IMPACT OF INFORMATION TECHNOLOGY ON OUTPUT GROWTH OF MANUFACTURING FIRMS IN KENYA

MERCY JEBET SIGILAI

X51/5987/2017

A RESEARCH PAPER SUBMITTED TO THE SCHOOL OF ECONOMICS IN FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTERS OF ARTS IN ECONOMIC POLICY MANAGEMENT OF THE UNIVERSITY OF NAIROBI.

OCTOBER 2020

DECLARATION

This paper is my original work and has not been submitted for an award of a degree in any other institution of higher learning.

Signature:  Date: ____10/10/2020_____

MERCY JEBET SIGILAI

This research paper has been submitted for examination with my approval as the university supervisor.

Signature:  Date: 10.10.2020

DR. JOHN KAMAU GATHIAKA

DEDICATION

I dedicate this research paper to my parents Mr and Mrs. Sigilai for the overwhelming support, financially and mentally. I am forever indebted to you for your support throughout my life and ensuring that I have what I need. This is what you have always wanted for us your children; to make big goals, to be happy and healthy. To my siblings George, Joram and Lindah, this is for you for standing with me throughout my graduate schooling and always encouraging.

ACKNOWLEDGEMENTS

I take this opportunity to thank the Almighty God for giving me the energy, endurance and good health throughout the program.

To my able supervisor Dr. John Kamau Gathiaka who contributed immensely in the development of this study. I can never thank you enough for the times I knocked at your office, and messages for consultation. Through you I have learnt to be patient in life in order to get the best.

Special thanks to the School of Economics and its staff, the library and the computer lab staff that I interacted with during this program. You were very supportive.

Lastly to my classmates, Boaz, Ndegwa, Karen, Joseph, Birir, Silvia and Grace, thank you for the friendship, encouragement and support during the entire program.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

BPO Business Process Outsourcing

DEA Development Envelopment Analysis

GDP Gross Domestic Product

ICT Information Communication Technology

IT Information Technology

KIRDI Kenya Industrial Research and Development Institute

MTP Medium Term Plan

R&D Research and Development

SMEs Small and Medium-sized Enterprises

VIF Variance Inflation Factor

ABSTRACT

Manufacturing firms strive to improve their output growth by using modern technology. It is evidenced that investments in modern technology have a positive link with firm performance and output growth. Since investments are subject to diminishing returns, there is need for monitoring and replacing them when necessary, or upgrading them. The connection between IT investment and output growth in the manufacturing sector remains unclear. This study aimed to investigate whether technological investments affect output growth of manufacturing firms in Kenya. The specific objectives included: to assess the type of information technologies adopted by manufacturing firms in Kenya; to evaluate the marginal impact of a shilling's information technology investment on manufacturing industry's output growth; and to evaluate the impact of information technology training on output growth of production firms in Kenya. The research was guided by the following theories: innovation theory of profit; risk and uncertainty bearing theory of profit; and diffusion of innovation theory. Using data from the Kenya National Bureau of Statistics and World Bank for the period from 2011 to 2018, the study estimated how IT investments impact industry output growth in Kenya using ordinary least squares method. The study findings revealed that manufacturing firms in Kenya have adopted several information technologies including computer-aided designs, computer-aided engineering, computer-aided manufacturing, resource planning for manufacturing, and computer-integrated development. Information technology investment had a positive and significant effect on industry output growth. Manufacturing firms should consider increasing their budgetary allocation towards acquisition of modern information technologies to further boost their output growth. The government should lower the cost of information technology access to make manufacturing firms use more of it for increased output growth.

CHAPTER ONE: INTRODUCTION

1.1 Background

According to Kenya's development plan Vision 2030 six priority sectors are identified as a high potential area to stimulate economic growth and development in the country. Of these, the manufacturing sector is considered to be one of the key sectors that will force the achievement of 10 percent annual GDP growth and propel Kenya to take off towards sustainable growth (GoK, 2012). According to the first phase of the Medium Term Plan (2008-2012), an annual average growth of 3.2 per cent was reported in the manufacturing sector. That contributed 9.8 per cent of GDP growth on average. However, development was hampered by insufficient and costly infrastructure, low technology adoption, high business costs and rising gas prices (Cirera, 2015).

The manufacturing sector comprises of textile industries, petroleum and chemicals, non-metallic minerals, beverages and tobacco, food processing, refinery, paper, metal based products, cement and glass industries (Coughlin & Ikiara, 1988). The Kenya Vision 2030 note this sector contributes over 10 per cent to GDP. According to the government's Medium Term Plan (2013-2017) of the 2030 vision, medium- and large-scale industries contributed over 60 per cent of GDP in the manufacturing sector, small and micro-enterprises accounted for about 95 per cent of all firms, and only 20 per cent of GDP in manufacturing.

Information and Communication Technology (hereafter ICT) smoothens service provision by firms (Cusolito & Cirera, 2016) and Kenya manufacturing sector must exploit ICT to boost its output growth. Over the years, the government has promoted ICT based industries (Fagerberg et al., 2010) such as Airtel, Safaricom and Horizon as well as computer hardware and software manufacturers and information and broadcasting firms. According to Sheng and Mykytyn (2002), even though firms invest in information technology, evidence of whether the investments result to improved output growth is mixed. The efficacy and reliability of the implemented information system need to be checked, as well as the consistency of data flowing in the information system of the businesses.

IT is a tool with ability to fuel economic growth. Given that IT investments constitute an ever-increasing share of capital investments, it is vital to understand whether they are paying off (Gilchrist et al. 2007). IT investments once coupled with complementary investments,

human resources and restructuring contribute to the overall performance of a company (Sobhani, 2008).

The training seeks to enhance employees' performance, cognitive, and psychomotor skills, which propels them to follow a crucial method of employee growth to boost growth (Ezeani & Oladele, 2013). Through training, employees receive the necessary skills required to accomplish organisational tasks at their maximum level especially in the light of rapid technological advancements. Training is a vital mechanism aimed at enhancing the efficiency of an organization's staff (Kum, Cowden & Karodia, 2014). In this study, IT training includes the process of improving awareness, acquiring skills, bringing about improvements in attitude and behavior and enhancing the employee's ability to use information technology that a manufacturing organization adopts for improved output growth. Colombo and Stanca (2008) observe that increasing the proportion of employees taking part in training has a positive impact on the output growth of the firm. When training intensity increases, probably output growth may also increase.

Manufacturing technologies relates to the physical transformation of materials, their movement, inspection and storage (Harrison, 2008). The technologies include computer-aided design and engineering, and integrated computer processing. It includes modular Automated Guided Vehicle Systems development cells, and robots. It can also be known as computer-aided process planning and computer-aided numerical control machining. Digital technology, automated telecommunications systems, monitoring systems, automatic applications, download connections, and office technologies such as word processors and spreadsheets can be known as advanced manufacturing company technologies. The advantages of these innovations include reduction in labor expenses, time schedule, efficient system use and proper waste management among others (Nyori & Ogola, 2015).

1.2 Problem Statement

Investments in information technology are widely regarded as having potential to reduce production costs and enhance a firm’s competitive advantage. However, they entail costs and it’s debatable whether IT investments pay off in terms of higher output growth. Weil (1992), Barua et al., (1995), Kohli & Grover (2008), Xiang, Kim, Lee & He (2009), Ilebrand et al., (2010), Whitaker et al. (2011) and Mithas et al, (2008, 2012) believe IT investments have positive effects on firm output growth. But Loveman, (1994), Rai et al. (1997), Lai (2001), Aral and Weill (2007) find a negative link between the two.

The relationship between IT investment and output growth in manufacturing sector is not out rightly positive (Cirera, 2016). This paper aimed at determining the connection between IT investment and output growth in manufacturing sector in the Kenyan case. The study investigated whether firms' investments in IT spur their output growth, with a specific focus on Kenya's manufacturing firms.

1.3 Research Questions

i. Which type of information technologies have manufacturing firms in Kenya invested in?
ii. What is the marginal shilling of an IT investment in a manufacturing industry in Kenya?
iii. What is the effect of IT training on output growth of manufacturing firms in Kenya?

1.4 Research Objectives

The general objective of the study was to investigate whether technological investments affect output growth of manufacturing firms in Kenya.

The specific objectives of the study were:

i. To determine the type of information technologies adopted by manufacturing firms in Kenya
ii. To evaluate the impact of a shilling's information technology investment on manufacturing firms' output growth
iii. To examine the impact of information technology training on output growth of manufacturing firms in Kenya

1.5 Justification of the Study

The outcome of this examination may act as a guideline to senior managers in a given firm in allocation of funds to IT investment. Findings from the study may be critical in advising managers on the amount and level of IT investment in their firms. This study may eventually add to the existing literature across the world conducted in this research area.

1.6 Scope of the Study

The paper concentrated on information technologies adopted by production firms in Kenya and the marginal impact of a shilling's information technology investment on manufacturing industry's output growth. The research covered selected manufacturing firms including sugar, beverages, galvanized sheet, cement and assembled vehicles. Annual data on the study variables-firm output growth (% output growth in output), IT investment (in Kenya shillings), training in IT (in Kenya shillings), Capital (in Kenya shillings), and Labour (in Kenya shillings) was extracted from the Kenya National Bureau of Statistics and World Bank for the period from 2011 to 2018.

1.7 Outline of the Study

The rest of the research is organized as follows: the second chapter covers a selected review of existing literature from previous studies on impact of IT adoption and investment and impacts on firms output growth while, chapter 3 presents the methodology and data analyzed. Chapter 4 provides data analysis and discussion, while chapter 5 outlines research conclusion and policy direction.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section presents the theoretical literature review as well as empirical review of researches on the influence of IT investment on firms' output growth. It also summarizes findings by discussing an overview of both the theoretical and empirical literature.

2.2 Theoretical Literature Review

There are several theories that guide the estimation on how IT investment on influences firms' output growth. This study was guided by the following theories: innovation theory of profit, theory of innovation diffusion and risk and uncertainty bearing theory of profit.

2.2.1. Innovation Theory of Profit

Joseph Schumpeter (1934) introduced this theory and explains that economic profits stem from successful advancement. According to Schumpeter, the main task of a business person is to implement economic innovations, and profits are compensation for performing this task. As Schumpeter used invention has a very broad connotation. Any new initiative or strategy taken by an entrepreneur to reduce production costs or raise demand for his product is an innovation.

Innovations can thus be broken down into two groups. The first method shrinks production costs. Included in this breakthrough are the implementation of a new equipment, new and cheaper manufacturing technique or procedure, the utilization of a new source of raw materials and modern, improved way of organizing manufacturing. The second form of innovation makes the product more demanding. This category involves the introduction of a new product, a new variety or product design, a modern and superior form of advertising and the discovery of a new market. When an invention appears to be successful, that is, whether it achieves the objective of either lowering production costs or increasing the market for a commodity, it will yield profits (Schumpeter, 1934).

The innovation theory of profit is relevant to this study because it supports profit maximization by firms through innovation. According to the theory, firms can maximize profits is through reduction of production cost or increase in demand for their products. The study sought to determine the impact of IT investment on Kenya's production companies' output growth. It was predicted that firms that have invested in adoption of IT would be more

productive. Smith (2008) studied the effect that IT has on efficiency. The author concluded that IT role in efficiency is to magnify the impact of taking democratic decisions and improve business processes.

2.2.2 Risk and Uncertainty Bearing Theory of Profit

This principle was introduced by Hawley (1907) and explains that profits in a changing economy are the entrepreneur's required reward for bearing risk and uncertainty. It is a functional profit theory. Profits happen with confusion. Under uncertainty the entrepreneurs undertake production. They are making predictions of potential demand for their goods and other factors that influence supply and expense. They make contracts with suppliers of production factors in the light of their forecasts and anticipations.

Once it was manufactured and sold on the market, they know the amount of production generated by the hired factors. Nevertheless, a great deal of time is invested in the manufacturing and selling process of the drug. Yet there can be many shifts between contract periods and production revenues that may disrupt anticipations for good or for worse, resulting in earnings, both positive and negative (Liesch, Welch & Buckley, 2014). Now if the conditions existing at the time of selling of produce could be established or expected when the entrepreneurs enter into contractual relationships with the production factors regarding their remuneration rates, there would have been no confusion and therefore no income. Thus ambiguity, that is, ignorance of the potential demand and supply conditions, is the source of profits.

The principle is imperative in this investigation since it explains the conditions that a firm must endure so as to reap maximum benefits. According to the theory, profits are the reward that a firm receives for taking risks. Some of the risks could include investing in IT. It was predicted that organizations investing in IT would be more productive.

2.2.3 Diffusion of Innovation

This theory originates from the works of Roger (1983, 1995). It is one of the most used theories to justify technology adoption by firms (Persan et al., 2005). Even though its background was based at an individual level, it’s been advanced to capture the organizational adoption of innovation. The theory describes the process and pattern of IT adoption through the social system of a given firm. Indeed, Roger (1983) defines it as the process through which adoption is communicated across the channels in a given firm organizational structure.

The end result of the diffusion process is that people, being part of the social system, adopts a new era of idea, product or their behavior. They therefore do things differently than they previously did. This process though does not happen simultaneously but it's a process that takes time. There are those that are apt in uptake of the adoption whereas others take them slowly. Its therefore necessary to explores different categories of the group. These groups are divided into five. Innovators, those who want to be first at trying the new innovation; Fast adopters, who represent the organization's policy leaders; early majority, these are those who embrace new methods and concepts before the average person; Late majority, represents the sceptics in the structure and can only adopt a new idea if and only if it's been tried and proved to be working; finally, we have the Laggards that represents the conservatives.

The stages to uptake of any adoption of a given innovation is guided usually by creating awareness on the need to adopt a new idea, decision to uptake or reject the idea and finally the initial test of the idea before its fully adopted by a given firm. Roger, (1983) goes ahead to put forth the main factors that justify the adoption of a new technology. These are relative advantage to the firm, compatibility to the organizational structure, complexity in terms of easiness to understand and use the new idea, triabilty in terms of how easy is it to test the idea before full implementation and finally observability in terms of results brought about by the adoption of the innovation.

One of the issues in estimation of the impact of IT investment to firms' growth is the direction of the link. This has led to the coining of the name "growth paradox" by the study by Dedrick et al. (2003) in their study on effect of IT investment on economic performance. This led to a study on resolving growth paradox of IT investment by Mithas et al. (2008). Given this, some studies have on one hand establish that there exist a direct and substantial link between IT investment and firms growth (Mithas et al., 2012; Whitaker et al., 2011; Kohli and Grover, 2008) whereas on the other hand some studies have established a negative link between IT investment and firms growth (Ilebrand et al. 2010; Aral and Weil, 2007).An area of skepticism in the research on this line of study is measure on how IT investment influences firms' performance and growth. There have been two channels that IT investment has been argued to influence firms' growth (Mithas et al. 2008).

This includes revenue-enhancing projects and the cost savings channels. On one hand, Mithas et al. (2012) postulates that the impact is accounted by IT-enabled revenue enhancing channels. In their study, they argue that the link is stronger through revenue-enhancing IT

investment than through operating cost reduction channels. This to them is occasioned by the fact that firms adopting revenue enhancing channels enjoys a competitive advantage to their competitors as they enjoy information not available to the public real sources of the competitive advantage. This is due to the fact that this type of investment is path dependent to a specific firm that requires significant firm learning before adoption and as such may not be easily replicated by other firms. On the other hand, studies by Kohl, (2007) argues that investment in IT is mainly directed towards automation of the systems within the firms set up with the main focus being cost savings in the long run. But the argument here is that in the occasion that this cost reduction IT tools are not firm specific as is the case with revenue-enhancing tools. As such in the occasion that these tools may be available over the counter, other firms may have them at their disposal and adoption thus reducing the competitive advantage associated to the first firm. There is need therefore to establish what tools are more in line with firms' growth before investing in IT.

There have been divergent views on the agreed measure input and output for studies in this area. This has been attributed to data limitation and methodological issues (Singh and Harmon, 2003). The question that begs therefore is whether indeed there exists output validity in the right choice of IT measure. Is the measure of IT business value applied by different researches measure the right thing (Kauffman and Kriebel, 1989)? Different studies have adopted different measures of IT over the years ranging from: total annual IT investment (Dewan & Ren, 2011; Rai et al., 1997; Mithas et al., 2012); ratio of IT spending to number of employees in the firm (Barua et al., 1995; Hitt and Brynjolfssons, 1996); proportion of total spending that a firm spends on IT investment (Singh and Harmon, 2003) and yearly IT investment budget as sales' percentage (Aral and Weil, 2007). Singh and Harmon, (2003) suggest that taking percentages or proportions of total expenditure that a business spends on IT is a better measure of any company's commitment to IT investment than an absolute shilling or dollar sum spent on IT related investment.

Another challenge that researchers face in the analysis of the impact of IT on output growth are methodological related and data limitations (Dedrick, 2011). Limitation of data hinders the extent of analysis; like exhaustively analyzing the different dimensions of IT. These may include the scale of IT such as its competency. This may help in analyzing risks returns profiles for a given firm that is pursuing IT investment (Singh and Harmon, 2003). Different authors have adopted different methodologies in their analysis. Depending on the methodologies adopted results may be varying from one study to the other for Loveman,

(1994) adopting a Cobb-Douglass production function using same data with Barua et al. (1995) find different results who uses a two stage approach. There is need to adopt the right methodology depending on data availability to the researcher to have consistent results that may be useful in policy implications. Researcher should also ensure data recency given the changing market diversity and trends in IT infrastructure to have an informed impact of IT in most recent time.

Manufacturing industry strives to improve its growth by using modern technology. And as such over the years technology use has become a critical part of the manufacturing sector. This has enhanced accessibility to its products. High technology environment has developed around the world in the manufacturing sector. The use of IT is widespread, from the developing countries to the least developed countries, although the degree of overall usage is closely linked to the level of growth. Manufacturing sector has invested in IT extensively. This has been seen through the use of computerized systems. In order to survive on the market, IT has become a necessity for manufacturing firms and they continue to try to come out with new IT-based services / products.

Adopting modern technology in a firm is still difficult because it is costly in terms of implementation and maintenance and training of personnel. Nevertheless, literature suggests that businesses are more effective at achieving higher growth through IT-driven revenue growth than cost cuts allowed by IT (Mithas et al., 2012). The effect of IT spending on sales and efficiency is greater than that of other discretionary expenditures, such as advertising and R&D (Mithas et al., 2012). This argument will therefore guide executive managers and senior firm advisor in the choice between IT discretionary investment and those geared towards revenue growth.

Over time, as firms continue having appetite for IT investments the question of how and in what contexts such investments payoff have attracted research in this area. Informational technology forms an inter-linkage between customers and organization unit. A study by Rahman and Bennett, (2009) postulates that; IT is integrated into business processes and life cycle administration of customer resources. Use of IT on growth will be greater through revenue than through costs (Mithas et al., 2012).

The principle is important in this paper as it describes the process and pattern of IT adoption by organizations. The theory also supports the reason why firms adopt technology. The paper

aimed to evaluate the influence of IT investment on growth of Kenya's production companies. The theory, therefore, supported IT adoption and investment.

2.3 Empirical Literature Review

This part presents some of empirical evidence from studies on IT investment and their impact on firm output growth on country specific cases. We present county specific evidence of the impact of investing in IT on output growth of companies across the world. Literature on impact of IT adoption on growth in the production firms especially in developing countries remains scant.

Basant et al. (2006) in their cross country research of the impact of IT adoption on manufacturing firms in India and Brazil find that ICT capital influence growth of firms. Specifically the impact is intense for Indian firms than for the Brazil firms. They also find that IT related benefits increase given organizational practices and management.

Kwon and Stoneman, (1995) using an augmented Cobb Douglas production model to estimate the impact of IT adoption on firms output and growth find that firms that reported to have adopted IT in their production process had increased output than their counterparts. After controlling for IT endogeneity though, they found that IT related benefits fall. They argue that IT endogeneity could be brought about by issues of skills and education levels and unless this is controlled for IT related benefits may be outrageously high.

A research by Doms et al. (2004) on the relationship between IT expenditure and U.S. retail growth established that the connection between IT and growth is positive and statistically important. They further find that due to the complexity of the large firms' processes they are likely to invest heavily in IT.

The use of ICT would enable manufacturing firms to achieve operational efficiency. Where operational efficiency refers to the ability of employees to work well and produce good results by using the available time and supplies effectively (Loveman, 1994). The aim of operational efficiency is to economize the cost of labor and maximize growth by the firms (Loveman, 1994). Implementing new technology provides a range of benefits to a company, including decreased competition and aggregate demand, increased monitoring of compliance, allowing employees to service consumers quicker and more faithfully, time savings, strengthened client relationships, decreased administrative costs and facilitated rapid transactions, thereby increasing the financial results.

Sabir et al. (2014) discussed the impact of training on staff growth at Pakistan's power companies. Researcher is using the techniques of non-probability sampling and random sampling. The findings indicate that teaching has positively affected employee efficiency. It must be effective and rapid as well as simple to satisfy to ensure that the training is followed by the employees. The research supports the idea that the most important and positive effect on employee satisfaction comes from specific training variables.

In Abri and Mahmoudzadeh (2015) paper, the effect of IT on output of production firms in Iran was analysed. For the period 2002-2006 data were collected from Iranian manufacturing industries. The result showed that IT significantly impact on manufacturing industries efficiency. This implied that firms that are more IT oriented would be more productive compared to others.

A research by Ghorbanzad and Beig (2012) assessed the contribution of IT towards output growth among firms in Iran. The findings revealed that there exists a direct and meaningful link between IT and growth. The methodology of Structural Equations was used for data processing. However, because it was carried out in another country and not in Kenya, the study poses research distance. Present work focuses on the Kenyan manufacturing firms.

Study by Rezaei, Rezaei, Zare, Akbarzadeh and Zare (2014) looked at how IT affects human resource output in Iran. This research established eight human resource success indexes, including motivation, imagination and innovation, based on a review of the theoretical context and literature, as well as exploratory interviews with participants; spirit of competition, reduction of operating costs, enhancement of service quality, reduction of working hours, employee satisfaction and the spirit of human resources. Results showed that the IT-human resource efficiency partnership has been successful.

A report by Appiahene, Missah and Najim (2019) examined the effect of information technology on the operations of Ghana 's banks. The research applied a model of the DEA in two phases. The efficiencies were measured in R programming using the kit Robust DEA. Results showed that IT had a major impact on banks' overall output as a large number of banks were effective in their operations while their respective deposit and investment efficiencies were not important.

Niri (2017) investigation based on the effect of technology influences on the efficiency of the Al Borg Cement Factory employees in Libya. This clearly explains the decline in efficiency

from the reduction in results that faces workers within the workplace. The article further claims that the shortcoming is the effective use of technology , computer systems, networking networks (internet) and the organization's lack of interest is planning a training plan. Among other factors these factors influence the growth that causes the workers to be less productive at their workplaces. Furthermore, this impacts the economy negatively. However, the decline in person growth is demonstrated by the results of the survey of individuals who lack management confidence in planning a time-training plan and computing program for working at Al Borg Cement Factory in Libya.

Gakuubi (2018) paper examined IT impact on the success of logistics companies in Kenya. Descriptive research design has been used to provide accurate and efficient representation of under study variables. The research conducted Pearson correlation and analysis regression to determine the relationship between under research variables. Data on IT systems and competitive advantage revealed that the enterprise resource planning program has helped the company optimize more of its activities to improve efficiency; the organization is using radio frequency identification program technology to track vehicles and goods to a very large degree. The company is using enterprise resource planning approach to a very large degree, and internal and external processes within the organization have been significantly enhanced by effective information flow management.

Zehir, Muceldili and Akyuz (2010) looked at the relationship between information technology and organizational success in Turkey's national and multinational companies. The main dimensions included: level of investment, use, understanding, decision-making process, future outlook, outlook to technology. Statistics from this study have been collected from a survey of various organisations. This study's findings have shown that IT investments are vital component of firm success. If firms successfully manage IT investments, they will enhance company performance. In addition, the study informs not only the practitioners but also the academics for future research. However, the study did not focus on firms in Kenya investing in IT and growth. The current study attempted to bridge that knowledge gap.

Palvalin, Lönnqvist and Vuolle (2013) investigated how IT can be used as a way of increasing the efficiency of the European medium-sized teleoperators. A case study is carried out in a medium-sized European teleoperator which offers ICT services for the individuals and business markets. The results show that ICT can be used to remove, or render more effective, non-value - adding tasks, thereby giving time to the most critical tasks of

information workers. ICT can also lead to an increase in the health of workers by reducing frustration with ICT systems and by transforming job material by removing unimportant activities. Second, none of the possible ICT-based growth benefits are automatic, but rely instead on how the respective ICT service is applied and used in the given context.

Mutuku and Nyaribo (2015) evaluated the impact of IT on employee growth at banks, Kenya. The thesis followed the descriptive Regression test of analysis style was used to check the relation between the variables of the study. The study found that both positively and negatively importantly, IT impacts the growth in the workplace of banks. Through these findings an change is evident in the implementation of The results to improve employee growth. The study recommends commercial banks in Kenya should increase their creative capacity because of the market dynamics. Therefore, in order to help and sustain enhanced efficiency, innovation should be one of the key focus areas of commercial bank executives at the top management level in order to improve the growth of employees. However, the paper concentrated on employee growth in banks and not production companies.

Ali, Jabeen, Nikhitha and India (2016) investigated the effect ICTs have on Zambia's agricultural output growth. The research used random sampling technique on several stages to pick the sample farmers. The study showed positive effects of ICTs on output growth in agriculture. The impact of television on productivity was positive, and statistically significant. Owing to the use of more ICTs, farmers' performance in the 25-40 year age group was higher. Efficiency and net income factors were calculated using the usual least square Regression techniques. Using ICTs along with seed, fertilizer and the amount borrowed was positive for increasing agriculture. The impact of ICTs along with seed, fertilizer, loaned amount and education level on net income per acre was also positive but statistically negligible. The study suggested that the government establish an integrated agricultural information system on agro-technologies and techniques, pricing, and market information to provide strategic information at national, provincial, and district level to farmers and other stakeholders. Nevertheless, the research concentrated on profitability of farming firms and not manufacturing firms.

There has also been an inconclusive discussion on the impact of IT on firms' output growth. Han and Mithas (2011) conducted a study on whether IT outsourcing reduce costs for firms in Canada. There is therefore need to establish IT output growth link and levels relative to discretionary investments in R&D on output growth. This would be vital in guiding managers

on resource allocation. The allocation must be carried out with great caution, because IT investment is synonymous with other firm marketing and product development processes that may include both advertisement and R&D expenses (Hans & Mithas, 2011). Most of sales and marketing strategies to day are IT enabled to enable firms reach more customer base in the market place (Bradley & Bartlett, 2007). As such it was expected that firms would shift some of the income spent on advertising to IT investment if such shifts would enable them to reach more customers efficiently (Gordon & Tarafdar 2010). IT adoption and investment will impact organizational processes involving both digital and non-digital means of communication and encourage an organization to involve a wider range of stakeholders in its ecosystem for innovation (Han & Mithas 2011).

2.4 Overview of the Literature Review

Early research on returns to IT investment in the manufacturing sector (Weil, 1992; Barua et al., 1995) established positive results. But this is contrary to the works of Loveman, (1994) that found out a negative link between IT investment and output growth in the production industry. But Barua and Lee, (1997) attributes the results to methodological issues. Early researcher on the subject attributed this to the fact that it's easy to measure manufacturing firms output and could go ahead to adjust to quality improvements associated with IT investment. While some studies in other regions have indicated that indeed the direction of relationship is not conclusive, other studies (Kohli & Grover, 2008; Ilebrand et al., 2010; Mithas et al., 2012) have found that indeed IT investment is a worthwhile investment that firms should adopt.

Over the years studies conducted to test the impact of IT on output growth have had divergent views on the direction of the relationship. Whereas on one hand studies by (Kohli & Grover, 2008; Ilebrand et al, 2010) establishes that there exist a positive and significant link between IT investment and adoption with firms output growth more specifically mediated through revenue enhancement strategy (Mithas, 2008); on the other hand (Rai et al., 1997; Lai, 2001; Aral and Weill, 2007) found a negative link between the two. Although there exist divergent views on the impact of IT investment on firms output growth, some studies (Doms et al., 2003; Mithas et al., 2008; Kohli & Grover, 2008; Whitaker et al. 2011; Mithas et al. 2012) finds a positive and statistically significant link between IT investment and output growth.

There are challenges in the examination of the influence IT on output growth that range from data unavailability, choice of methodology adopted and the inputs and output measures. How

much the return to IT given a specific firm may vary across industry and economies and it's therefore necessary to analyze the impact across different firms and economies. From the reviewed literature it's also clear that given changing times and trends in IT output growth there is need to employ most recent data to test the significant of IT investment on firms output growth. Indeed IT investments are worthwhile to any firm as they ease production process and eventually may translate to increase in annual sales. IT investment should be aligned in any firm's production strategy. But unless organizations come up with policies to fully utilize IT potential, the IT investments may not be worthy. These may include training of personnel attached to the adoption of IT programs. Whether Kenya's manufacturing firms need to adopt IT investment to increase output growth can only be informed by research conducted using manufacturing sector data. Just how much to be invested by these firms can only be advised from a research base. The current study adds to existing literature of analysis of effect of IT investment on output growth of Kenya's production organizations.

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This section presents methodology of the study starting with theoretical framework and the analytical model. It also describes the data and the estimation techniques used in this research.

3.2 Theoretical Framework

Previous studies on IT and firm output growth use production economics (Loveman, 1994; Brynjolfsson & Hitt, 1997). This involves the use of the Cobb Douglas production function. Production economics endeavours to link inputs invested by firms in production to value added output (Dedrick et al., 2003). Production functions represent specification by given firms in the choice of a mixture of inputs. This input mix was used for the production of target output. Barua and Lee (1997) warns that it should be taken with a lot of caution. To them, production functions do not in any way capture prices for the inputs and outputs that firms should use as their guide in choosing levels for inputs and output. As such researchers in this area of subject should consider modelling for choice of input mix and output to have consistent estimates. But the challenge in most of the Enterprise survey which is also our case fails to capture input prices of the firms as such it may be impossible to address the issue. This research, therefore, was guided by the Cobb Douglas production model that was augmented to capture how IT investment impacts on output growth. The production function is modeled as follows

$$Q = AK^{\alpha}L^{\beta} \qquad (1)$$

Where Q represents output, K the physical capital, L labour employed.

Given the production function, the profit function of the firm is modelled as follows

$$\pi = pQ - qK - wL \qquad (2)$$

and subsequently the profit maximization conditions are presented as follows

$$\frac{d\pi}{dK} = 0 \qquad (3)$$

$$\frac{d\pi}{dL} = 0 \qquad (4)$$

The first objective in this study was addressed by analysing published documents and reports on the types of information technologies that the manufacturing firms in Kenya have adopted. These documents were obtained from websites of various manufacturing firms as well as reports from the Kenya Association of Manufacturers (KAM).

3.3 Analytical Model

The analytical model starts from the Cobb Douglas specification type that guides the production economics and has been adopted by other studies (Weil, 1992; Loveman, 1994; Barua et al., 1995; Barua and Lee, 1997). Over the years history has it that firms have been viewing IT investment as mainly being automation- related investment focusing on reducing costs rather than revenue generation related. As a result the efficiency gains associated to IT investment may have just been exhausted and as such the need to pursue other direction of IT investment (Mithas et al., 2012). This justifies therefore the need to focus more on revenue growth line of IT investment rather than cost related ones. The study sought to establish whether any investment geared towards IT influences output growth of an organization. Following the works of Kruse, (1992) we model our production technology. We assume that factors of production capital, labour and technology or innovation enters and augments the Cobb Douglas production function separately. We therefore, define output (Q) to be a function of physical capital (K), labour (L), information technology (IT) and a set of observable firm heterogeneity (Z) represented by training. Our model is therefore specified as follows

$$Q = ZK^{\alpha}L^{\beta}IT^{\gamma} \qquad (5)$$

Where the exponents ($\alpha, \beta \; and \; \gamma$) represent share contribution to production of a variable (proxied by annual sales of the firm) with respect to individual input factors.

The model is as follows:

$$q = Z + \alpha K + \beta L + \gamma IT + \varepsilon \qquad (6)$$

Where;

q=Growth measured as a percentage growth of output

IT= Investment in information technology (Amount in Kenya shillings)

Z= Training in information technology (Amount in Kenya shillings)

K=Capital investment (Amount in Kenya shillings)

L=Labour investment (Amount in Kenya shillings)

Table 3.1 is on variable definition, measurement and source.

Table 3.1: Variable definition, measurement and source

Variable	Description and measurement	Source
q	% growth of output per industry	Doms et al., (2004)
IT	Amount of money manufacturing firms invested on IT in Kenya shillings	(Mithas et al., 2012; Chae et al., 2018)
Z	Amount of money manufacturing industries spent on IT Training in Kenya shillings	(Dedrick et al., 2003; Tallon et al., 2002)
K	Amount of money manufacturing industries spent on capital in Kenya shillings	Kwon and Stoneman, (1995)
L	Amount of money manufacturing industries spent on labour in Kenya shillings	Kwon and Stoneman, (1995)

Source: Author (2020)

3.4 Data Type, Source, and Typology of Variables

This study analyzed panel data obtained from the KNBS and World Bank for the period from 2011 to 2018. Annual data on the study variables-firm growth (growth of output), IT investment (in Kenya shillings), training in IT (in Kenya shillings), Capital (in Kenya shillings), and Labour (in Kenya shillings) was collected from the mentioned sources. The study used STATA version 14 to do the analysis.

3.5 Diagnostic Tests

The following diagnostic tests were tested and results provided in this section.

3.5.1 Normality Test

The test was conducted using Skewness/Kurtosis tests. The null hypothesis of normal distribution is accepted if the p value is found to exceed five percent and vice versa.

3.5.2 Heteroscedasticity Test

One of the key assumptions in OLS regression is that variance of errors or residuals should never increase with fitted values of output variable. This is commonly referred to as homogeneity of the residual terms. This is a key concern when dealing with cross sectional data. There exist methods to test for it which can either be graphical or by using statistical tests such as the Breush Pagan test.

3.5.3 Serial correlation Test

The Wooldridge check was used to test for auto correlation. The Ho is that the error terms are not correlated across time. A probability value more than 0.05 results to acceptance of the null hypothesis and vice versa.

CHAPTER FOUR: DATA ANALYSIS AND DISCUSSION

4.1 Introduction

This chapter deals with data analysis and discussion. The primary objective of the study was to investigate whether investment in information technology affect firm output growth in manufacturing firms in Kenya. Secondary data for the period 2011-2018 from the KNBS and World Bank was analyzed.

4.2 Descriptive Summary

This section provides statistical summary results of the study variables: output growth, IT investment and training.

Table 4.1: Descriptive Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Industry Output growth	40	3.6125	13.9958	-38.2	33.1
IT investment	40	2656.18	1014.45	1031	4931
IT Training	40	528.075	253.636	120	971
Capital	40	9011.03	2626.01	5498	14898
Labour	40	6485.8	2017.18	3023	9919

Source: Author (2020)

Results in Table 4.1 indicated that the mean of output growth for selected manufacturing firms was 3.6. This implies that the average output growth for selected manufacturing firms over the measurement period from 2011-2018 was 3.6% per year. The findings also revealed that on average selected manufacturing firms invested about Ksh.2.6 Billion in information technology yearly. Further, results revealed that on average selected manufacturing firms allocated Ksh 0.528 Billion annually in information technology training. In addition, the findings showed that on average selected manufacturing firms spent Ksh 9 Billion and 6 Billion on capital and labour annually. Investment in information technology, training in IT, capital and labour is expected to boost output growth in the manufacturing sector.

4.3 Diagnostic Test Results

4.3.1 Normality Test Results

Normality testing was done using skewness/ Kurtosis test.

Table 4.2: Normality Test

Skewness/Kurtosis tests for Normality						
				------ joint ------		
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	adj	chi2(2)	Prob>chi2
My Residuals	40	0.3803	0.0656		4.29	0.1172

Source: Author (2020)

The findings in Table 4.2 indicated significance value of 0.1172, greater than 0.05. Thus, the null hypothesis of normal distribution was not rejected.

4.3.2 Heteroskedasticity Test Results

Table 4.3: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance
Variables: fitted values of IPI
chi2(1) = 0.17
Prob > chi2 = 0.9758

Source: Author (2020)

The findings in Table 4.3 revealed a significance value of 0.9758, greater than 0.05. Therefore, there was no heteroscedasticity problem.

4.3.3 Autocorrelation Test Results

Table 4.4: Wooldridge test for autocorrelation in panel data

H0: no first-order autocorrelation
F(1,4) = 1.334
Prob > F = 0.3125

Source: Author (2020)

The findings in Table 4.4 showed that the Ho of no serial correlation was not rejected since the significance value of 0.3125>0.05. Therefore, the residuals were not auto correlated across time.

4.4 Correlation Analysis Results

This section provides outcome on the association between IT investment, IT training, capital, labour and output growth. The findings are shown in Table 4.5.

Table 4.5: Correlation Matrix

	Output growth	IT investment	IT Training	Capital	Labour
Output growth	1				
IT investment	0.4232*	1			
IT Training	0.5513*	0.5035*	1		
Capital	0.6590*	0.3008	0.3424*	1	
Labour	0.6274*	0.2139	0.5470*	0.6945*	1

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
Source: Author (2020)

The findings in Table 4.5 revealed a direct and meaningful association between IT investment and output growth of manufacturing firms (r=.4232*). This implies that an increase in amount of money invested in IT is accompanied by an increase in output growth of manufacturing firms.

Results also indicated a direct and meaningful association between IT training and output growth of manufacturing firms (r=0.5513*). This implies that an increase in amount of money invested in IT training is accompanied by enhancement in manufacturing firms' output growth.

The findings further showed that a direct and meaningful association exists between capital and output growth of manufacturing firms (r=0.6590*). This implies that an increase in amount of money spent on acquisition of capital is accompanied by enhancement in manufacturing firms' output growth.

In addition, the outcome demonstrated that a direct and meaningful association exists between labour and output growth of manufacturing firms (r=0.6274*). This implies that an increase in amount of money spent on labour is accompanied by an increase in output growth of manufacturing firms.

4.5 Regression Analysis Results

This section provides regression results on the effect of investment in IT, training in IT, capital and labour on output growth of manufacturing firms in Kenya. Tables 4.6, 4.7 and 4.8 provide model summary, ANOVA and coefficient results respectively.

Table 4.6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.778[a]	.605	.560	9.2868104

a Predictors: (Constant), Labour, IT Training, IT investment, Capital
Source: Author (2020)

The study findings indicated R square of 0.605. This denotes that investment in IT, training in IT, capital and labour account for 61% of total variations in output growth of production companies. The results also imply that there are other factors that determine output growth but were not part of this study model.

Table 4.6: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4620.814	4	1155.204	13.394	.000[b]
	Residual	3018.570	35	86.245		
	Total	7639.384	39			

a Dependent Variable: Output growth
b Predictors: (Constant), Labour, IT Training, IT investment, Capital
Source: Author (2020)

Results in table 4.6 revealed an F statistic of 13.394, with P value of 0.000, which was less than 0.05 at 95% confidence interval implying that the study model was significant. Therefore, investment in IT, training in IT, capital and labour are good predictors of manufacturing firms' output growth.

Table 4.7: Regression Coefficients

Model		Unstandardized Coefficients			
		B	Std. Error	t	Sig.
1	IT investment	24.773	12.423	1.994	.048
	IT Training	11.210	7.606	1.474	.149
	Capital	37.805	18.085	2.090	.044
	Labour	10.566	15.683	.674	.505
	(Constant)	-299.144	48.106	-6.218	.000

a Dependent Variable: Output Growth

Source: Author (2020)

Manufacturing Firms' Output growth= -299.144+24.773 Investment in IT+37.805 Capital

The outcomes captured in Table 4.7 indicate that information technology investment had a direct and noteworthy effect on manufacturing firms' output growth (β=24.773, p value =0.048<0.05). This implies a one unit increase in information technology investment would lead to improvement in output growth of manufacturing firms by 24.773 units.

The outcome supported the work of Basant et al., (2006) who found that ICT capital influence output growth of firms. Kwon and Stoneman, (1995) using an augmented Cobb Douglas production model to estimate the influence of IT adoption on firms output and output growth find that firms that reported to have adopted IT in their production process had increased output than their counterparts.

The finding further corroborated the study by Doms et al. (2004) on the relationship between IT investment and the output growth of US retail trade, which established that there exist a direct and noteworthy connection between IT and output growth. According to Loveman (1994), the use of ICT would enable manufacturing firms to achieve operational efficiency. Where operational efficiency refers to the ability of employees to work well and produce good results by using the available time and supplies effectively. Similar findings were established by Abri and Mahmoudzadeh (2015) discuss information technology's effect on firm output growth. The authors find that IT has had a strong and significant effect on the profitability of the manufacturing companies.

The results further indicate that capital had a direct and noteworthy impact on manufacturing firms' output growth (β=37.805, p value =0.044<0.05). This means that output growth of production firms improves by 37.805 units following a unit increase in capital.

Further, the study findings demonstrated that IT training and labour had a direct though insignificant effect on manufacturing firms' output growth (p value=0.149, 0.505>0.05).

CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION AND POLICY DIRECTION

5.1Introduction

This chapter outlines the summary of findings, conclusion and policy direction of the research. This is done as per the study objectives. The study targeted manufacturing firms in Kenya, where secondary data was collected for a period from 2011 to 2018. Data was sourced from KNBS and World Bank. The primary goal of the paper was to investigate how technological investments affect output growth of IT companies in Kenya.

5.2 Summary of Findings

5.2.1 Types of Information Technologies

The paper determined the type of information technology that manufacturing companies adopted in Kenya. The research found that a variety of innovations have been adopted by the manufacturing firms in Kenya. These include computer-assisted designs, computer-assisted engineering, computer-assisted production, resource planning of manufacturing, and integrated manufacturing of computers. Other new information technology embraced by the manufacturing firms include automated telecommunications systems, bar coding or monitoring systems, automatic applications, download links and office technology such as word processors and spreadsheets. Such innovations are known to have the following advantages: The advantages of these innovations include reduction in labor expenses, time schedule, efficient system use and proper waste management.

5.2.2 Information Technology

The paper also assessed the influence of the information technology expenditure on the production of IT firms in Kenya. The study findings indicated that information technology investment had a direct and substantial influence on firm output growth. This denoted that increase in IT investment is expected to enhance production companies' output growth.

5.2.3 Investment Technology Training

The paper sought to establish IT training impact on output growth of IT companies in Kenya. Research findings indicated that IT training had a direct though insignificant impact on firms' output growth.

5.3 Conclusion

Based on the results, the conclusion was that technological investments affect the manufacturing firms' output growth. In particular, investment in IT directly and significantly contributes to output growth of IT companies in Kenya. The implication of the outcomes is that manufacturing firms are likely to increase their output growth by investing more in information technologies.

5.4 Policy Directions

The research established that information technology investment had a direct and meaningful effect on manufacturing industry's output growth. Therefore, the management of manufacturing firms should consider increasing their budgetary allocation towards acquisition of modern information technologies. This will further boost their output growth. The government through the necessary ministries should also streamline information technology oriented policy to make them favorable to the manufacturing sector.

5.5 Recommendation for Further Research

This study investigated whether technological investments affect output growth of manufacturing firms in Kenya. Future studies could consider similar research but in other sectors such as agriculture, tourism among others.

REFERENCES

Abdi Rahman, A., & Bennett, D. (2009).Advanced manufacturing technology adoption in developing countries: The role of buyer-supplier relationships.*Journal of Manufacturing Technology Management*, *20*(8), 1099-1118.

Abri, A. G., & Mahmoudzadeh, M. (2015). Impact of information technology on growth and efficiency in Iranian manufacturing industries. *Journal of industrial engineering international*, *11*(1), 143-157.

Ali, S., Jabeen, U. A., Nikhitha, M., & INDIA, Z. (2016). Impact of ICT on Agricultural Growth. European Journal of Business, Economics, and Accountancy, 4(5), 82-92.

Appiahene, P., Missah, Y. M., & Najim, U. (2019). Evaluation of information technology impact on bank's performance: The Ghanaian experience. *International Journal of Engineering Business Management*, *11*, 1847979019835337.

Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of management*, *17*(1), 99-120.

Barua, A., Kriebel, C. H., &Mukhopadhyay, T. (1995). Information technologies and business value: An analytic and empirical investigation. *Information systems research*, *6*(1), 3-23.

Chae, H. C., Koh, C. E., & Park, K. O. (2018). Information technology capability and firm performance: Role of industry. *Information & Management*, *55*(5), 525-546.

Cirera, X. (2015). *Catching Up to the Technological Frontier?: Understanding Firm-level Innovation and Growth in Kenya*.

Colombo, E., & Stanca, L. (2008). The impact of training on growth: evidence from a large panel of firms.

Coughlin, P. E., & Ikiara, G. K. (Eds.). (1988). *Industrialization in Kenya: in search of a strategy*. East African Publishers.

Cusolito, A., & Cirera, X. (2016). *A Firm-Level Growth Diagnostic for Kenya's Manufacturing and Services Sector*. World Bank.

Dedrick, J., Gurbaxani, V., & Kraemer, K. L. (2003). Information technology and economic performance: A critical review of the empirical evidence. *ACM Computing Surveys (CSUR)*, *35*(1), 1-28.

Dewan, S., & Ren, F. (2011). Information technology and firm boundaries: Impact on firm risk and return performance. *Information Systems Research*, *22*(2), 369-388.

Doms, M. E., Jarmin, R. S., &Klimek, S. D. (2004). Information technology investment and firm performance in US retail trade. *Economics of Innovation and new Technology*, *13*(7), 595-613.

Ezeani, N. S. and Oladele, R. (2013). Implication of training and development in selected business organizations in Onitsha, Anambra State Nigeria, *International Journal of Asian Social Science, Vol.3*(1) pp. 266-281.

Fagerberg, Jan; Martin Srholec and Bart Verspagen (2010).“Innovation and Economic Development” in B.H. Hall and N. Rosenberg, eds. Handbook of the Economics of Innovation. Amsterdam: Elsevier, pp. 833-872.

Gakuubi, D. K. (2018). The Impact Of Information Communication Technology On Organizational Performance: A Case of Nairobi Bottlers Logistics Operation’s (Doctoral dissertation, United States International University-Africa).

Ghorbanzad, Y., & Beig, M. (2012). The impact of information technology on growth using structural equations technique in Iran Behnoush Company. *Management Science Letters*, *2*(4), 1195-1202.

Gilchrist, S., & Zakrajsek, E. (2007). *Investment and the cost of capital: New evidence from the corporate bond market* (No. w13174). National Bureau of Economic Research.

Gordon, S. R., &Tarafdar, M. (2010).The IT audit that boosts innovation.*MITsloan management review*, *51*(4), 39.

Government of Kenya, Transforming Kenya; Pathway to Devolution, Social-Economic Development, Equity and National Unity 2012, Ministry of Devolution and Planning.

Hall, B. H. (2011). *Innovation and growth* (No. w17178). National bureau of economic research.

Hall, B.H.(2011). “Innovation and growth”.Nordic Economic Policy Review, 2, pp.167-204.

Han, K., & Mithas, S. (2011). *Does IT Outsourcing Reduce Non-IT Costs for Firms? Theory and Evidence*.Working Paper, McGill University, Montreal, Canada.

Harris, S. E., & Katz, J. L. (1991).Organizational performance and information technology investment intensity in the insurance industry.*Organization science*, *2*(3), 263-295.

Harrison, A. (2008). Manufacturing strategy and the concept of world class manufacturing. *International Journal of Operations & Production Management*.

Hitt, L. M., &Brynjolfsson, E. (1996). Growth, business profitability, and consumer surplus: three different measures of information technology value. *MIS quarterly*, 121-142.

Ilebrand, N., Mesoy, T., &Vlemmix, R. (2010).Using IT to enable a lean transformation.*McKinsey on Business Technology*, *18*, 1-3.

Kauffman, R. J., & Weill, P. (1989). An evaluative framework for research on the performance effects of information technology investment. *Information Systems Working Papers Series, Vol*.

Kauffman, R. J., &Kriebel, C. H. (1989).Identifying business value linkages for production processes involving information technology.*Advances in Working Capital Management*, *2*, 67-93.

Kohli, R., & Grover, V. (2008). Business value of IT: An essay on expanding research directions to keep up with the times. *Journal of the association for information systems*, *9*(1), 1.

Kum, F. D., Cowden, R. and Karodia, A. M. (2014). The Impact of training and development on employee performance: A Case Study of Escon Consulting, *Singaporean Journal of Business, Economics and Management Studies 3* (3) 72-105

Kwon, M. J., & Stoneman, P. (1995). The impact of technology adoption on firm growth. *Economics of Innovation and New Technology*, *3*(3-4), 219-234. Lai, L. L. (Ed.). (2001). *Power system restructuring and deregulation: trading, performance and information technology*. John Wiley & Sons.

Liesch, P. W., Welch, L. S., & Buckley, P. J. (2014). Risk and uncertainty in internationalisation and international entrepreneurship studies. In *The multinational enterprise and the emergence of the global factory* (pp. 52-77). Palgrave Macmillan, London.

Loveman, G. W. (1994). An assessment of the growth impact of information technologies.*Information technology and the corporation of the 1990s: Research studies*, *84*, 110.

Lucas, H. C. 1993. "The Business Value of Information Technology: A Historical Perspective and Thoughts for Future Research," in Strategic Information Technology Management: Perspectives on Organizational Growth and Competitive Advantage, R. D. Banker, R. J. Kauffman, and M. A. Mahmood (eds.), Harrisburg, PA: Idea Group Publishing, pp. 359-374.

Madhani, P. M. (2010). Resource based view (RBV) of competitive advantage: an overview. *RESOURCE BASED VIEW: CONCEPTS AND PRACTICES, PankajMadhani, ed*, 3-22.

Mata, F. J., Fuerst, W. L., & Barney, J. B. (1995). Information technology and sustained competitive advantage: A resource-based analysis. *MIS quarterly*, 487-505.

Melville, N., Kraemer, K., & Gurbaxani, V. (2004). Information technology and organizational performance: An integrative model of IT business value. *MIS quarterly*, *28*(2), 283-322.

Mithas, S., Ramasubbu, N., &Sambamurthy, V. (2011). How information management capability influences firm performance. *MIS quarterly*, *35*(1), 237.

Mithas, S., Tafti, A. R., Bardhan, I., & Goh, J. M. (2012). Information technology and firm profitability: mechanisms and empirical evidence.

Mithas, S., Tafti, A., Bardhan, I., & Goh, J. M. (2008). *Resolving the profitability paradox of information technology: Mechanisms and empirical evidence*.University of Maryland Working Paper.

Mithas, S., Whitaker, J., &Tafti, A. (2017). Information technology, revenues, and profits: Exploring the role of foreign and domestic operations. *Information Systems Research*, *28*(2), 430-444.

Mutuku, M. N., & Nyaribo, W. M. (2015). Effect of Information Technology on Employee Growth in Selected Banks in Kenya. *Review of Contemporary Business. Research*, *4*(1), 49-57.

Niri, A. A. M. (2017). The Impact of Technology Factors on the Workers' Growth an Empirical Study on Al Borg Cement Factory in Libya. *Int J Econ Manag Sci*, *6*(435), 2.

Nyori, G. M., & Ogola, J. M. (2015). Advanced manufacturing technology adoption in manufacturing companies in Kenya. *International Journal of Research in Engineering and Technology*, *4*(10), 356-369.

Nyori, G. M., & Ogola, J. M. (2015). Advanced manufacturing technology adoption in manufacturing companies in Kenya. *International Journal of Research in Engineering and Technology*, *4*(10), 356-369.

Palvalin, M., Lönnqvist, A., & Vuolle, M. (2013). Analysing the impacts of ICT on knowledge work growth. Journal of Knowledge Management, 17(4), 545-557.

Rezaei, M., Rezaei, M., Zare, M., Akbarzadeh, H., & Zare, F. (2014). The Effects of Information Technology (IT) on Employee Growth in Shahr Bank (Case study of Shiraz, Iran). *Applied mathematics in Engineering, Management and Technology, Special Issue in Management and Technology*, 1208-1214.

Rogers Everett, M. (1995). Diffusion of innovations. *New York*, *12*.

Sabir, R. I., Akhtar, N., Bukhari, F. A. S., Nasir, J., & Ahmed, W. (2014). Impact of training on growth of employees: A Case study of electricity supply company in Pakistan. *International Review of Management and Business Research*, *3*(2), 595-606.

Schumpeter, J. (1942). "Capitalism, Socialism, and Democracy". New York: Harper & Bros.

Sheng, Y. H., & Mykytyn Jr, P. P. (2002). Information Technology Investment and Firm Performance: A Perspective of Data Quality. In *ICIQ* (pp. 132-141).

Smith, J. (2008). Information Technology's Influence on Growth.

Sobhani, A. (2008). Impact of information technology on growth.

Solow, Robert M (1957). "Technical Change and the Aggregate Production Function". Review of Economics and Statistics (The MIT Press) 39 (3): 312–320

Xiang, J. Y., Kim, J. K., Lee, S., & He, Z. (2009). The impact of IT investment on firm performance in Korean insurance industry. In *2009 First International Conference on Information Science and Engineering* (pp. 3124-3127). IEEE.

Zehir, C., Muceldili, B., & Akyuz, B. (2010). The impact of information technology investments on firm performance in national and multinational companies, Journal of Global Strategic Management, vol,4 DOI: 10.20460/JGSM.2010415846