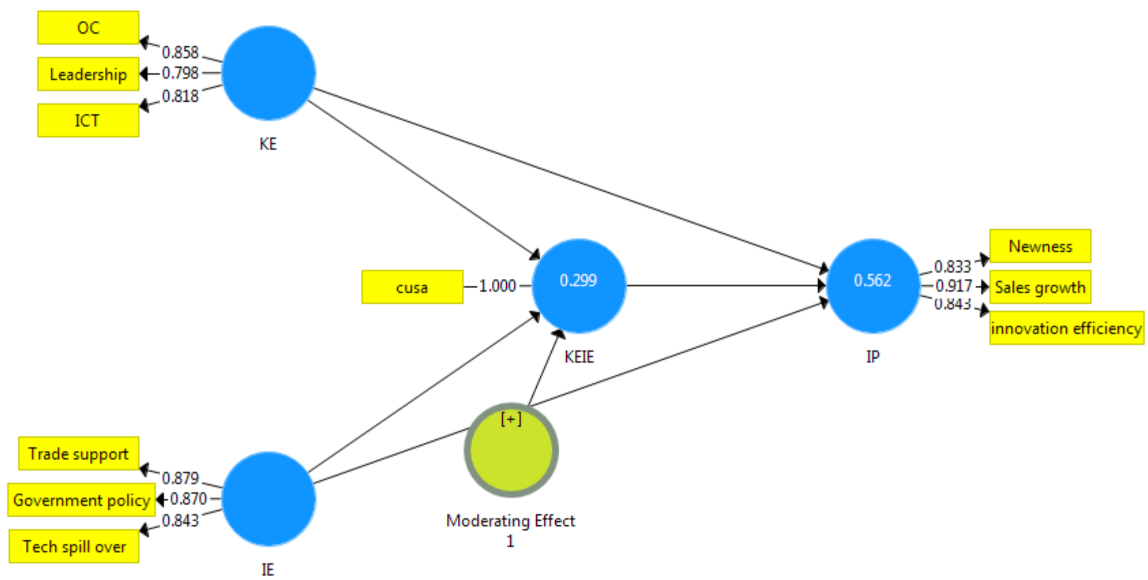

Figure 4. 26: The Interralationshionship among KE, IE, KEIE and IP

The factor loadings were all above 0.60 means that the model is fit for construct loading. This is in tandem with Valaei, *et al*., (2017) who found that the minimum threshold for constructs loading of 0.6 confirms the fitness of the model. The model fitness was further assessed through the Standard Root mean Square Residual (SRMR). The fit summary from the Smart PLS produced a value of 0.074 as indicated in table 4.42.

Table 4. 42: The Model Fit Summary

	Saturated Model
SRMR	0.074
d_ULS	0.301
d_G	0.147
Chi-Square	317.049
NFI	0.820

The model fit of 0.074 is less than 0.1. This implies that the model fit is good. The finding is in tandem with Hair, Henseler, Dijkstra, Sarstedt, Ringle, Diamantopoulus, Straub, Ketchen and Calantone (2014) who found that a value of less than 0.1 confirms that the model has a good fit. This is consistent with Dijkstra and Henseler (2015); Henseler *et, al.*, (2016) who found that SRMR identifies the difference between the model correlation matrix and the empirical.

The structural model assessment was then conducted to test the third hypothesis that IE has a significant moderating effect between KE and IE. This was done through a procedure of bootstrapping to allow for testing of hypothesis statistics. The results for the P-value of the relationship between KEIE and IP were zero as shown in table 4.43.

Table 4. 43: Testing of Hypothesis Statistics

	Standard Deviation (STDEV)	**T Statistics (|O/STDEV|)**	**P Values**
i. IE -> IP	0.060	5.673	0.000
ii. KE -> IP	0.060	6.983	0.000
iii. KE -> KEIE	0.059	3.039	0.002
iv. KEIE -> IP	0.044	11.573	0.000

The P-value of zero led to the rejection of the null hypothesis and acceptance of the alternative hypothesis which states that IE has a significant moderating effect between KE and IP. This is consistent with Valaei *et al.*, (2017) who found that a zero P-value leads to rejection of the null hypothesis and the alternative hypothesis is accepted.

The three hypotheses are therefore tested and a comparative analysis of both hieratical moderated multiple regressions and SEM PLS has confirmed the moderating effect of IE between KE and IE. This is another form of triangulation.

It was observed that IE has a moderating effect between KE and IP. The procedure for testing the moderating effect was hierarchical moderated multiple regression which is consistent with Liu, Li and Wei, (2009b) who found that hierarchical moderated multiple regression is suitable for analyzing the influence of moderating effects. There were several aspects of moderation that were observed with the first one being collaborations and networking. The finding is in tandem with Luca et, al. (2007) who found that Knowledge and open collaboration influence IP through knowledge integration.

The finding concurs with Frenz and Letto-Gillies (2009) who found that intra-firms own generated, external sources of knowledge, internal networks and their interactions increase the IP of an enterprise. The IE is therefore important for promoting networking and collaborations. The finding is in line with those of Ebersberger et, al. (2010) who found that a broad-based and collective approach has a significant influence on IP, but this activity should not substitute internal knowledge development which is crucial in generating IP.

It was further observed that not all collaborations such as competitors, suppliers and customers provide the moderating effect. The findings are consistent with Tsai (2009) who found that despite KE significantly influencing the relationship between collaboration with competitors, suppliers, and research organizations with IP, it has a negative influence on collaboration with customers. This concurs with Shrader (2001) cross-functional integration through collaboration and decisions made based on information from industry in manufacturing firms are all significantly collated to IP, but internal information generated from suppliers, customers and competitors are negatively collated to IP. However, the findings contrast those of Zerenler et, al. (2008) who found that the rate of growth for the supplier industry has been regarded as a moderator between intellectual capital and IP. Collaborations with competitors, suppliers and customers should, therefore, be investigated further to establish whether they have a moderating effect between KE and IP.

The other moderating effect of IE between KE and IP was observed in the conducive environment for operation. This concurs with Shrader (2001) who found that scanning the external information moderates the effect of KE on IP. The findings are also consistent with Goh (2005) who found that knowledge-centered principles, initiatives and infrastructure enhances IP although creativity, imagination, intuition and an enabling environment is required. The finding is consistent with that of Oke (2011) who found that innovation climate has a positive influence on IP and has a moderating effect on KE and IP. Dirk and Hanna (2008) also found that locational factors influence innovation systems, IP, knowledge transfer and spillovers which emanates from universities, research institutions, experts in specific industries, suppliers, competitors, customers and collaborating partners which all generate positive knowledge externalities.

It was also observed that trust among the collaborating partner's moderates the influence of KE on IP. The finding concurs with those of Wang et, al. (2011) who found that trust in collaborations moderates the influence of contracts on IP in a situation of environmental uncertainty. However, the findings contradict other findings which indicate that despite collaboration providing a moderating effect between KE an IP, mistrust among the participating firms can inhibit IP. Park et, al. (2014) found that high cooperation and competition have a positive influence on IP, but there is a need to investigate the nature and effects of tension, balancing and IP. This concurs with Ritala *et al*. (2014) who found that sharing knowledge with external players has a positive influence on IP, but cautioned that knowledge leakage has a negative effect on IP.

The findings on the moderating effect concurs with Valencia *et al*. (2010) who found that there is a need to introduce moderating variables when examining the relationship between KE and IP. The findings are also in line with Sharifirad and Ataei (2012) who found out the need for introducing the moderating variable between OC and IP. The findings are also consistent with *Uzkurt et, al.,* (2013) who found there is a need to include the environmental context which can be described as IE in establishing the relationship between KE and IP. The findings are also in tandem with Anning-Dorson (2017) who found that KE is shaped by the operating environment and hence it is important to consider the contexts in which a firm is operating.

The diagnostic tests conducted are also consistent with other previous findings from other researchers. Validity was confirmed through convergent validity where the findings are consistent with Taghavi and Seyedsalehi (2015) who found that if the CR is greater than AVE, then convergent validity is confirmed. The finding is also consistent with Valaei *et al*. (2017) who found that AVE should be above 0.5 to indicate a convergent validity. The findings on Multicollinearity concur with Suki and Suki (2015) who found that a VIF of less than 10 does not warrant any action.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

The chapter comprise of the summary of findings from the study objectives, the conclusion, the recommendations for policy implications and areas of further study. The content herein is derived from the previous chapter

5.2. Summary of the Findings

It was observed that KE and IE separately and jointly have significant influence on IP. However, the combination of KE and IE has a huge contribution on IP than each one of them separately. This indicates that IE is a moderating variable between KE and IP. The extent of moderating effect of IE on the relationship between KE and IP indicates that IE has a great moderating effect between KE and IP in manufacturing firms in Kenya.

5.2.1. Influence of Knowledge Entrepreneurship on Innovation Performance

It was found that KE has a significant influence on IP in Kenya manufacturing firms in Kenya. Furthermore each of the constructs of KE which are OC, OL, ICT and leadership had each separately had a significant influence on IP.

Manufacturing firms should, therefore, enhance their KE by building on OC, OL, ICT and leadership to ensure that firms make the best out of the prevailing environment, networking and collaboration for improved innovation output and efficiency. Transformation leadership is particularly important in taping, developing and utilization of both internally and externally generated knowledge while at the same time creating a conducive working environment that is open and responsive to open innovation to realize high IP.

5.2.2. Influence of Innovation Ecosystem Innovation Performance

It was found that IE has a significant influence on IP in Kenya manufacturing firms in Kenya. Innovation Ecosystem is therefore a crucial determinant of the levels of IP. It is therefore paramount that supportive environment, existing alliances, networking, collaborations and networking systems are enhanced for higher IP. Moreover, business services support such as accelerators and incubators, trade organization support, technology transfer and infrastructure development should be encouraged for improved IP and thus high competitiveness.

5.2.3. Influence of Innovation Ecosystem on Knowledge Entrepreneurship and Innovation Performance

It was found that IE has a significant moderating effect on the relationship between KE and IP. Further analysis indicated that the moderating effect of IE on KE and IP is large. This underscores the importance of manufacturing firms in leveraging on the available business services, trade organization support, technology transfer, government support and policy. Manufacturing firms should therefore recognise the important role IE plays in their performance.

Knowledge entrepreneurship coupled with the appropriate IE is therefore important for an improved IP and greater competitiveness. High levels of IP will lead to lower cost of production, value addition, new products, processes and markets that will make manufacturing firms more competitive in local and the international market thus creating the much needed job as well as increase the value of the country exports and favorable balance of payments.

High IP will also lead to the expansion of manufacturing and other related sectors leading to diversification of the economy, increased profitability, job creation and thus economic growth and development. This will accelerate the achievement of the 4 big agenda especially on manufacturing sector which focuses on transforming the sector to provide employment. The findings have also brought out the importance of IP in achieving Kenya's Vision 2030 which envisages the country becoming the dominant supplier of manufactured products in East and Central Africa through enhanced efficiency and improved competitiveness.

Improved levels of IP will also lead to efficient utilization of scarce resources, environmental conservation and improved levels of human development index without compromising the survival of future generations. This will form the basis for attaining sustainable development goal number 8 on sustainable economic growth and decent employment for all. The findings demonstrate how the country can accelerate the economic growth to the desired levels for attaining a high middle-income status as well as improve the living standards of the citizens. The interplay between KE and IE should, therefore, be enhanced for the economic prosperity of the nation.

5.3. Conclusion

It is concluded that KE significantly influence IP. It is therefore imperative that KE should be enhanced by addressing OL, OC, ICT and transformational leadership in manufacturing firms in Kenya. However, for KE to have major improvement on IP, it is important that IE should be addressed to provide a mutual and symbiotic relationship between all the stakeholders in manufacturing firms in Kenya.

5.4. Recommendations

There are several recommendations that can be drawn from the conclusion. Manufacturing firms should leverage on KE to nurture human capital by tapping on their intellectual capacity and blending it with emerging issues for greater productivity through appropriate knowledge management mechanisms. Improved KE will enhance the proper utilization of skills, talent, expertise and technology spillover for greater performance of manufacturing firms.

There is a need to encourage manufacturing firms to patent their new products. This would help manufacturing firms to gain value for their innovation and safeguard against counterfeits which is counterproductive. The authority concerned with patent registration in the country (Kenya Intellectual Properties Institute) should, therefore, promote the registration of patents by easing their processes to encourage more firms to obtain the patents rights within a reasonable time.

Manufacturing firms should also tap into the immense opportunities available within their ecosystem through networking, collaboration, partnership and forming formidable strategic alliances for their improved performance. Collaboration, particularly between manufacturing and research organizations and universities, should be strengthened to promote the commercialization of innovation emanating from research activities. Networking within the IE can create opportunities that are important for knowledge exchange, business support, lobbying and advocacy for a better operating environment such as availability of requisite infrastructure, regulatory framework, tax and tariff reductions and policy interventions on the overall competitiveness of manufacturing firms.

Synergies within the IE should also be enhanced and developed within the manufacturing sector by providing forums for peer interactions for greater value addition. High-value addition leads to the development of new products, processes and markets which are likely to contribute to sustainable development.

Concerted efforts from stakeholders (such as Government agencies like quality standard bodies, Kenya Association of Manufacturers, universities, and research institutions) should be geared towards improving the operating environment in the manufacturing sector. Transport systems and high energy costs should be addressed to reduce the cost of production. Elimination of counterfeits and safeguarding of intellectual property rights should also be prioritized to encourage innovation activities. This lead to increased IP, low cost of production, improved competitiveness of products from manufacturing firms and more exports and foreign currency thus a balanced or favorable balance of payment in international trade.

Management in manufacturing firms should focus on innovation output to provide a diversity of their products to satisfy the ever-changing customer's taste and preferences. Leaders in manufacturing firms should also enhance their innovation efficiency by utilizing appropriate technology to produce quality products at low cost which can improve their competitiveness in the local, regional and global markets.

5.5. Contribution to Body of Knowledge

The study contributed to new knowledge in two major ways. The first was in terms of theory development and the other development of a new model for measuring IP.

5.5.1. Contribution to Theory Development

The findings contributed to addressing the shortcomings of the Schumpeter's (1934) innovation theory and the Gleick (1989) complexity theory. The findings brought out the importance of the operating environment in which manufacturing firms operate which was ignored in the Schumpeter's (1934) innovation theory. This was done by demonstrating value of IE on IP. The findings indicate that IE has a high moderating effect between KE and IP thus underscoring the importance of operating environment on innovation.

The findings also attempted to address the key components of break-even points which were ignored in Schumpeter's (1934) theory of innovation. The key elements of break-even points are the fixed costs, variable costs and revenue. Fixed cost and variable cost were addressed by measuring the innovation efficiency which was one of the factions of IP. Innovation efficiency was demonstrated by the ratio of innovation output relative to input which addresses the cost component. The revenue was addressed by factoring in the sales growth rate brought about by innovation.

The gaps in the Gleick (1989) complexity theory have also been attempted to be resolved. The issue of excessive complexity can be eliminated in a number of ways. First, engaging in collaborations and partnerships within the business services provider is likely to increase the acquisition of external knowledge and its assimilation. Trade support through common goals members association has the benefit of agitating sector concerns in different forums which would otherwise be difficult for an individual firm. The associations play a major role in lobbying for appropriate Government policy such as development of infrastructure, favourable taxation and supportive regulation. The interaction between the various players within the National Innovation System is likely to result into technology spill over and transfers from research institutions to the industry thus deepening technology adoption hence improved IP thus making the system to be enablers of innovation rather than a hindrance. These efforts can reduce the complexity of operations of manufacturing firms.

The findings also addresses the shortcoming of Gleick (1989) complexity theory of viewing innovation as solely the outcome of technical and social coevolution. The findings have indicated that KE can nurture a culture of innovation, promote OL and offer supportive leadership which coupled with the right ICT can result into individual champions in innovations. The champions play a key role in bringing about incremental and radical innovations leading to greater IP. The role of an individual entrepreneur cannot therefore be ignored.

5.5.2. Contribution to the Development of a New Model for Measuring IP.

The other major contribution of the findings is the development of a new model for measuring IP. The model was derived from the two-stage Data Envelopment Analysis (DEA) model. The model generates the IP from the summation of the product of innovation output and innovation efficiency. This has mathematically been denoted as $IP = \sum_{n=1}^{t=3}\{(\text{Output})\ (\text{Efficiency})\}$. This is can be expressed as;

$$IP = \sum_{n=1}^{t=3}\{(\text{Inp} + \text{Pa} + \text{Nip} + \text{Ne})\ \ (SGR)\}$$

Where IP is innovation performance, Inp is the sum of the Increased New Product as a result of innovation, Pa is patents acquired, Nip is the new innovation process, Ne is the new enterprises as a result of innovation and SGR is the percentage sales growth rate brought about by innovation.

The finding closes the gap on empirical review which had indicated the lack of an IP measurement model. This contributed to new knowledge in the area of innovation studies.

5.6. Suggestions for Further Research

There is a need for further study on how customers' and suppliers' information can be enhanced for a more enriched KE. It has been observed that customers and suppliers' input do not influence IP yet they are critical components of manufacturing firms. Customers and suppliers in the manufacturing sector are important stakeholders and their input is important in improving the IP.

The other area of further study is on managing trust in IE. It has been observed that there are issues of mistrust in collaboration as a result of competition. There is a need to find out how different actors can develop mutual trust for a win-win situation for a more competitive sector.

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APPENDICES

APPENDIX I: QUESTIONNAIRE FOR RESPONDENTS IN MANUFACTURING FIRMS

QUESTIONAIRE FOR RESPONDENTS IN MANUFACTURING FIRMS

The purpose of this questionnaire is to collect information relating to knowledge entrepreneurship, innovation ecosystem and innovation performance from manufacturing firms in Kenya with the aim of fulfilling thesis requirement. The information you provide shall be used for the purpose of this study only and not any other. Your responses shall be treated with confidentiality.

i). Name of the firm ……………………………………………………………………

ii). Location of the firm …………………………………………………………………

iii). The sub sector………………………………………………………………………

iv). Position you hold in the organization……………………………………………

v). Highest level of qualification. Certificate ☐ Diploma ☐ Degree ☐ Masters ☐

PhD ☐

Part A: Demographic Information

☐ ☐

i). Gender. Male Female

ii). Age bracket in years. Less than 18-25 ☐ 25-35 ☐ 35-45 ☐ 45-55 ☐ Above ☐

55

iii). Number of years employed in the organisation. Less than1 ☐ 5-1 ☐ over ☐

10 ☐

iv). Cumulative years of employment. Less than1 ☐ 1-5 ☐ 5-10 ☐ over 10 ☐

Part B

Section1: Pertinent Information on Knowledge Entrepreneurship

Please score the statement in questions according to the extent of agreement with Strongly Disagree (SD) =1 point, Disagree (D) = 2 points, Undecided (U) = 3 points, Agree (A) = 4 points and Strongly Agree (SA) = 5 points.

1. Organization Learning

Serial No.		SD	D	U	A	SA
i	There is liberty of experimentation and autonomy in my job					
ii	I am empowered to apply what i have learnt and to generate new ideas					
iii	There is managerial commitment for support in my work					
iv	I am allowed to take risks without fear of reprimanding in case of failure					
v	There are avenues for knowledge transfer and integration					
vi	There is freedom of openness and interaction with external environment					
vii	Continued organization learning is encouraged in this firm					

What are the factors that affect organization learning in relation to innovation in the firm?

i……………………………………………………………………………………………
ii……………………………………………………………………………………………
iii…………………………………………………………………………………………..
iv…………………………………………………………………………………………..
v……………………………………………………………………………………………

2. Organization Culture

Serial No.		SD	D	U	A	SA
i	There is strong team work in decision making at work place					
ii	Strong collaboration with and between departments exist in this firm					
iii	Knowledge sharing ocurs naturaly within the organisation					
iv	I am encouraged to provide better decisions and actions					
v	I feel valued and trusted in the work place					
vi	The firm has the willingness to cannibalize successful products					
vii	There is emphasized future orientation					

What are the factors that affect organization culture in relation to innovation in the firm?

i……………………………………………………………………………………………
ii……………………………………………………………………………………………
iii……………………………………………………………………………………………
iv……………………………………………………………………………………………
v……………………………………………………………………………………………

3. Leadership

Serial No.		SD	D	U	A	SA
i	Entrepreneurial capacity is nourished in this firm					
ii	Entrepreneurship activities in this firm are linked to strategy					

iii	Learders in this firm protects disruptive innovations					
iv	Learders in this firm provide an opportunity for creativity					
v	Leadership in this firm allow for questioning the dominant logic					
vi	Leadership in this firm provide inspiration motivation					

What are the factors that affect leadership in relation to innovation in the firm?

i………………………………………………………………………………………………

ii……………………………………………………………………………………………

iii………………………………………………………………………………………………

iv………………………………………………………………………………………………

v………………………………………………………………………………………………

4. Information, Communication and Technology

Serial No.		SD	D	U	A	SA
i	The firm have adequate computers to facilate working					
ii	There is availability of internet and intranets services					
iii	The firm has a social media platform to facilitate interactions					
iv	The firm has provided a reliable network connectivity					
v	The firm has an appropriate management information system					
vi	The firm has instituted a customer relashionship management system					
vii	The firm is characterized with high levels of automation					

What are the factors that affect information, communication and technology in the firm in relation to innovation?

i…………………………………………………………………………………………

ii………………………………………………………………………………………

iii………………………………………………………………………………………

iv……………………………………………………………………………………….

v…………………………………………………………………………………………

What factors affect knowledge management in relation to innovation in the firm?

i…………………………………………………………………………………………

.ii…………………………………………………………………………………………

.iii………………………………………………………………………………………

iv………………………………………………………………………………………

v…………………………………………………………………………………………

Section II:

Pertinent Information on Innovation Ecosystem

Serial No.		SD	D	U	A	SA
i	There are presence of accelerators and incubators in this locality					
ii	There is availability of business services in this area					
iii	There is availability of trade organization support within our locality					
iv	There is technology spill over in this industry from universities and other research institutions					
v	There exist a dynamic networking within the firms in this industry					
vi	There is plenty of infrastructure to support business operations					

What factors affect the operating environment in which innovation occurs in the firm?

i………………………………………………………………………………………….

ii…………………………………………………………………………………………

iii…………………………………………………………………………………………

iv…………………………………………………………………………………………

v…………………………………………………………………………………………

PART C

Information on Innovation Performance

Indicate the state of affairs in your firm for the last three years (2015, 2016 and 2017) as pertains to Innovation Performance

i). What is the number of increased new product as a result of innovation in the last three years ?

2015………. 2016………… 2017………..

ii). The number of patents aquired in the last 3 years were; 2015………. 2016………… 2017………..

iii). The number of new enterprises as result of innovation for the last three years were; 2015………. 2016………… 2017………..

iv). The number of new innovation process introduced in the last 3 years are; 2015………. 2016………… 2017………..

v). The number of new enterprises that have resulted from innovation in the last 3 years are; 2015………. 2016………… 2017……

vi). The total sales of the firm for the last 3 years are; 2015………. 2016………… 2017………..

vii). Sales growth atributable to innovations for the last 3 years are; 2015………. 2016………… 2017………..

viii). The percentage sales growth rate brought about innovations for the last 3 years are; 2015………. 2016………… 2017………..

ix). What were the total assets of the firm for the last 3 years?

2015………. ………………2016………………… 2017………………

APPENDIX II: THE INTERVIEW SCHEDULE FOR KEY INFORMANT

Section A. Knowledge Entrepreneurship

Part I: Leadership

i). How does the leadership in manufacturing firms promote knowledge sharing both in and out of the organisation?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

ii). How do you ensure that manufacturing firm taps into the available knowledge base?

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

Part II: Organization Learning

i). How has manufacturing firms aligned themselves to organization learning to promote innovation?

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

ii). What attributes of organization learning affects innovation in manufacturing firm?

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

Part III: Organization Culture

i). What systems in your opinion have manufacturing firms put in place to encourage the culture of idea generation?

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

ii). What are the factors that affect organization culture in relation to innovation in manufacturing firms?

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

Part IV: Information Communication and Technology

i). How does manufacturing firms leverage on technology to bring about innovation?

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

ii). How does your organization or department ensure that manufacturing firms are embracing the appropriate Information, Communication and Technology platforms?

....

....

……………………………………………………………………………………………

Section B. Innovation Ecosystem

i). What initiatives have your organization or department put in place to promote networking with other manufacturing firms?

....

....

....

ii). What infrastructure development can you attribute to innovation performance in manufacturing firms?

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

iii). What prevailing legal and statutory requirements affects innovation performance in manufacturing

firms?………………………………………………………………………………….

…………………………………………………………………………………………

…………………………………………………………………………………………

iv). How can you link the Government policy on manufacturing and innovation performance?

…………………………………………………………………………………………

…………………………………………………………………………………………

…………………………………………………………………………………………

Section C. Innovation Performance

i). How does your organization or department encourage the spirit of innovation in manufacturing firms?

....

....

....

ii). What innovations have been developed in the last three years in manufacturing firm?

…………………………………………………………………………………………

…………………………………………………………………………………………

………………………………...

iii).What has been the contribution of innovation to the competitiveness of manufacturing sector?

....

....

....

APPENDIX III: THE CHECK LIST

Section A. Knowledge Entrepreneurship

Part I: Organization Learning

i). Operational Research and Development department

ii). Functional customer relationship management system

iii). Visible training programs and schedules

Part II: Organization Culture

i). Existing list of innovation champions

ii). Existence of incentive programs

iii). Evidence of working teams

Part III: Leadership

i). Evidence of corporate learning, adherence to regulatory framework and innovation in the vision and mission statements.

ii). Existence of independent business unit

iii). Open channel of communication

Part IV: Information Communication and Technology

i). Evidence of automation

ii). High level of mechanization

iii). Utilization of Information Communication and Technology platforms

Section B. Innovation Ecosystem

i). Fulfillment of regulatory requirement

ii). Evidence of firm adaptability

iii). Presence of external mandates and expectations in vision and mission statements

Section C. Innovation Performance

i). Evidence of differentiation

ii). Presence of innovation incubators

iii). Patent rights acquired

iv). Variety of production lines.

APPENDIX IV: DATA COLLECTION APPROVAL

Inspiring Innovation and Leadership
KARATINA UNIVERSITY
SCHOOL OF BUSINESS
OFFICE OF THE DEAN
Email: deansob@karu.ac.ke

Tel: +254-(0)729721200

P.O. BOX 1957 – 10101,
KARATINA,
KENYA.

7th March, 2018

TO WHOM IT MAY CONCERN:

RE: ISAAC MUIRURI GACHANJA – B401/1571P/14

This is to confirm that the above named is a bonafide student at Karatina University School of Business; he is pursuing a PhD in Entrepreneurship.

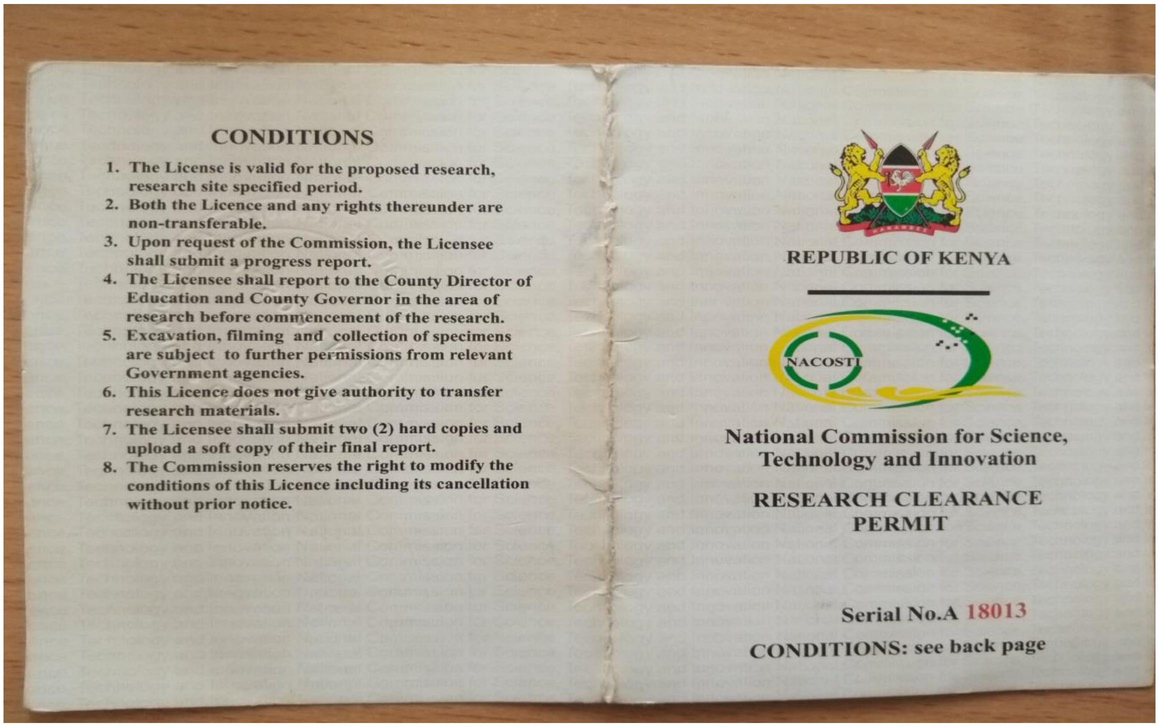
Isaac has successfully defended his PhD proposal and he has been permitted to collect data on his thesis titled: **"Moderating effect of innovation ecosystem between knowledge entrepreneurship and innovation performance in manufacturing firms in Kenya".**

Any assistance accorded to him will be highly appreciated.

Thank you.

Dr. David Gichuhi
DEAN, SCHOOL OF BUSINESS

APPENDIX V: DATA COLLECTION PERMIT



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REPUBLIC OF KENYA

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Serial No.A 18013

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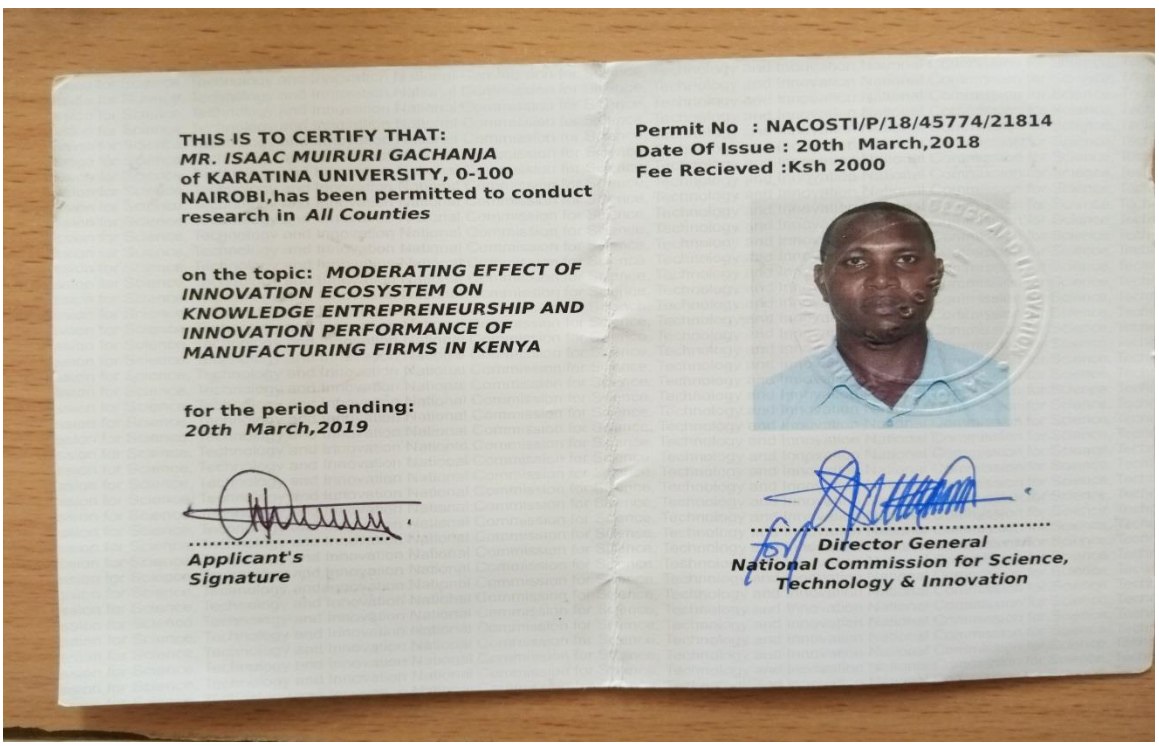

THIS IS TO CERTIFY THAT:
MR. ISAAC MUIRURI GACHANJA
of KARATINA UNIVERSITY, 0-100
NAIROBI,has been permitted to conduct research in *All Counties*

on the topic: *MODERATING EFFECT OF INNOVATION ECOSYSTEM ON KNOWLEDGE ENTREPRENEURSHIP AND INNOVATION PERFORMANCE OF MANUFACTURING FIRMS IN KENYA*

for the period ending:
20th March,2019

Applicant's Signature

Permit No : NACOSTI/P/18/45774/21814
Date Of Issue : 20th March,2018
Fee Recieved :Ksh 2000

Director General
National Commission for Science, Technology & Innovation

APPENDIX VI. INNOVATION PERFORMANCE ACROSS MANUFACTURING FIRMS IN KENYA

Firm	location	Sub sector	New product	Patents	New process	New enterprise	Innovation output	Sales growth attributed to innovation	Innovation performance
1.	1	1	0	0	3	1	4	0.30	1.20
2.	1	1	7	4	3	3	17	0.15	2.25
3.	1	1	5	0	2	10	17	0.07	1.19
4.	1	2	3	2	1	2	8	0.2	1.60
5.	1	2	3	5	0	7	15	0.07	1.05
6	1	2	12	0	1	1	14	0.50	7
7.	1	2	5	0	5	7	17	0.5	8.5
8.	1	2	2	1	1	1	5	0.2	1
9.	1	2	13	0	0	2	15	0.25	3.75
10.	1	2	9	1	0	2	12	0.11	1.32
11.	1	2	1	0	0	0	1	0	0
12.	1	2	1	0	0	0	1	0.01	0.01
13.	1	3	7	5	2	4	16	0.50	9.00
14.	1	3	2	1	0	0	3	0.02	0.6
15.	1	3	8	4	3	5	20	0.54	10.80

16.	1	3	6	3	1	2	12	0.40	4.80
17.	1	3	7	2	4	3	16	.48	7.68
18.	1	4	2	1	1	1	5	0.30	1.50
19.	1	4	5	2	1	2	10	0.40	4.00
20.	1	4	4	3	2	1	10	0.38	3.8
21.	1	4	3	3	2	2	10	0.35	3.5
22.	1	4	7	5	3	3	18	0.54	9.72
23.	1	4	1	1	0	0	2	0.03	0.06
24.	1	4	3	2	1	0	6	0.05	0.30
25.	1	4	4	2	1	1	8	0.25	2.00
25.	1	4	1	0	0	0	1	0.01	0.01
26.	1	4	7	5	2	4	16	0.50	9.00
27.	1	4	2	1	0	0	3	0.02	0.6
28.	1	4	8	4	3	5	20	0.54	10.80
29.	1	4	6	3	1	2	12	0.40	4.80
30.	1	4	7	2	4	3	16	.48	7.68
31.	1	4	2	1	1	1	5	0.30	1.50
32.	1	5	0	0	3	1	4	0.30	1.20
33.	1	6	7	4	3	3	17	0.15	2.25
34.	1	6	5	0	2	10	17	0.07	1.19

35.	1	6	3	2	1	2	8	0.2	1.60
36.	1	6	3	5	0	7	15	0.07	1.05
37.	1	6	12	0	1	1	14	0.50	7
38.	1	6	5	0	5	7	17	0.5	8.5
39.	1	6	2	1	1	1	5	0.2	1
40	1	7	13	0	0	2	15	0.25	3.75
41.	1	7	9	1	0	2	12	0.11	1.32
42.	1	7	1	0	0	0	1	0	0
43.	1	7	1	0	0	0	1	0.01	0.01
44.	1	7	7	5	2	4	16	0.50	9.00
45.	1	8	2	1	0	0	3	0.02	0.6
46.	1	8	8	4	3	5	20	0.54	10.80
47.	1	8	6	3	1	2	12	0.40	4.80
48.	1	8	7	2	4	3	16	.48	7.68
49.	1	8	2	1	1	1	5	0.30	1.50
50.	1	8	5	2	1	2	10	0.40	4.00
51.	1	8	4	3	2	1	10	0.38	3.8
52.	1	8	3	3	2	2	10	0.35	3.5
53.	1	8	7	5	3	3	18	0.54	9.72
54.	1	9	1	1	0	0	2	0.03	0.06

55.	1	9	3	2	1	0	6	0.05	0.30
56.	1	10	4	2	1	1	8	0.25	2.00
57.	1	10	1	0	0	0	1	0.01	0.01
58.	1	10	7	5	2	4	16	0.50	9.00
59.	1	10	2	1	0	0	3	0.02	0.6
60.	1	10	8	4	3	5	20	0.54	10.80
61.	1	10	6	3	1	2	12	0.40	4.80
62.	1	10	7	2	4	3	16	.48	7.68
63.	1	11	2	1	1	1	5	0.30	1.50
64.	1	12	5	2	1	2	10	0.40	4.00
65.	2	1	4	3	2	1	10	0.38	3.8
66.	2	2	3	3	2	2	10	0.35	3.5
67.	2	4	7	5	3	3	18	0.54	9.72
68.	2	4	1	1	0	0	2	0.03	0.06
69.	2	4	3	2	1	0	6	0.05	0.30
70.	2	4	4	2	1	1	8	0.25	2.00
71.	2	6	1	0	0	0	1	0.01	0.01
72.	2	10	7	5	2	4	16	0.50	9.00
73.	2	11	2	1	0	0	3	0.02	0.6
74.	2	11	8	4	3	5	20	0.54	10.80

75.	3	1	6	3	1	2	12	0.40	4.80
76.	3	4	7	2	4	3	16	.48	7.68
77.	4	4	2	1	1	1	5	0.30	1.50
78.	4	4	1	0	0	0	1	0.01	0.01
79.	4	6	7	5	2	4	16	0.50	9.00
80.	4	11	2	1	0	0	3	0.02	0.6
82.	4	12	8	4	3	5	20	0.54	10.80
83.	5	4	6	3	1	2	12	0.40	4.80
84.	5	4	7	2	4	3	16	.48	7.68
85	5	4	2	1	0	0	3	0.2	0.6
86	5	6	8	4	3	5	20	0.54	10.8
87	5	8	6	3	1	2	12	0.40	4.8
88	5	10	7	2	4	3	16	0.48	7.68
89.	5	4	2	1	1	1	5	0.30	1.50
90.	5	4	1	0	0	0	1	0.01	0.01
91.	5	6	7	5	2	4	16	0.50	9.00
92.	6	8	2	1	0	0	3	0.02	0.6
93.	6	10	8	4	3	5	20	0.54	10.80
94.	6	4	6	3	1	2	12	0.40	4.80
95.	6	6	7	2	4	3	16	.48	7.68

96.	6	10	7	5	2	4	16	0.50	9.00
97.	6	11	2	1	0	0	3	0.02	0.6
98	7	4	8	4	3	5	20	0.54	10.80
99	7	4	6	3	1	2	12	0.40	4.80
100	7	7	7	2	4	3	16	.48	7.68
101	7	11	2	1	1	1	5	0.30	1.50
TOTAL			**485**	**217**	**157**	**228**	**1071**	-	-
MEAN			**4.80**	**2.15**	**1.56**	**2.26**	**10.60**	**30%**	**4%**

APPENDIX VII. SCORE ON KNOWLEDGE ENTREPRENEURSHIP

Firm	location	Sub sector	OL	OC	Leadership	ICT	KE
1.	1	1	31	26	23	31	111
2.	1	1	26	31	26	24	107
3.	1	1	31	28	24	32	105
4.	1	2	30	30	26	30	116
5.	1	2	27	34	22	28	111
6	1	2	30	24	26	31	111
7.	1	2	31	28	25	22	106
8.	1	2	20	21	23	21	85
9.	1	2	33	19	17	31	100
10.	1	2	19	32	27	18	96
11.	1	2	31	19	16	32	98
12.	1	2	28	31	27	27	113
13.	1	3	31	28	24	31	114
14.	1	3	23	31	26	21	101
15.	1	3	30	21	18	31	100
16.	1	3	31	30	26	31	118
17.	1	3	30	31	28	31	120
18.	1	4	33	30	26	33	122
19.	1	4	32	33	28	23	116
20.	1	4	24	22	17	22	85
21.	1	4	25	23	18	18	84
22.	1	4	20	25	20	31	96
23.	1	4	33	19	16	18	86

24.	1	4	19	32	27	32	110
25.	1	4	31	19	16	27	93
25.	1	4	28	31	27	31	117
26.	1	4	31	28	24	21	104
27.	1	4	22	31	26	31	110
28.	1	4	32	21	18	32	103
29.	1	4	26	25	25	30	106
30.	1	4	31	31	24	28	114
31.	1	4	30	28	26	31	115
32.	1	5	27	30	22	22	101
33.	1	6	30	34	26	22	112
34.	1	6	31	31	25	31	118
35.	1	6	20	27	17	18	82
36.	1	6	33	28	27	32	120
37.	1	6	19	21	16	27	83
38.	1	6	31	19	27	31	108
39.	1	6	28	32	24	21	105
40	1	7	31	19	26	31	107
41.	1	7	22	31	17	31	101
42.	1	7	30	28	26	31	115
43.	1	7	33	31	28	33	125
44.	1	7	30	21	26	23	100
45.	1	8	33	30	28	22	113
46.	1	8	22	31	17	26	96
47.	1	8	24	30	18	18	90
48.	1	8	24	33	19	31	107

49.	1	8	33	22	15	18	88
50.	1	8	19	23	27	32	101
51.	1	8	31	26	16	27	100
52.	1	8	28	19	27	31	105
53.	1	8	31	32	24	21	108
54.	1	9	22	19	26	31	98
55.	1	9	30	31	18	31	110
56.	1	10	31	28	26	31	116
57.	1	10	30	31	28	33	122
58.	1	10	33	21	26	23	103
59.	1	10	22	30	28	22	102
60.	1	10	24	31	17	25	97
61.	1	10	25	30	18	18	91
62.	1	10	20	33	20	31	104
63.	1	11	33	22	16	18	89
64.	1	12	19	23	27	32	101
65.	2	1	31	25	16	27	99
66.	2	2	28	19	27	31	105
67.	2	4	31	32	24	21	108
68.	2	4	22	19	26	18	85
69.	2	4	20	31	18	18	87
70.	2	4	33	28	16	31	108
71.	2	6	19	31	27	18	95
72.	2	10	31	21	16	32	100
73.	3	11	28	19	27	27	101
74.	3	11	31	32	24	31	118

75.	4	1	22	19	18	21	80
76.	4	4	20	31	16	18	85
77.	4	4	33	28	27	31	119
78.	4	4	19	31	16	18	84
79.	4	6	31	21	27	32	111
80.	4	11	28	19	24	27	98
82.	4	12	31	32	26	31	120
83.	5	4	22	19	18	21	80
84.	5	4	20	31	16	18	85
85.	5	4	33	28	27	31	119
86.	5	4	19	31	16	18	84
87.	5	6	31	21	27	32	111
88.	5	8	28	19	24	27	98
89.	5	10	32	32	26	31	121
90.	5	4	22	19	18	21	80
91.	5	6	20	22	16	19	77
92.	6	8	33	28	27	30	118
93.	6	6	19	31	18	18	86
94	6	10	31	21	20	20	92
95	6	11	28	19	17	18	82
96	6	4	32	20	28	30	110
97	6	8	29	18	16	28	91
98	7	4	30	21	27	32	110
99	7	4	28	19	24	27	98
100	7	7	31	31	26	31	119
101	7	11	22	21	18	21	82

APPENDIX VIII. SCORE ON INNOVATION ECOSYSTEM

Firm	location	Sub sector	Innovation Ecosystem
1.	1	1	22
2.	1	1	19
3.	1	1	26
4.	1	2	19
5.	1	2	20
6	1	2	19
7.	1	2	19
8.	1	2	18
9.	1	2	28
10.	1	2	16
11.	1	2	28
12.	1	2	25
13.	1	3	27
14.	1	3	18
15.	1	3	26
16.	1	3	27
17.	1	3	25
18.	1	4	28
19.	1	4	17
20.	1	4	21
21.	1	4	22
22.	1	4	16
23.	1	4	28
24.	1	4	16

25.	1	4	28
25.	1	4	25
26.	1	4	27
27.	1	4	18
28.	1	4	22
29.	1	4	19
30.	1	4	26
31.	1	4	22
32.	1	5	20
33.	1	6	19
34.	1	6	19
35.	1	6	17
36.	1	6	28
37.	1	6	16
38.	1	6	28
39.	1	6	25
40	1	7	27
41.	1	7	18
42.	1	7	26
43.	1	7	26
44.	1	7	25
45.	1	8	28
46.	1	8	17
47.	1	8	21
48.	1	8	21
49.	1	8	15

50.	1	8	28
51.	1	8	16
52.	1	8	28
53.	1	8	25
54.	1	9	27
55.	1	9	18
56.	1	10	26
57.	1	10	25
58.	1	10	24
59.	1	10	28
60.	1	10	17
61.	1	10	21
62.	1	10	22
63.	1	11	16
64.	1	12	28
65.	2	1	16
66.	2	2	28
67.	2	4	25
68.	2	4	18
69.	2	4	16
70.	2	4	28
71.	2	6	16
72.	2	10	28
73.	2	11	25
74.	2	11	27
75.	3	1	16

76.	3	4	16
77.	4	4	28
78.	4	4	16
79.	4	6	28
80.	4	11	25
82.	4	12	27
83.	5	4	18
84.	5	4	16
85.	5	4	28
86.	5	4	16
87.	5	6	28
88.	5	8	25
89.	5	10	27
90.	5	4	18
91.	5	6	16
92.	6	10	27
93.	6	19	17
94	6	4	29
95	6	6	26
96	6	10	28
97	6	11	16
98	7	4	28
99	7	4	25
100	7	7	27
101	7	11	18

APPENDIX IX: CORRELATIONS BETWEEN EACH OF THE PARAMETERS OF KNOWLEDGE ENTREPRENEURSHIP AND INNOVATION PERFORMANCE

		IP	OL	OC	Leadership	ICT
Pearson Correlation	IP	1.000	.743	.799	.789	.764
	OL	.743	1.000	.940	.892	.890
	OC	.799	.940	1.000	.929	.890
	Leadership	.789	.892	.929	1.000	.865
	ICT	.764	.890	.890	.865	1.000
Sig. (1-tailed)	IP	.	.000	.000	.000	.000
	OL	.000	.	.000	.000	.000
	OC	.000	.000	.	.000	.000
	Leadership	.000	.000	.000	.	.000
	ICT	.000	.000	.000	.000	.
N	IP	295	295	295	295	295
	OL	295	295	295	295	295
	OC	295	295	295	295	295
	Leadership	295	295	295	295	295
	ICT	295	295	295	295	295

APPENDIX X. RESULTS OF STRACTURAL EQUATION MODEL SMART PARTIAL LEAST SQUARE

The Outer Model Residual

Case ID	Government policy	ICT	Innovation efficiency	Leadership	Newnes	OL	Sales growth	Technology spill over	Trade support	cusa
1	-0.546	0.081	-0.731	-0.067	0.801	-0.072	-0.302	-0.171	0.319	0.000
2	0.149	-0.093	-0.062	0.495	0.352	-0.082	-0.020	0.053	0.031	0.000
3	0.123	-1.581	-0.944	0.343	0.688	0.574	0.362	0.009	-0.044	0.000
4	-0.234	-0.766	-0.062	-0.962	0.352	1.060	-0.020	0.203	0.206	0.000
5	0.001	0.342	0.122	-1.236	-0.126	0.629	0.191	0.446	-0.133	0.000
6	0.384	-0.109	-0.062	-0.280	0.352	0.040	-0.020	0.296	-0.308	0.000
7	-1.498	0.532	-0.062	-1.023	0.352	0.517	-0.020	1.596	-0.088	0.000
8	-0.286	0.052	0.410	-0.082	0.114	0.155	-0.509	0.116	0.055	0.000
9	-0.592	0.126	0.305	0.723	-0.605	-0.422	0.402	0.398	0.457	0.000
10	0.149	-0.357	0.303	-0.522	0.057	0.608	-0.176	0.053	0.031	0.000
11	0.098	-0.328	-1.248	-0.508	0.842	0.380	-0.075	-0.035	-0.120	0.000
12	0.715	-1.507	0.411	1.147	-0.548	-0.003	0.070	0.058	-0.634	0.000
13	0.515	0.037	-0.030	-0.857	-0.380	0.277	0.262	0.363	-0.950	0.000
14	-0.139	0.680	-0.062	0.586	0.352	-0.637	-0.020	1.344	-1.028	0.000
15	-0.766	1.118	-1.066	1.040	1.026	-1.317	-0.443	0.747	0.217	0.000
16	-0.311	-0.518	-0.289	-0.721	-0.029	0.493	0.086	0.072	-0.020	0.000
17	0.838	-0.093	0.183	0.495	-0.267	-0.082	-0.403	-0.379	-0.545	0.000
18	0.532	-0.093	0.303	0.495	0.057	-0.082	-0.176	-0.097	-0.144	0.000
19	0.358	0.461	0.122	0.359	-0.126	-0.297	0.191	0.252	-0.384	0.000
20	0.358	0.271	-0.213	0.146	0.098	-0.185	0.050	0.252	-0.384	0.000
21	0.020	-0.298	1.399	-0.493	-0.827	0.153	-0.644	-0.166	-0.346	0.000
22	0.175	0.242	-0.062	0.131	0.352	0.043	-0.020	0.097	0.107	0.000
23	0.298	0.461	-0.213	0.359	0.098	-0.297	0.050	-0.340	0.196	0.000
24	0.186	-0.882	-0.184	-0.371	0.690	0.596	-0.825	-1.020	0.624	0.000
25	0.481	-0.138	0.305	-0.295	-0.605	0.268	0.402	-0.185	-0.295	0.000
26	-0.592	0.242	-0.213	0.131	0.098	0.043	0.050	0.398	0.457	0.000
27	0.037	0.416	0.303	-0.431	0.057	0.052	-0.176	-0.627	0.460	0.000
28	-0.234	0.197	-0.319	-0.659	0.042	0.392	0.382	0.203	0.206	0.000
29	0.020	-1.187	-0.074	0.008	-0.577	0.244	0.000	-0.166	-0.346	0.000
30	0.009	0.271	0.595	0.146	-1.026	-0.185	0.282	0.950	-0.864	0.000
31	-0.583	-0.283	0.487	0.282	-0.421	0.031	0.035	0.902	-0.274	0.000
32	0.063	0.126	-0.062	0.723	0.352	-0.422	-0.020	-0.583	0.535	0.000
33	-0.086	-0.093	-0.062	0.495	0.352	-0.082	-0.020	-0.190	0.371	0.000

34	-0.529	-1.974	-0.062	0.678	0.352	0.904	-0.020	-0.631	1.125	0.000
35	0.306	-0.518	-0.182	-0.721	0.028	0.493	-0.247	0.164	-0.535	0.000
36	-0.137	-0.518	1.034	-0.721	-0.532	0.493	-0.488	-0.278	0.220	0.000
37	-0.111	0.126	-0.213	0.723	0.098	-0.422	0.050	-0.234	0.295	0.000
38	0.506	0.007	0.303	-0.872	0.057	0.505	-0.176	-0.141	-0.219	0.000
39	0.629	-0.592	0.518	-1.525	-0.491	1.070	-0.262	-0.578	-0.130	0.000
40	-0.346	-0.576	-0.731	-0.749	0.801	0.947	-0.302	-0.476	0.635	0.000
41	-0.592	0.680	-0.397	0.586	0.577	-0.637	-0.161	0.398	0.457	0.000
42	-1.679	0.242	0.665	0.131	1.087	0.043	-1.490	-0.180	1.650	0.000
43	1.101	-0.283	0.302	0.282	0.720	0.031	-0.755	-1.714	0.439	0.000
44	-0.277	0.445	0.777	-0.417	-0.843	-0.175	-0.086	0.620	-0.675	0.000
45	0.629	0.825	0.849	0.009	0.608	-0.400	-1.279	-0.578	-0.130	0.000
46	-0.486	-0.443	-0.654	0.084	0.266	-0.084	0.242	0.421	-0.260	0.000
47	-0.111	-0.283	-0.062	0.282	0.352	0.031	-0.020	-0.234	0.295	0.000
48	-0.277	-0.647	0.669	0.632	-0.237	0.134	-0.332	0.620	-0.675	0.000
49	-0.434	0.081	-0.364	-0.067	-0.156	-0.072	0.121	0.509	-0.109	0.000
50	0.149	-0.138	-0.138	-0.295	0.225	0.268	0.015	0.053	0.031	0.000
51	0.384	0.606	0.485	-0.218	0.241	-0.060	-0.544	0.296	-0.308	0.000
52	0.123	-0.618	0.487	0.646	-0.421	-0.094	0.035	0.009	-0.044	0.000
53	-0.086	0.052	0.122	-0.082	-0.126	0.155	0.191	-0.190	0.371	0.000
54	-0.103	0.520	-0.546	0.387	-0.339	-0.752	0.488	0.271	-0.435	0.000
55	0.186	0.375	1.038	0.964	-1.856	-0.989	0.669	-1.020	0.624	0.000
56	-0.337	-0.254	0.154	0.297	-0.859	-0.197	0.473	0.028	-0.096	0.000
57	0.175	0.242	-0.062	0.131	0.352	0.043	-0.020	0.097	0.107	0.000
58	-0.729	0.226	0.046	-0.644	-0.253	0.165	0.226	-0.326	0.809	0.000
59	0.595	0.126	-0.062	0.723	0.352	-0.422	-0.020	-1.126	0.525	0.000
60	0.175	0.242	-0.062	0.131	0.352	0.043	-0.020	0.097	0.107	0.000
61	-0.260	1.118	-1.019	1.040	0.561	-1.317	0.398	0.160	0.131	0.000
62	-0.060	-0.312	0.303	0.268	0.057	0.258	-0.176	-0.146	0.446	0.000
63	-0.277	0.490	-0.515	0.373	-0.409	-0.525	0.191	0.620	-0.675	0.000
64	1.159	1.118	0.303	1.040	0.057	-1.317	-0.176	0.499	-1.389	0.000
65	-1.349	0.271	0.228	0.146	-0.070	-0.185	-0.141	1.203	0.076	0.000
66	0.149	0.461	0.849	0.359	0.608	-0.297	-1.279	0.053	0.031	0.000
67	-0.086	0.271	0.046	0.146	-0.253	-0.185	0.226	-0.190	0.371	0.000
68	-0.337	0.155	0.334	0.737	-0.013	-0.649	-0.473	0.028	-0.096	0.000
69	0.123	-0.138	0.228	-0.295	-0.070	0.268	-0.141	0.009	-0.044	0.000
70	0.358	0.680	0.046	0.586	-0.253	-0.637	0.226	0.252	-0.384	0.000
71	0.098	-0.138	0.228	-0.295	-0.070	0.268	-0.141	-0.035	-0.120	0.000
72	-0.223	-0.034	-1.250	0.524	1.504	-0.536	-0.654	-0.913	0.723	0.000
73	-0.966	0.052	-0.213	-0.082	0.098	0.155	0.050	1.052	-0.099	0.000
74	0.864	-1.916	-0.062	0.707	0.352	0.450	-0.020	-0.336	-0.470	0.000

75	0.481	0.126	0.228	0.723	-0.070	-0.422	-0.141	-0.185	-0.295	0.000
76	-0.766	-0.167	-0.062	-0.309	0.352	0.495	-0.020	0.747	0.217	0.000
77	-0.346	-0.138	0.046	-0.295	-0.253	0.268	0.226	-0.476	0.635	0.000
78	1.553	0.925	-0.515	-1.358	-0.409	0.186	0.191	-0.768	-1.046	0.000
79	0.717	-2.647	-0.062	-0.779	0.352	2.046	-0.020	-1.563	0.614	0.000
80	-0.398	-1.581	0.489	0.343	-1.083	0.574	0.614	-0.564	0.483	0.000
81	0.220	0.081	-0.030	-0.067	-0.380	-0.072	0.262	-0.472	-0.031	0.000
82	-1.323	0.197	0.852	-0.659	-0.716	0.392	-0.121	1.247	0.152	0.000
83	0.037	-0.547	0.671	-0.735	-0.900	0.720	0.246	-0.627	0.460	0.000
84	0.098	-0.547	-0.882	-0.735	0.547	0.720	-0.231	-0.035	-0.120	0.000
85	0.149	0.052	-0.138	-0.082	0.225	0.155	0.015	0.053	0.031	0.000
86	-0.208	0.606	0.122	-0.218	-0.126	-0.060	0.191	0.247	0.282	0.000
87	0.220	-0.109	0.672	-0.280	-1.562	0.040	0.825	-0.472	-0.031	0.000
88	0.384	0.271	-0.062	0.146	0.352	-0.185	-0.020	0.296	-0.308	0.000
89	-0.060	-0.866	-0.760	0.405	0.209	0.473	0.574	-0.146	0.446	0.000
90	0.098	-0.138	0.046	-0.295	-0.253	0.268	0.226	-0.035	-0.120	0.000
91	-0.383	-0.093	-0.138	0.495	0.225	-0.082	0.015	0.597	0.042	0.000
92	0.149	0.271	-0.138	0.146	0.225	-0.185	0.015	0.053	0.031	0.000
93	0.420	-0.064	0.303	0.510	0.057	-0.309	-0.176	-0.777	0.285	0.000
94	0.175	0.242	-0.062	0.131	0.352	0.043	-0.020	0.097	0.107	0.000
95	-0.025	-0.328	0.305	-0.508	-0.605	0.380	0.402	0.402	-0.209	0.000
96	-0.460	-0.138	0.228	-0.295	-0.070	0.268	-0.141	0.465	-0.185	0.000
97	-0.137	0.925	0.669	-1.358	-0.237	0.186	-0.332	-0.278	0.220	0.000
98	-0.060	-0.283	-0.138	0.282	0.225	0.031	0.015	-0.146	0.446	0.000
99	0.149	-0.692	-0.213	-0.158	0.098	0.483	0.050	0.053	0.031	0.000
100	0.384	0.461	0.305	0.359	-0.605	-0.297	0.402	0.296	-0.308	0.000
101	-0.163	0.709	0.226	0.600	0.593	-0.864	-0.720	-0.321	0.144	0.000
102	-0.234	0.126	-1.795	0.723	0.953	-0.422	0.448	0.203	0.206	0.000
103	0.593	-0.647	-0.944	0.632	0.688	0.134	0.362	0.495	-0.723	0.000
104	0.020	-1.072	0.367	-0.584	-0.745	0.708	-0.191	-0.166	-0.346	0.000
105	0.123	0.561	-0.395	-1.008	-0.085	0.289	0.418	0.009	-0.044	0.000
106	0.220	-0.663	-0.882	-0.144	0.547	0.256	-0.231	-0.472	-0.031	0.000
107	-0.617	-2.209	0.120	-0.325	0.536	1.366	-0.388	0.354	0.381	0.000
108	-0.260	-0.502	0.487	0.055	-0.421	0.371	0.035	0.160	0.131	0.000
109	0.175	-0.312	0.122	0.268	-0.126	0.258	0.191	0.097	0.107	0.000
110	0.123	0.226	0.150	-0.644	0.466	0.165	-0.685	0.009	-0.044	0.000
111	-1.061	0.242	0.122	0.131	-0.126	0.043	0.191	-0.088	1.136	0.000
112	-0.260	0.680	0.851	0.586	-0.054	-0.637	-0.700	0.160	0.131	0.000
113	0.209	0.461	-0.138	0.359	0.225	-0.297	0.015	0.645	-0.548	0.000
114	-0.286	1.118	1.399	1.040	-0.827	-1.317	-0.644	0.116	0.055	0.000
115	-0.815	-1.652	0.305	1.724	-0.605	-0.240	0.402	-0.962	1.313	0.000

116	0.175	0.242	-0.062	0.131	0.352	0.043	-0.020	0.097	0.107	0.000
117	-0.557	0.226	-0.319	-0.644	0.042	0.165	0.382	0.946	-0.198	0.000
118	-0.607	-0.109	0.046	-0.280	-0.253	0.040	0.226	-0.763	0.898	0.000
119	-0.815	-0.692	-0.515	-0.158	-0.409	0.483	0.191	-0.962	1.313	0.000
120	-0.208	0.242	0.122	0.131	-0.126	0.043	0.191	0.247	0.282	0.000
121	0.627	0.242	0.120	0.131	0.536	0.043	-0.388	1.043	-1.378	0.000
122	-0.086	-0.692	-0.364	-0.158	-0.156	0.483	0.121	-0.190	0.371	0.000
123	0.149	0.052	-0.062	-0.082	0.352	0.155	-0.020	0.053	0.031	0.000
124	0.209	-0.209	0.228	1.087	-0.070	-0.546	-0.141	0.645	-0.548	0.000
125	0.123	0.825	-0.136	0.009	-0.437	-0.400	0.594	0.009	-0.044	0.000
126	-0.460	-1.362	0.303	0.570	0.057	0.234	-0.176	0.465	-0.185	0.000
127	-0.200	-0.283	-0.319	0.282	0.042	0.031	0.382	0.752	-0.449	0.000
128	0.369	-0.663	-0.213	-0.144	0.098	0.256	0.050	-0.865	0.134	0.000
129	0.446	0.780	0.489	-0.781	-1.083	-0.051	0.614	-0.733	0.360	0.000
130	-0.546	0.709	0.593	0.600	-0.364	-0.864	-0.297	-0.171	0.319	0.000
131	0.072	-0.518	1.034	-0.721	-0.532	0.493	-0.488	-0.079	-0.195	0.000
132	-0.234	0.126	0.122	0.723	-0.126	-0.422	0.191	0.203	0.206	0.000
133	-0.234	0.197	-0.138	-0.659	0.225	0.392	0.015	0.203	0.206	0.000
134	-0.755	-0.547	0.003	-0.735	-1.113	0.720	0.544	-0.370	0.734	0.000
135	-1.149	1.189	-0.062	-0.341	0.352	-0.503	-0.020	0.897	0.392	0.000
136	-1.026	-1.027	-0.209	0.206	-1.226	0.359	1.208	0.460	0.481	0.000
137	0.175	0.461	-0.062	0.359	0.352	-0.297	-0.020	0.097	0.107	0.000
138	0.446	0.606	0.487	-0.218	-0.421	-0.060	0.035	-0.733	0.360	0.000
139	-0.208	0.242	-0.062	0.131	0.352	0.043	-0.020	0.247	0.282	0.000
140	-0.137	-0.109	-0.213	-0.280	0.098	0.040	0.050	-0.278	0.220	0.000
141	-0.208	-0.167	-0.062	-0.309	0.352	0.495	-0.020	0.247	0.282	0.000
142	0.011	1.189	-0.395	-0.341	-0.085	-0.503	0.418	-0.671	0.384	0.000
143	0.506	0.271	0.046	0.146	-0.253	-0.185	0.226	-0.141	-0.219	0.000
144	-0.607	0.052	-0.699	-0.082	0.069	0.155	-0.020	-0.763	0.898	0.000
145	1.605	-0.372	-0.397	-1.298	0.577	0.730	-0.161	-0.680	-0.895	0.000
146	1.370	-0.692	0.336	-0.158	-0.675	0.483	0.106	-0.923	-0.556	0.000
147	0.175	0.680	-0.062	0.586	0.352	-0.637	-0.020	0.097	0.107	0.000
148	0.272	-0.357	-0.062	-0.522	0.352	0.608	-0.020	-0.384	0.120	0.000
149	0.009	0.564	-1.172	1.177	0.969	-1.101	-0.111	0.950	-0.864	0.000
150	0.123	0.561	0.046	-1.008	-0.253	0.289	0.226	0.009	-0.044	0.000
151	0.272	-0.283	-0.578	0.282	0.393	0.031	0.206	-0.384	0.120	0.000
152	0.323	0.387	-0.062	-0.446	0.352	0.280	-0.020	-0.296	0.271	0.000
153	0.506	0.271	0.303	0.146	0.057	-0.185	-0.176	-0.141	-0.219	0.000
154	-0.383	0.461	-0.321	0.359	0.704	-0.297	-0.196	0.597	0.042	0.000
155	0.037	-1.130	-1.460	-0.612	0.729	1.163	0.589	-0.627	0.460	0.000
156	-0.111	-0.692	0.851	-0.158	-0.054	0.483	-0.700	-0.234	0.295	0.000

157	-0.383	0.126	0.669	0.723	-0.237	-0.422	-0.332	0.597	0.042	0.000
158	-0.086	-0.093	0.044	0.495	0.409	-0.082	-0.352	-0.190	0.371	0.000
159	0.420	0.226	0.122	-0.644	-0.126	0.165	0.191	-0.777	0.285	0.000
160	0.420	0.052	-1.095	-0.082	0.434	0.155	0.433	-0.777	0.285	0.000
161	0.149	-0.167	-0.062	-0.309	0.352	0.495	-0.020	0.053	0.031	0.000
162	-0.408	-0.837	-0.213	0.419	0.098	0.246	0.050	0.553	-0.034	0.000
163	0.158	0.780	-0.213	-0.781	0.098	-0.051	0.050	0.557	-0.699	0.000
164	0.246	-0.138	0.042	-0.295	1.071	0.268	-0.931	-0.428	0.045	0.000
165	0.690	-0.138	-0.030	-0.295	-0.380	0.268	0.262	0.014	-0.710	0.000
166	0.593	-0.167	0.122	-0.309	-0.126	0.495	0.191	0.495	-0.723	0.000
167	0.209	0.825	-0.062	0.009	0.352	-0.400	-0.020	0.645	-0.548	0.000
168	0.123	0.561	0.122	-1.008	-0.126	0.289	0.191	0.009	-0.044	0.000
169	0.123	0.052	0.413	-0.082	-1.210	0.155	0.649	0.009	-0.044	0.000
170	-0.200	-0.093	-0.213	0.495	0.098	-0.082	0.050	0.752	-0.449	0.000
171	1.428	0.461	1.040	0.359	-2.519	-0.297	1.248	1.290	-2.383	0.000
172	0.098	-0.837	-0.730	0.419	0.139	0.246	0.277	-0.035	-0.120	0.000
173	0.063	-0.283	0.669	0.282	-0.237	0.031	-0.332	-0.583	0.535	0.000
174	0.246	0.300	0.851	0.160	-0.054	-0.412	-0.700	-0.428	0.045	0.000
175	0.244	0.899	0.489	0.813	-1.083	-0.977	0.614	1.193	-1.203	0.000
176	-0.469	-0.212	0.122	-1.099	-0.126	0.844	0.191	-0.039	0.546	0.000
177	-0.434	0.925	-0.138	-1.358	0.225	0.186	0.015	0.509	-0.109	0.000
178	0.001	-0.547	-0.343	-0.735	0.895	0.720	-0.396	0.446	-0.133	
179	-0.398	-0.109	-0.548	-0.280	0.323	0.040	-0.091	-0.564	0.483	0.000
180	-0.086	-0.618	0.485	0.646	0.241	-0.094	-0.544	-0.190	0.371	0.000
181	-0.617	0.564	0.122	1.177	-0.126	-1.101	0.191	0.354	0.381	0.000
182	0.655	-0.544	0.851	1.451	-0.054	-0.670	-0.700	-0.534	-0.055	0.000
183	0.072	0.081	0.593	-0.067	-0.364	-0.072	-0.297	-0.079	-0.195	0.000
184	0.481	0.226	0.303	-0.644	0.057	0.165	-0.176	-0.185	-0.295	0.000
185	0.569	0.925	0.780	-1.358	-2.167	0.186	1.072	-1.170	0.449	0.000
186	0.455	0.475	0.077	-0.403	-0.323	-0.402	-0.070	-0.229	-0.370	0.000
187	0.184	0.271	0.487	0.146	-0.421	-0.185	0.035	0.601	-0.624	0.000
188	0.890	0.461	-0.136	0.359	-0.437	-0.297	0.594	-0.292	-0.394	0.000
189	1.073	0.152	0.046	-1.449	-0.253	0.742	0.226	-0.137	-0.885	0.000
190	0.655	-0.547	-0.213	-0.735	0.098	0.720	0.050	-0.534	-0.055	0.000
191	-0.964	0.635	-1.095	-0.204	0.434	-0.288	0.433	-0.569	1.149	0.000
192	0.123	-0.283	0.228	0.282	-0.070	0.031	-0.141	0.009	-0.044	0.000
193	0.123	0.185	0.046	0.751	-0.253	-0.876	0.226	0.009	-0.044	0.000
194	-0.408	1.702	-0.062	0.918	0.352	-1.759	-0.020	0.553	-0.034	0.000
195	-0.086	0.052	-0.213	-0.082	0.098	0.155	0.050	-0.190	0.371	0.000
196	0.186	0.490	0.303	0.373	0.057	-0.525	-0.176	-1.020	0.624	0.000
197	-0.697	0.256	1.947	-0.630	-0.938	-0.063	-1.168	1.843	-1.093	0.000

198	0.149	-0.502	0.669	0.055	-0.237	0.371	-0.332	0.053	0.031	0.000
199	0.446	0.635	-0.160	-0.204	0.417	-0.288	-0.184	-0.733	0.360	0.000
200	0.358	0.052	-0.395	-0.082	-0.085	0.155	0.418	0.252	-0.384	0.000
201	-0.025	-0.283	-0.062	0.282	0.352	0.031	-0.020	0.402	-0.209	0.000
202	-0.286	-1.581	0.079	0.343	-0.986	0.574	0.508	0.116	0.055	0.000
203	0.829	-0.647	-0.062	0.632	0.352	0.134	-0.020	-0.884	0.185	0.000
204	-0.434	0.490	0.281	0.373	-0.543	-0.525	0.375	0.509	-0.109	0.000
205	0.175	0.010	-0.062	1.314	0.352	-0.886	-0.020	0.097	0.107	0.000
206	0.175	-0.093	0.122	0.495	-0.126	-0.082	0.191	0.097	0.107	0.000
207	-0.372	-0.064	-0.807	0.510	0.674	-0.309	-0.267	-0.520	0.559	0.000
208	0.149	-1.610	-0.321	0.329	0.704	0.801	-0.196	0.053	0.031	0.000
209	0.384	0.387	-0.062	-0.446	0.352	0.280	-0.020	0.296	-0.308	0.000
210	-0.434	0.052	-0.138	-0.082	0.225	0.155	0.015	0.509	-0.109	0.000
211	-0.077	0.490	-0.699	0.373	0.069	-0.525	-0.020	0.314	-0.360	0.000
212	-1.026	0.899	0.228	0.813	-0.070	-0.977	-0.141	0.460	0.481	0.000
213	0.926	-0.737	-1.826	-0.948	1.024	0.833	0.745	-1.365	0.199	0.000
214	-0.486	-0.518	-0.289	-0.721	-0.029	0.493	0.086	0.421	-0.260	0.000
215	0.593	0.970	0.046	-0.568	-0.253	-0.163	0.226	0.495	-0.723	0.000
216	0.358	0.780	0.489	-0.781	-1.083	-0.051	0.614	0.252	-0.384	0.000
217	-0.617	-0.837	0.669	0.419	-0.237	0.246	-0.332	0.354	0.381	0.000
218	0.175	0.387	0.281	-0.446	-0.543	0.280	0.375	0.097	0.107	0.000
219	-0.049	0.899	-0.476	0.813	1.774	-0.977	-1.284	-1.263	0.964	0.000
220	0.046	0.111	0.624	-0.053	-0.435	-0.299	-0.594	-0.123	-0.271	0.000
221	-1.052	0.899	0.149	0.813	1.128	-0.977	-1.264	0.416	0.405	0.000
222	0.072	0.155	-0.730	0.737	0.139	-0.649	0.277	-0.079	-0.195	0.000
223	0.175	-0.167	-0.062	-0.309	0.352	0.495	-0.020	0.097	0.107	0.000
224	-0.286	-0.109	0.336	-0.280	-0.675	0.040	0.106	0.116	0.055	0.000
225	0.926	0.416	0.302	-0.431	0.720	0.052	-0.755	-1.365	0.199	0.000
226	0.629	0.300	-0.731	0.160	0.801	-0.412	-0.302	-0.578	-0.130	0.000
227	0.175	0.242	0.305	0.131	-0.605	0.043	0.402	0.097	0.107	0.000
228	-0.643	-0.618	0.046	0.646	-0.253	-0.094	0.226	0.310	0.306	0.000
229	0.175	0.461	-0.062	0.359	0.352	-0.297	-0.020	0.097	0.107	0.000
230	1.553	0.242	-0.062	0.131	0.352	0.043	-0.020	-0.768	-1.046	0.000
231	-0.346	0.461	0.485	0.359	0.241	-0.297	-0.544	-0.476	0.635	0.000
232	0.306	-0.473	0.122	0.069	-0.126	0.143	0.191	0.164	-0.535	0.000
233	-0.077	-0.852	-0.062	-0.357	0.352	0.368	-0.020	0.314	-0.360	0.000
234	0.046	-0.298	0.077	-0.493	-0.323	0.153	-0.070	-0.123	-0.271	0.000
235	0.123	0.271	-0.838	0.146	0.745	-0.185	0.030	0.009	-0.044	0.000
236	-0.086	-1.201	-0.138	0.769	0.225	0.349	0.015	-0.190	0.371	0.000
237	-0.208	0.052	0.122	-0.082	-0.126	0.155	0.191	0.247	0.282	0.000
238	-0.641	0.461	0.699	0.359	-0.308	-0.297	-0.629	-1.311	1.553	0.000

239	-0.546	0.680	-0.062	0.586	0.352	-0.637	-0.020	-0.171	0.319	0.000
240	-0.014	-0.778	1.218	0.448	-1.011	-0.208	-0.277	-0.715	0.309	0.000
241	0.089	0.825	-0.062	0.009	0.352	-0.400	-0.020	-0.539	0.611	0.000
242	0.743	0.345	0.046	0.950	-0.253	-0.761	0.226	-1.520	0.689	0.000
243	-0.111	0.591	-1.172	-0.994	0.969	0.062	-0.111	-0.234	0.295	0.000
244	0.384	0.680	0.487	0.586	-0.421	-0.637	0.035	0.296	-0.308	0.000
245	0.046	-0.707	1.324	-0.934	-0.954	0.605	-0.609	-0.123	-0.271	0.000
246	1.310	0.461	0.046	0.359	-0.253	-0.297	0.226	-1.515	0.024	0.000
247	-0.139	0.490	-0.321	0.373	0.704	-0.525	-0.196	1.344	-1.028	0.000
248	0.446	-0.840	-0.062	-1.766	0.352	1.637	-0.020	-0.733	0.360	0.000
249	-1.410	-0.328	-0.138	-0.508	0.225	0.380	0.015	0.611	0.655	0.000
250	0.593	0.780	-1.201	-0.781	0.377	-0.051	0.765	0.495	-0.723	0.000
251	0.272	0.081	-0.213	-0.067	0.098	-0.072	0.050	-0.384	0.120	0.000
252	0.035	0.677	0.046	-1.600	-0.253	0.753	0.226	0.994	-0.788	0.000
253	0.123	-0.183	0.303	-1.085	0.057	0.617	-0.176	0.009	-0.044	0.000
254	-0.137	-0.328	-0.654	-0.508	0.266	0.380	0.242	-0.278	0.220	0.000
255	0.298	1.118	-1.066	1.040	1.026	-1.317	-0.443	-0.340	0.196	0.000
256	0.175	0.899	0.122	0.813	-0.126	-0.977	0.191	0.097	0.107	0.000
257	0.149	0.126	0.305	0.723	-0.605	-0.422	0.402	0.053	0.031	0.000
258	-0.408	-0.064	-1.019	0.510	0.561	-0.309	0.398	0.553	-0.034	0.000
259	-0.408	-0.283	0.410	0.282	0.114	0.031	-0.509	0.553	-0.034	0.000
260	-0.607	0.445	0.669	-0.417	-0.237	-0.175	-0.332	-0.763	0.898	0.000
261	0.175	0.242	-0.062	0.131	0.352	0.043	-0.020	0.097	0.107	0.000
262	0.098	0.126	-0.062	0.723	0.352	-0.422	-0.020	-0.035	-0.120	0.000
263	0.220	0.490	0.152	0.373	-0.196	-0.525	-0.106	-0.472	-0.031	0.000
264	0.567	0.490	-0.138	0.373	0.225	-0.525	0.015	0.451	-0.799	0.000
265	-0.234	0.197	-0.062	-0.659	0.352	0.392	-0.020	0.203	0.206	0.000
266	-0.408	0.680	-0.138	0.586	0.225	-0.637	0.015	0.553	-0.034	0.000
267	0.123	0.487	-1.095	-1.813	0.434	0.866	0.433	0.009	-0.044	0.000
268	0.020	-0.737	-0.395	-0.948	-0.085	0.833	0.418	-0.166	-0.346	0.000
269	-0.086	0.825	0.122	0.009	-0.126	-0.400	0.191	-0.190	0.371	0.000
270	-0.137	-0.328	0.122	-0.508	-0.126	0.380	0.191	-0.278	0.220	0.000
271	0.455	-0.138	-0.289	-0.295	-0.029	0.268	0.086	-0.229	-0.370	0.000
272	0.123	0.461	-0.364	0.359	-0.156	-0.297	0.121	0.009	-0.044	0.000
273	-0.669	-0.183	0.046	-1.085	-0.253	0.617	0.226	0.266	0.230	0.000
274	0.037	-1.101	0.851	-0.598	-0.054	0.935	-0.700	-0.627	0.460	0.000
275	0.332	-0.283	0.228	0.282	-0.070	0.031	-0.141	0.208	-0.459	0.000
276	-0.398	0.783	-1.066	1.405	1.026	-1.441	-0.443	-0.564	0.483	0.000
277	-0.609	-0.064	-0.472	0.510	0.450	-0.309	-0.126	0.858	-0.349	0.000
278	0.681	-0.183	0.122	-1.085	-0.126	0.617	0.191	-0.491	0.021	0.000
279	-0.400	-0.283	-0.594	0.282	-1.052	0.031	1.169	1.057	-0.764	0.000

280	0.281	-0.079	-1.826	-0.266	1.024	-0.187	0.745	0.120	-0.610	0.000
281	0.306	-0.328	-0.289	-0.508	-0.029	0.380	0.086	0.164	-0.535	0.000
282	0.009	-0.982	0.386	0.996	0.176	0.009	-0.536	0.950	-0.864	0.000
283	-0.546	0.564	0.489	1.177	-1.083	-1.101	0.614	-0.171	0.319	0.000
284	-0.014	-0.663	-0.030	-0.144	-0.380	0.256	0.262	-0.715	0.309	0.000
285	0.532	0.490	0.122	0.373	-0.126	-0.525	0.191	-0.097	-0.144	0.000
286	-0.904	0.081	0.156	-0.067	-1.521	-0.072	1.052	0.023	0.569	0.000
287	-0.016	-0.283	-0.213	0.282	0.098	0.031	0.050	0.906	-0.939	0.000
288	0.098	-0.328	-0.213	-0.508	0.098	0.380	0.050	-0.035	-0.120	0.000
289	0.506	-0.138	-0.213	-0.295	0.098	0.268	0.050	-0.141	-0.219	0.000
290	-0.025	-0.692	-0.138	-0.158	0.225	0.483	0.015	0.402	-0.209	0.000
291	0.020	0.520	-0.881	0.387	-0.115	-0.752	0.347	-0.166	-0.346	0.000
292	0.384	0.052	-0.062	-0.082	0.352	0.155	-0.020	0.296	-0.308	0.000
293	0.123	0.242	-0.062	0.131	0.352	0.043	-0.020	0.009	-0.044	0.000
294	0.098	0.081	-0.838	-0.067	0.745	-0.072	0.030	-0.035	-0.120	0.000
295	-0.163	-0.183	0.152	-1.085	-0.196	0.617	-0.106	-0.321	0.144	0.000
296	-0.434	0.081	-0.107	-0.067	0.155	-0.072	-0.282	0.509	-0.109	0.000
297	0.020	-0.633	-0.882	-0.129	0.547	0.028	-0.231	-0.166	-0.346	0.000
298	0.281	1.118	1.216	1.040	-0.349	-1.317	-0.856	0.120	-0.610	0.000
299	-0.695	-0.518	0.046	-0.721	-0.253	0.493	0.226	0.222	0.154	0.000
300	0.098	-0.692	-0.263	-0.158	0.048	0.483	0.152	-0.035	-0.120	0.000
301	-0.617	0.052	-0.397	-0.082	0.577	0.155	-0.161	0.354	0.381	0.000
302	-0.025	0.680	0.046	0.586	-0.253	-0.637	0.226	0.402	-0.209	0.000
303	-0.260	0.345	0.046	0.950	-0.253	-0.761	0.226	0.160	0.131	0.000
304	-0.643	0.490	-0.101	0.373	-1.831	-0.525	1.455	0.310	0.306	0.000
305	0.360	0.635	0.122	-0.204	-0.126	-0.288	0.191	-1.369	0.864	0.000
306	-0.260	-0.283	0.228	0.282	-0.070	0.031	-0.141	0.160	0.131	0.000
307	0.175	0.242	-0.062	0.131	0.352	0.043	-0.020	0.097	0.107	0.000
308	0.158	0.929	-0.213	0.827	0.098	-1.204	0.050	0.557	-0.699	0.000
309	-0.189	0.037	1.689	-0.857	-1.249	0.277	-0.765	-0.365	0.068	0.000
310	0.149	0.751	-0.062	-0.795	0.352	0.177	-0.020	0.053	0.031	0.000
311	0.490	-0.562	-0.546	-1.511	-0.339	0.842	0.488	0.319	-1.025	0.000
312	-0.583	-0.254	1.398	0.297	-0.165	-0.197	-1.223	0.902	-0.274	0.000
313	0.804	0.271	0.122	0.146	-0.126	-0.185	0.191	-0.928	0.110	0.000
314	0.123	-0.882	-0.138	-0.371	0.225	0.596	0.015	0.009	-0.044	0.000
315	0.098	-0.618	0.122	0.646	-0.126	-0.094	0.191	-0.035	-0.120	0.000
316	-0.755	0.445	0.775	-0.417	-0.181	-0.175	-0.665	-0.370	0.734	0.000
317	-1.201	-0.882	-0.138	-0.371	0.225	0.596	0.015	0.810	0.240	0.000
318	-0.111	0.487	0.332	-1.813	0.649	0.866	-1.052	-0.234	0.295	0.000
319	0.072	-1.172	0.228	0.783	-0.070	0.122	-0.141	-0.079	-0.195	0.000
320	0.175	0.345	0.672	0.950	-1.562	-0.761	0.825	0.097	0.107	0.000

321	-0.286	0.490	0.152	0.373	-0.196	-0.525	-0.106	0.116	0.055	0.000
322	1.073	0.461	0.671	0.359	-0.900	-0.297	0.246	-0.137	-0.885	0.000
323	0.429	-0.882	-1.901	-0.371	0.897	0.596	0.780	-0.273	-0.446	0.000
324	0.472	0.081	-0.062	-0.067	0.352	-0.072	-0.020	-0.689	0.436	0.000
325	-0.592	-0.093	0.122	0.495	-0.126	-0.082	0.191	0.398	0.457	0.000
326	0.149	0.242	-0.062	0.131	0.352	0.043	-0.020	0.053	0.031	0.000
327	0.123	0.271	0.046	0.146	-0.253	-0.185	0.226	0.009	-0.044	0.000
328	-0.223	-0.618	-0.944	0.646	0.688	-0.094	0.362	-0.913	0.723	0.000
329	-0.286	0.081	0.336	-0.067	-0.675	-0.072	0.106	0.116	0.055	0.000
330	0.332	0.052	0.046	-0.082	-0.253	0.155	0.226	0.208	-0.459	0.000
331	0.306	0.271	0.152	0.146	-0.196	-0.185	-0.106	0.164	-0.535	0.000
332	-1.498	0.037	-0.062	-0.857	0.352	0.277	-0.020	1.596	-0.088	0.000
333	0.123	0.680	-0.213	0.586	0.098	-0.637	0.050	0.009	-0.044	0.000
334	-0.277	-1.726	-0.548	0.920	0.323	0.337	-0.091	0.620	-0.675	0.000
335	-0.128	-0.079	-0.623	-0.266	0.196	-0.187	-0.055	0.227	-0.511	0.000
336	-1.410	-0.064	1.067	0.510	-1.265	-0.309	-0.206	0.611	0.655	0.000
337	-0.111	-0.138	-0.138	-0.295	0.225	0.268	0.015	-0.234	0.295	0.000
338	0.046	-0.997	0.805	0.220	-0.601	0.131	-0.386	-0.123	-0.271	0.000
339	-0.189	0.899	-1.280	0.813	1.575	-0.977	-0.357	-0.365	0.068	0.000
340	-0.225	-0.109	-0.213	-0.280	0.098	0.040	0.050	0.708	-0.524	0.000
341	0.001	0.242	-0.062	0.131	0.352	0.043	-0.020	0.446	-0.133	0.000
342	-0.398	-1.249	1.216	-2.207	-0.349	2.089	-0.856	-0.564	0.483	0.000
343	0.098	0.490	-0.213	0.373	0.098	-0.525	0.050	-0.035	-0.120	0.000
344	0.681	0.197	-0.062	-0.659	0.352	0.392	-0.020	-0.491	0.021	0.000

Inner Model Residual Scores

Case ID	IE	IP	KE	KEIE
1		-0.192		0.470
2		0.081		0.713
3		0.180		0.369
4		0.482		0.057
5		0.076		-0.184
6		0.037		-0.171
7		0.822		1.417
8		0.709		-1.029
9		-0.162		-0.246
10		-0.061		-0.085
11		-1.000		-1.860
12		0.053		-1.294
13		0.407		-0.678
14		1.462		-0.448
15		-2.571		-0.813
16		0.094		-0.490
17		-1.361		-1.019
18		-0.090		-0.246
19		0.005		0.837
20		-0.836		0.048
21		-0.020		1.832
22		-0.207		0.321
23		-0.784		-0.057
24		-1.189		-0.930
25		0.496		0.530
26		-1.407		0.534
27		1.016		-0.275
28		-0.331		0.857
29		-0.068		-2.372
30		-0.174		-0.312
31		0.719		-0.330
32		0.353		1.047
33		0.292		0.919
34		0.326		1.008
35		-0.752		-1.655
36		-0.770		1.823
37		-0.812		1.294
38		0.541		-0.651
39		-1.053		-0.105

40		-0.250		-1.062
41		-0.395		-1.116
42		-0.217		1.258
43		0.583		0.564
44		-0.084		1.551
45		-0.049		0.577
46		-0.031		1.473
47		0.553		1.330
48		0.652		2.263
49		-0.500		-1.889
50		-0.324		-0.057
51		-0.862		0.509
52		-0.032		0.316
53		0.445		0.085
54		0.260		-1.246
55		-0.409		0.761
56		0.323		0.656
57		-0.207		0.321
58		0.248		0.855
59		0.346		1.041
60		-0.207		0.321
61		1.419		-3.032
62		-0.508		0.544
63		-0.586		-1.945
64		0.242		0.243
65		0.498		-0.134
66		-0.258		-1.010
67		-0.730		0.966
68		0.561		-0.233
69		-0.031		-0.564
70		-0.320		0.012
71		0.324		-0.217
72		-1.804		1.250
73		0.209		-0.269
74		1.118		-0.305
75		0.295		-0.378
76		0.211		0.816
77		0.633		-0.152
78		-1.750		-0.407
79		1.529		-0.134
80		1.020		1.474

81		0.273		0.257
82		-0.291		0.363
83		0.023		0.631
84		-2.296		-0.182
85		-0.230		-0.121
86		0.013		-0.379
87		0.862		0.321
88		-0.199		0.554
89		-0.734		0.562
90		0.141		0.636
91		-0.196		-0.134
92		-0.272		-0.093
93		0.018		1.352
94		-0.207		0.321
95		-0.372		1.107
96		0.685		0.135
97		1.109		-0.816
98		-0.441		-0.216
99		-1.483		0.813
100		-0.169		-0.363
101		0.861		0.356
102		-1.122		-1.712
103		-0.029		-0.189
104		-1.013		0.114
105		-0.013		-0.562
106		-0.247		-3.074
107		-0.193		1.095
108		-0.240		1.202
109		-0.477		0.338
110		-0.807		-0.517
111		1.038		-0.761
112		-0.263		0.324
113		-0.136		-0.116
114		0.552		-1.833
115		0.566		2.037
116		-0.207		0.321
117		0.533		-0.610
118		1.488		-0.360
119		-1.843		-0.576
120		-0.343		0.428
121		0.235		0.989

122		-1.414		-1.540
123		0.054		0.732
124		-0.331		-0.879
125		0.106		0.237
126		0.810		1.097
127		0.451		0.417
128		0.076		1.292
129		-0.615		1.026
130		1.331		-1.244
131		0.224		0.257
132		-0.096		0.848
133		0.276		-0.850
134		-0.901		-0.516
135		0.192		1.009
136		-0.023		-0.183
137		-0.249		0.350
138		-0.024		0.061
139		-0.098		0.428
140		0.602		-0.772
141		0.699		-1.243
142		0.666		0.083
143		-0.270		0.147
144		-0.910		-1.370
145		0.050		-0.149
146		-0.524		-0.073
147		0.135		-0.475
148		0.458		1.214
149		0.164		-2.834
150		-0.217		0.291
151		-0.061		0.370
152		-0.132		0.440
153		0.621		-0.706
154		-0.351		0.703
155		0.163		-0.298
156		-0.291		0.512
157		-0.503		-0.105
158		-0.234		0.066
159		0.630		0.536
160		-0.822		0.425
161		0.520		-0.150
162		-0.244		-0.559

163		-0.326		0.706
164		0.248		0.736
165		-0.108		-0.183
166		0.633		-1.068
167		0.079		0.784
168		0.492		0.291
169		-0.609		0.225
170		0.019		-0.500
171		-0.854		1.192
172		-0.401		-1.072
173		0.176		-0.623
174		-0.103		0.792
175		1.002		-1.379
176		0.474		0.246
177		0.745		-0.162
178		-0.249		-0.599
179		-0.004		-0.220
180		-0.173		0.176
181		0.779		-0.696
182		-0.112		-0.534
183		0.150		0.157
184		0.854		-0.276
185		-0.958		0.638
186		-0.244		-1.516
187		0.102		0.294
188		-0.467		0.830
189		0.437		-0.252
190		-0.312		-0.534
191		0.455		-0.681
192		-0.004		-0.583
193		-0.406		0.420
194		1.082		-0.497
195		-0.302		-0.768
196		1.104		-0.166
197		0.110		-2.444
198		-0.946		0.749
199		0.036		-0.699
200		-0.552		0.019
201		0.665		0.171
202		-0.679		-0.885
203		0.152		0.824

204		0.654		0.635
205		-0.424		0.469
206		-0.093		-0.487
207		-0.276		-1.502
208		0.365		-0.923
209		-0.091		0.481
210		0.486		0.578
211		-2.224		0.022
212		0.359		-0.289
213		0.259		0.929
214		-0.079		0.610
215		-0.161		-1.010
216		-0.250		0.113
217		-0.370		0.154
218		-0.268		-0.513
219		-0.022		0.005
220		-0.441		-1.110
221		0.435		-0.795
222		0.321		-1.539
223		0.165		-0.496
224		-0.232		-0.872
225		1.258		-0.041
226		-0.916		-0.167
227		-0.697		0.321
228		0.389		-0.325
229		-0.249		0.350
230		2.338		0.269
231		0.579		0.602
232		0.927		0.822
233		0.667		1.909
234		-0.189		-0.221
235		-0.177		-0.600
236		0.384		-0.753
237		-0.012		-0.362
238		-0.306		-0.939
239		1.875		1.223
240		1.062		-1.088
241		0.421		-0.151
242		-0.121		0.316
243		-0.905		-1.117
244		-0.453		-0.335

245		-0.711		0.668
246		0.802		-0.230
247		0.478		0.469
248		0.592		0.140
249		-0.053		1.632
250		-0.211		-0.946
251		-0.192		-0.436
252		0.256		-0.695
253		0.555		-0.481
254		-0.003		0.053
255		-3.009		0.028
256		-0.152		-0.447
257		-0.450		0.742
258		0.005		-0.548
259		0.185		-1.429
260		1.067		0.476
261		-0.207		0.321
262		1.175		0.581
263		0.508		-0.632
264		0.399		-0.637
265		0.560		0.004
266		0.142		0.224
267		-0.684		-0.572
268		0.837		1.775
269		0.853		-0.757
270		1.391		0.053
271		0.065		-0.830
272		-1.523		-0.664
273		0.237		0.931
274		0.183		-0.205
275		-0.285		0.411
276		-0.416		-1.135
277		0.308		-0.808
278		0.011		0.019
279		-1.003		1.011
280		0.435		1.308
281		-0.132		-0.866
282		0.082		-0.297
283		1.032		1.297
284		0.365		0.545
285		0.042		-0.171

286		-0.003		0.229
287		0.424		0.051
288		0.008		-0.153
289		-0.362		-0.670
290		0.328		-0.647
291		-0.880		0.054
292		-0.157		0.526
293		0.928		0.161
294		0.509		-1.042
295		0.059		0.418
296		-0.884		-0.183
297		-0.625		-0.682
298		-0.089		1.108
299		0.525		1.323
300		0.144		-0.200
301		-0.476		0.091
302		0.214		-0.735
303		-0.067		0.369
304		-1.833		1.348
305		0.641		0.460
306		-0.320		0.377
307		-0.207		0.321
308		-0.354		0.726
309		-0.868		0.793
310		0.476		-0.120
311		-0.741		0.621
312		-0.631		-0.237
313		0.643		0.347
314		-0.089		0.371
315		0.385		1.516
316		0.014		0.376
317		0.490		0.936
318		-0.332		-1.219
319		1.039		-0.680
320		-0.911		-0.430
321		-0.690		0.735
322		1.041		-1.242
323		-0.019		1.304
324		0.617		-1.029
325		0.124		-0.274
326		0.148		0.668

327		-0.161		0.254
328		1.137		1.174
329		-0.563		-0.083
330		0.449		-0.488
331		0.236		-0.966
332		0.525		1.619
333		-0.573		0.218
334		0.126		-0.170
335		-0.238		-0.799
336		-1.538		-0.129
337		0.242		0.495
338		0.179		-0.223
339		1.316		-0.215
340		0.116		0.022
341		0.046		0.568
342		0.118		1.428
343		0.113		-0.225
344		0.020		0.744

APPENDIX XI: LIST OF PUBLICATION FROM THE THESIS

1. **Gachanja, I. M,** Irura, S. N & Maina, L. K. (2020).The influence of leadership on innovation efficiency in manufacturing firms in Kenya. International Journal of Management, Knowledge and learning 9(1) 43-57. Available in print and electronic format; https://doi.org/toc/2232-5697
2. **Gachanja, I. M,** Irura, S. N & Maina, L. K. (2020).The influence of organization learning on innovation output in manufacturing firms in Kenya. International Journal of Innovation Studies 4 16-26. Available in print and electronic format; https://doi.org/10.1016/j.ijis.2020.02.001