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The Impact of Adoption and Usage of Information and Communication Technologies (ICTs) in Selected Manufacturing and Business Firms in Zambia

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Abstract This study was aimed at investigating the impact of adoption of Information Communication Technologies (ICTs) on selected manufacturing and business firms in Zambia.This study was exploratory in nature, hence, a cross sectional approach was undertaken to measure firms' responses regarding adoption of ICTs. The diffusion theory of innovation was used as a theoretical framework to understand the phenomenon of ICT adoption. A packet of 70 questionnaires, was sent to randomly selected organisations from mining, banking and finance, manufacturing and processing, education, professional management, IT related service and advertising sector using stratified random sampling method. The research findings reveal that common ICTs such as computers and internet have high usage among firms. However, the use of high-technology ICTs is still moderate and there is need for more effort from all stake holders to focus on stimulating accelerated ICT adoption. The results also shows that Zambia's manufacturing industries could rebrand and increase productivity, improve their profit margins and contribute effectively to the economy if they adopt more ICTs in their businesses. In this regard ICTs serve as a means of increasing productivity and efficiency. The study therefore, recommends that awareness be increased on the importance of ICTs amongst firms. In addition, company owners should be encouraged to train their employees in ICTs usage. Innovators should develop specific ICT systems that benefit firms in their areas of expertise. Firms must be encouraged to adopt and use ICTs in carrying out their businesses.

Keywords ICTs' adoption, Manufacturing and business firms, Effects on Zambian industry

1. Introduction

C. Blurton defined ICTs as a set of technological tools and resources used to create, communicate, disseminate, store, and manage information [8]. According to The Research Council of Norway ICTs include hardware, software and Netware as well as Institutional, financial, cultural and application-related parameters that determine how ICT will be shaped and developed by society.

People create technology and choose to adopt it. Once technology has been adopted, it can change individual's lifestyle and how they relate to other people and the environment [15]. There is no guarantee that every innovation will be adopted by the target market. The videophone never took off partly because it never reached critical mass. The videophone was not really any better than a regular phone unless the person you were calling also had a videophone. The worth of adopting videophones was as much as the number of people who possessed videophones [9]. The rapid development of Information and Communication Technologies (ICTs) across the world is quickly changing the way people interact and conduct their businesses. Research has found that adoption of ICTs can trigger economic and social development by being a part of capital deepening and a tool with which individuals and organisations can rapidly diffuse information [5].

1.1. ICT Adoption and SME Growth in Developed Countries

The website (www.tfi.com/ctu) show trends in Internet usage in the United States. By 2008, 74 million (63%) American households had high speed broadband access (Kessler, 2011). In 2009, the penetration increased to 70.9%, then to 75.3% in 2010 (More Americans, 2012). IDC reported that Internet users worldwide reached 1.5 billion in 2008 and forecast that the number would reach 2.3 billion in 2013, an annual growth rate of 9% (Kessler, 2011).

In 2010, the average amount of time per month spent connected to the Internet ranged from 22.3 hours per month for users of ages 12-17 to 39.3 hours for users of ages 45-54. Age groups in the range of 18-24; 25-34; 35-44; 55-64; and 65+ all averaged between 32.2 and 37.4 monthly hours of Internet activity (Kessler, 2011). The Internet became the

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primary reason that consumers purchased new computers during the first decade of the 21st century, (Kessler, 2007a). Cable modems and Digital Subscriber Line (DSL) telephone line connections increased among home users as the means for connecting to the Internet, as more than half of American households accessed the Net with high speed broadband connections.

Outside the United States, DSL has an edge over cable Internet access because of the much greater penetration of wired telephone lines relative to cable infrastructure (Bensinger, 2007). Viewers on YouTube, an online video viewing service created in 2005, watched 63 billion videos online that year (com Score as cited in Kessler, 2011). By 2010, 441 billion videos were seen online, representing an annual growth rate of 38% (Kessler, 2011).

In 2010, 142.4 million American households were viewing videos via the Internet, up by 4.8% from 2009. The average household viewing of this type occurred for 14 hours and 33 minutes monthly, an increase of 34.5% from the previous year (Amobi, 2011a). In July 2011, more than 180 million unique viewers of Internet video consumed an average of 1,107 minutes of online video (Kessler, 2011).

Apart from having widespread usage among households, ICTs are widely used by SMEs and multinational companies all across the world. This has resulted in the general increase of ICT facilities such as Internet servers. In 1994, Internet content was hosted on about 10,000 web servers. By 2006, more than 100 million servers were operating. In 2008, 187 million websites were operating and the number increased to 234 million in 2009 and 255 million in 2010. In 2011 online commercial revenues were 25% higher than in the previous year and the sixth consecutive year in which growth occurred. "By any measure, the internet has been one of the fastest growing commercial phenomena in history" (Kessler, 2011, p. 17).

The internet has changed the social aspect of society especially among the young people. Online access has spurred the development of social networking services, particularly among teenagers.

Social networking also operates through a variety of online services that allow individuals to use mobile phones to send out reports of daily activities. Social networking mobile applications such as twitter, WhatsApp and Facebook are obtained from websites online. The WhatsApp mobile application has found wide adoption for sharing messages, photographs and documents at all levels of human interaction (Stone & Richtel, 2007). Facebook emerged as the most popular social networking service (Kessler, 2009). In February 2010, the service reported more than 400 million users, a number equivalent to the third most populous country in the world, larger than the United States. The number of users passed 500 million in July 2010 and 750 million by mid-2011. More than 250 million users accessed the service in 2011 with mobile devices. By late 2010, Facebook had become not only the largest social network in the world, but the third largest Social website of any kind (Kessler, 2011). Blogging and micro blogging became popular in the early 21st century. *Twitter*, a micro blogging service that takes advantage of the Internet, was created in 2006 by a group working at Odeo, Inc. (Sagolla, 2009). The group created *Twitter* while attempting to develop a technique of communicating short text messages by mobile phone. The messages, or *tweets*, consist of 140 characters. By March 2011, Twitter registered 175 million users, equivalent with the seventh most populous nation in the world (Kessler, 2011).

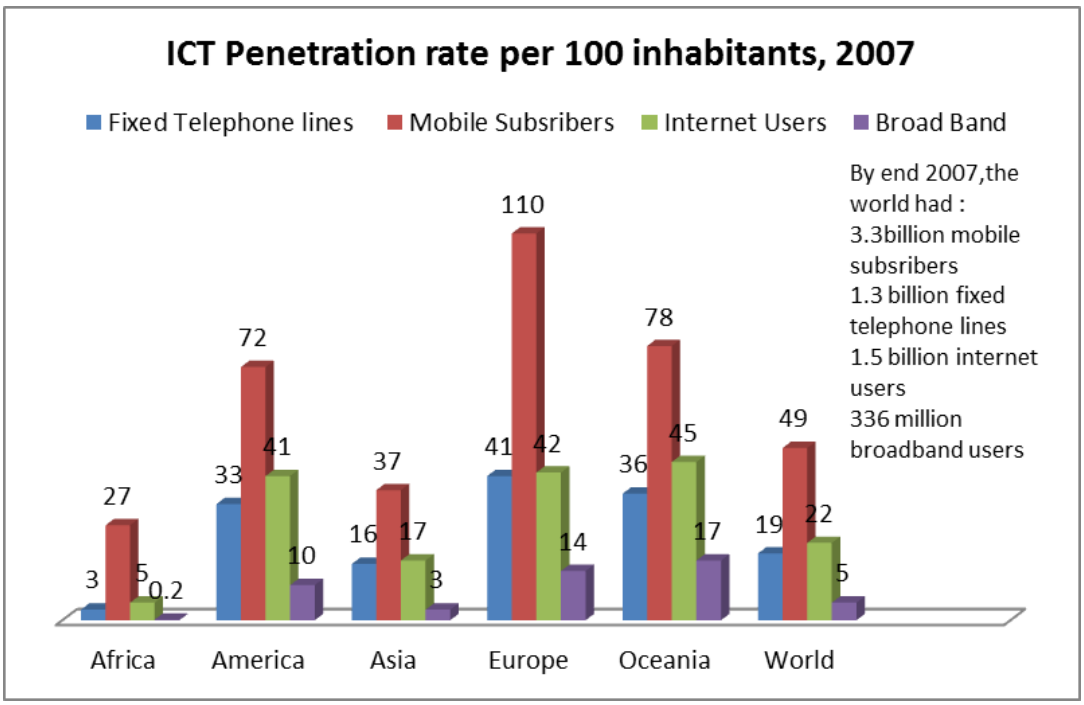

Figure 1. Global statistics on ICT penetration rate (Source: www.itu.int)

When an innovation has been adopted by individuals it's more likely to find broad adoption at firm level too. Locke (2004) carried out a study to establish the impact of ICTs on small scale businesses in New Zealand. The study revealed that there is a vivid relationship between ICT and the growth of small businesses, the nature of this relationship, and how it is affected when considering other factors found to have significant impact upon the ICT-growth relationship. It was found that high levels of internet adoption coupled with moderate adoption of cellular phones were encouraged by small scale business in New Zealand in order to promote growth in profit margins (Locke 2004). The research revealed that, 65 percent of the businesses experienced growth in sales levels and 57 percent achieved an increase in profitability over a twelve months period. The least frequently realised improvement in performance was an increase in market share, with 54 percent of the sample having achieved growth in such terms.

For the sample businesses that experienced an improvement in market share over the period of three years, half made high use of cellular phones and 40 percent made high use of the internet. This was not significantly different to a slightly lower 42 and 36 percent respectively for businesses that experienced growth in market share.

However, the extent to which small and medium enterprises are taking advantage of ICTs demands further investigation tailored to the Zambian industry. Zambian SMEs can emulate the strides undertaken by SMEs in New Zealand to establish new trends of ICT adoption in Zambia despite the different economic environments prevailing in the two countries.

1.2. The Integration of ICTs in Decanters

This is a case of industrial application of ICTs. The case study investigated and explored how Alfa Laval integrated ICTs into decanter centrifuges, allowing clients to run more efficient processes for sludge dewatering in wastewater treatment plants. Wastewater treatment plants treat effluent water and recycle safe water to waterbodies. Alfa Laval's business idea relates to the last phase in the wastewater plant. It involves manufacturing decanter centrifuges designed to remove as much water as possible from the sludge. This is the most cost-intensive process in the wastewater plant, representing some 35 per cent of the total operating costs [8]. Sludge dewatering is a constantly changing process involving a high degree of ambiguity, since the quality and density of feed also constantly vary. As the input to the process cannot be predicted it requires a high degree of attention if it is to run efficiently.

Alfa Laval began to work, on a system to automate decanter operations in 1991. After some problems related to ability to measure the quality of the sludge, the project was abandoned only to be revived in 1999 when improvements in the technology enabled sludge measurement. In 2002, Alfa Laval had a pre-launch of a self-optimizing system, Octopus, for sludge dewatering, which would operate at peak performance and optimize the dewatering process based on overall costs, solids recovery or cake dryness, independent of feed conditions. Octopus, in real-time, monitors, analyzes and adjusts the process parameters in the dewatering process in order to enhance the process in the absence of human supervision. Octopus is able to produce savings in the operating costs of the dewatering process of up to 20 per cent, which corresponds to a saving of about 7 per cent in the plant's total operating costs [8]. It also speeds up production as it enables plant operators to dewater sludge at a faster rate.

1.3. The Integration of ICTs in Compressors

This case study explored how Beta introduced new technologies to its compressed air installations, leading to reductions in energy costs through improved utilization of installed capacity. Compressed air plays a vital role in most industries in the world. A substantial part, around 30 per cent, of all energy used in industry is consumed by compressors [8]. Compressors are used for a wide range of applications that use compressed air as a source of power or as active air, in industrial processes. With a substantial increase in energy costs as well as pressure to limit carbon dioxide emissions, electricity consumption has become an important issue in many manufacturing industries. For compressed air users, energy costs are by any measure the highest cost center during the compressor's life-cycle [5].

Energy consumption represents around 70 per cent of the overall compressed air system life cycle cost, whereas the capital investment typically only represents 20 per cent and maintenance 10 per cent. Compressors typically have on board their own control. This control ensures that the compressor operates within a predetermined pressure range to deliver a volume of air that fluctuates with demand [5]. When the pressure reaches a predetermined level the compressor unloads decreasing the pressure and when the pressure drops to a lower predetermined level the compressor loads increasing the pressure. The range between these two pressure levels is the compressor's set-point, which defines when the compressor should load and unload. Local control works well in situations where a company has a single compressor and steady demand. However, most companies have a multiple compressor installation and add compressors as demand increases. When there is a series of compressors running, the load/unload of pressure of the individual compressors needs to be offset in order to prevent compressors from starting at the same time and to ensure stability in the net pressure. This method of connecting compressors is called cascading, and is the basic way of dealing with increases in air demand, resulting in a waste of a lot of energy. Beta considered that if it could lower the customer's energy costs this would result in a considerable saving of money over a compressor's life cycle.

Beta acted upon this business opportunity in 1999 by working on development of a centralized control system

operating in real-time. The idea was to optimize the running of compressors so that the customer could match demand with compressor output, as close as possible to what was required. The control system therefore had to be able to select what compressors need to be run, and stabilize and lower the pressure to the lowest possible point.

In 2002 the company had achieved a centralized control system that allowed customers to automatically select the optimum mix of compressors, either by installed power or by technology, allowing a reduction in the required working pressure, through a pressure sensing signal and control at one centralized point rather than at every individual compressor. The control takes over operation from the local compressor controllers and works with one communal set-point in lieu of one set-point for every compressor. In real-time the control selects the most energy efficient and optimal compressor mix, and their operating points. This enables users to save around 10 per cent on their energy costs, which is considerably great value for the customer.

This centralized control was enabled through the incorporation of ICT into the compressed air installation. The control system comprised of hardware and software. The control system hardware consists of an industrial computer, a monitor and a controller area network which links all local compressor controllers to the centralized controller unit, the computer, in the form of a closed box. It is the software inside the computer that is critical to the control system.

The software consists of algorithms of the compressor's operation, including reaction times, and flow and energy characteristics, and control logic for starting, stopping, unloading and loading the compressors to maintain the user-defined pressure level, which involves decisions about which compressors should be run. These algorithms represent Beta's core capabilities and are highly specific to the company. While the algorithms were developed in-house, everything related to the coding and manufacture of the hardware was contracted out to external suppliers.

1.4. The Integration of ICTs in Ball Bearing Housings

This case analyses how SKF tried to provide monitoring of customer application processes around its process point, the bearing, to create new value for users. Ball bearing housings, which are an important part of SKF's product portfolio, are used to protect bearings from break downs. In many applications, it is sufficient just to have a bearing housing for the bearing, which runs until it breaks down; in others bearing housings are not needed. Though, some applications are very critical and it vital for processes to function continuously with no unintentional stops or redundancy in production, which in some industries would prove extremely costly. By measuring various parameters around the bearing SKF was able to extract information about how a given machine was performing, which brings benefits such as production reliability, increased safety and increased application knowledge. From as far back as the mid-1980s SKF had measured these various parameters using decoupled sensors, through point measurements in large production and process plants. It believed that it could increase functionality for its customers by incorporating an integrated sensor solution into its ball bearing housings. The initial idea was to equip all ball bearing housings with shaft diameters of 50–120 mm, annual sales of which were some 500,000, with pre-installed sensors that could measure speed and temperature. SKF considered that to prepare the housings with these sensors would not cost much and could become the reference point in bearing housings. A vibration sensor, on the other hand, was more expensive.

The ability to measure temperature and speed would become the new selling point, which it was hoped would increase the chances that customer would want the functionality that the new technology would provide. It was also seen as providing an efficient distribution channel. If customers wanted the monitoring functionality they would be able to purchase a box that could be connected to the housing and that would show the data on a display, or even charge the customer, depending on how much the customer exploited the functionality of the new technology for controlling machines.

In 2003 SKF launched what it called Smart Housing, which was a bearing housing equipped with sensors and electronics for monitoring the customer application process in which it was being used. With Smart Housing allowed vibrations (axial and radial), temperature and rotational speed to be measured within the bearing housing, giving a status report on the customer's application. The sensors and electronics in Smart Housing reside in the base cavities of the bearing housing. Signals from the sensors are transferred by two connectors on the front of the housing. One connector is connected to an assembly of two directional accelerometers in the sensor holder, which deliver axial and radial vibration. The other connector delivers rotational speed and bearing seat temperature, which are protected and adjusted by a printed circuit board. Temperature is measured by an integrated circuit sensor with linear relation to temperature, while speed is measured by a Hall Effect sensor sensing a magnet mounted on the shaft. Signals are transferred to data collectors or analysis equipment through the output connectors. The user can either employ a portable device for periodic monitoring or a local monitoring unit for continuous monitoring. The connectors and sensors are standard equipment and can be incorporated into any third party systems, but can also be bought from SKF. The signals can also be incorporated into process control and decision support systems.

1.5. Research Justification

From the statistics above it can be seen that there is no guarantee that any technological advancement will attract corresponding consumer adoption. Africa has the least ICT penetration rate in the world. New technologies are adopted to solve problems but they created new problems too. For

example, anecdotal evidence from physicians and physical therapists reveals that the growing popularity of laptop computers is increasing the number of people suffering from wrist, neck, shoulder, and back pain. And that is due to the awkward places many people use laptop computers, such as traditional college lecture halls with cramped seating and tiny writing surfaces [23]. The adoption of motor vehicle technology has resulted in severe emissions of greenhouse gases which have denatured the global climate pattern leading to global warming.

The effect of ICT adoption in manufacturing and business firms has to be researched on as some work is already available on households.

1.6. Problem Statement

There is little research done on the Impact of ICTs on the Zambian Industry. The world has moved towards the Information age hence the need to investigate the impact this change is having on firms.

It is vital for sound policy formulation at personal, organisational and national level to understand the impact of ICTs on society.

Among several macro environmental factors affecting mobile telecommunication companies' ability to serve their customers in Zambia is the technological environment. Not only is Mobile telecommunication service provision high capital intensive but the pace of asset replacement and investment in new technologies is extremely rapid. In addition, there is increased research and development where most technological advances focus on minor improvements.

This creates an investment dilemma and limits the diffusion of ICTs in Zambia. As a result there are huge adoption and usage gaps of technology in Zambia. For instance from the time 4G (LTE) was unleashed on the market in 2009 many operators in Zambia are still lagging behind rolling out this technology. However, other reasons unique to Zambia are yet to be researched. Once technology is adopted it changes people physically, mentally and emotionally. Technology adoption also changes the way people interacts with others as well as how people interact with the environment.

1.7. Problem Statement

To investigate the adoption and use of ICTs and their impact on selected manufacturing and business firms in Zambia.

1.8. Research Objectives

a. To investigate drivers for adoption of ICTs in selected firms in Zambia
b. To establish the types of ICTs used by firms in Zambia
c. To establish the effects of adoption of ICTs on firm's performance.

1.9. Research Questions

a. What are the types of ICTs existing in Zambia?
b. What is the pattern of ICT usage?
c. What are the effects of ICT adoption on firm's productivity?
d. What are the effects of ICT adoption on firm's efficiency?

2. Theoretical Framework

The research was based on roger's theory of diffusion of innovation. The innovation diffusion theory states that there are four factors which influence the adoption of innovation by target consumers.

Firstly, the innovation, secondly, the communication channel employed to communicate information about the innovation, thirdly, time and fourthly nature of the group to which it is introduced [17].

2.1. Conceptual Framework

The research was based on the concept that ICT Adoption rate is positively correlated to cost reduction, enhanced Quality of Service, Efficiency and competitive advantage.

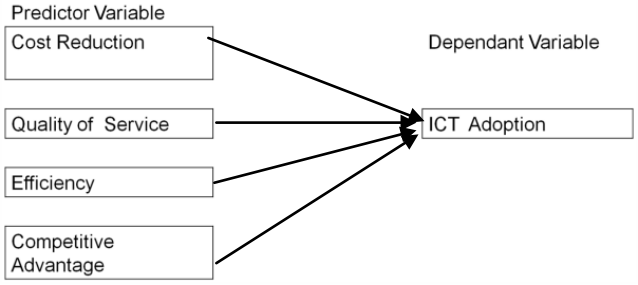

Figure 2. Conceptual Framework of the research

3. Research Methodology

Exploratory research is defined by Burns and Groove (2001, 374) as research conducted to gain new insights, discover new ideas, and for increasing knowledge of the phenomenon [6].

Exploratory research is aimed at discovering new information where no hypotheses or preconceived ideas exist [7]. Hence, a **cross sectional approach** was undertaken to measure firms' responses regarding adoption of ICTs and how it has impacted firm's operations.

3.1. Population and Sampling

A packet of 70 questionnaires, was sent to randomly selected organisations from mining, banking and finance, manufacturing and processing, education, professional management, IT related service and advertising sector in

Southern, Lusaka, Central, Copper-belt and North-western provinces of Zambia using stratified random sampling method.

Stratified random sampling is a method of sampling that involves the division of a population into smaller groups known as strata [14].

The strata were formed based on members' shared characteristics and then random samples were picked from each strata. The sample size of 70 was representative especially if you consider the central limit theorem or the law of large numbers. This theory states that given a sufficiently large sample size from a population with a finite level of variance, the mean of all samples from the same population will approximately equal to the mean of the entire population.

3.2. Ethical Consideration

Data was collected from the respondents based on the premise that the researcher will not expose the names of the organisations involved in the research.

Organisations involved in this research were not mentioned for fear of exposing confidential corporate information to competitors.

3.3. Limitations of the Research

This research is not without its limitations like other empirical studies. The sample consisted of manufacturing and business firms mainly from Lusaka and Copperbelt provinces of Zambia which may limit the generalizability of the results despite these regions being the industrial hub of the country. The sample size is relatively small considering time and resource within which the research had to be done. However, the sample size of 70 was representative especially if you consider the central limit theorem or the law of large numbers.

The research can be strengthened by increasing the sample size and including participants in other geographical areas. With an increased sample size, a more detailed empirical analysis among the independent variables and the variables that have multiple categories can be performed. Potential correlations between some of the independent variables (e.g. gender, race, education level of the manager) need to be reported in a future research.

3.4. The Demographic Characteristics of the Respondents

The demographic orientations of the respondents were as shown in the below. Respondents whose firms are based in Chingola equalled 3.2%, Chipata was at 1.6%, Choma 4.8%, and those who indicated Copperbelt for the sake of anonymity equalled 4.8%. The highest numbers of respondents were from Lusaka at 45.1% followed by Kitwe at 12.9%. Respondent whose firms have outlets across the country was at 3.2%.

4. Research Findings

4.1. Existence of ICTs in Manufacturing and Business Firms

The respondents were asked using a multiple response question to indicate whether some ICTs such as Computers, SCADA, telephone, CAD-CAM Software, Intranet and internet were present in their organisation.

Results in Table below reveal that 90.3% of the firms use computers, 91.9% use Software, 83.9% using phones, 93.5% use internet while 62.9% use intranet.

The availability of CAD-CAM Software among firms was at 27.1% that of manufacturing support software was at 29.2%, Design software was at 60.4%, while the prevalence of SCADA Software was at 47.9%.

The availability of office application for management purposes among firms was at 86.4%, Project Management applications were at 42.4%, Communication Software was at 44.1%, while 61% of firms make use of the Internet for management.

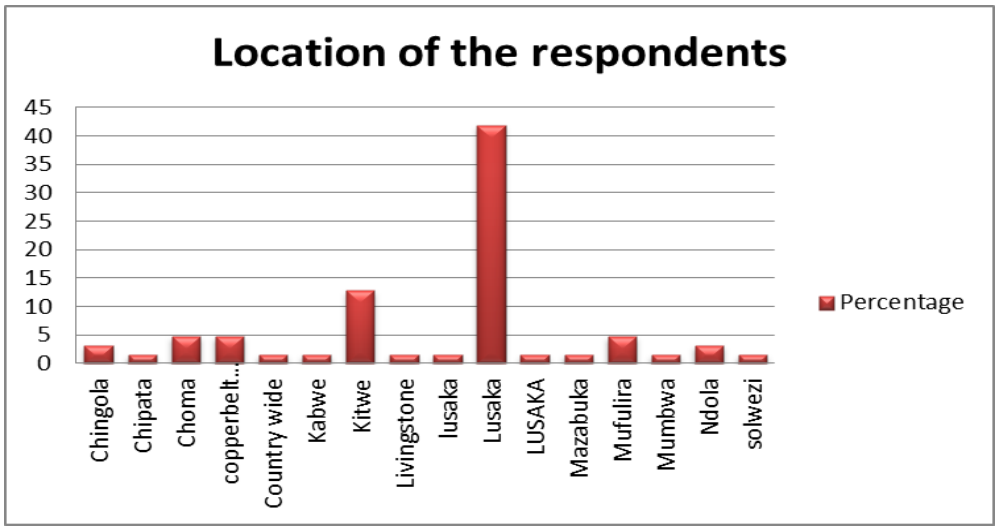

Figure 3. Physical location of respondents

4.2. The Pattern of ICT Usage in Manufacturing and Business Firms in Zambia

It was found that 77% of the cases use ICTs for Financial and administrative activities, 68.9% use ICTs for Internal and external communications, 54.1% use ICTs for monitoring company progress, 62.3% use ICTs for Providing Support to company processes and operations.

It was observed that 77.8% of the cases used ICTs for Process operations, 42.6% use ICTs for Feeding Operations, 40.7% use ICTs for providing support to Process and Feeding Operations. It was realised that 86.4% used ICTs for providing Technical Support to Personnel; 54.2% of the cases used ICTs for Training and Preventive maintenance while 23.7% used ICTs for system development.

4.3. Productivity and Efficiency Levels of Manufacturing and Business Firms in Zambia before and after Adopting ICTs

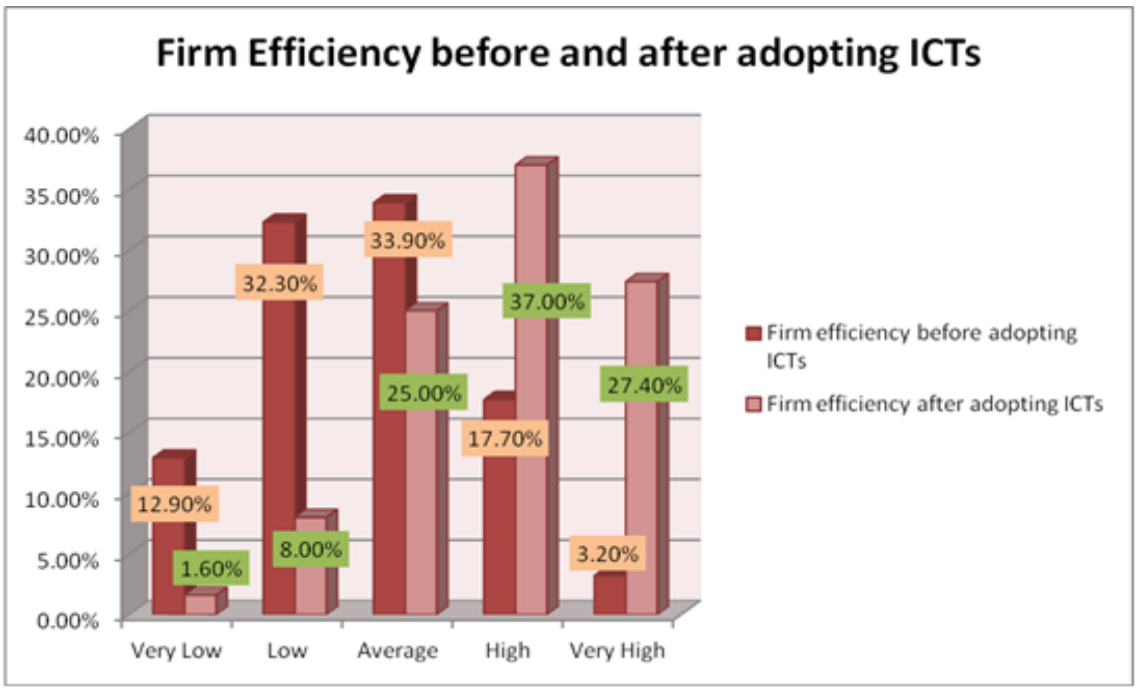

Figure 4. Firn productivity before and after adopting ICTs

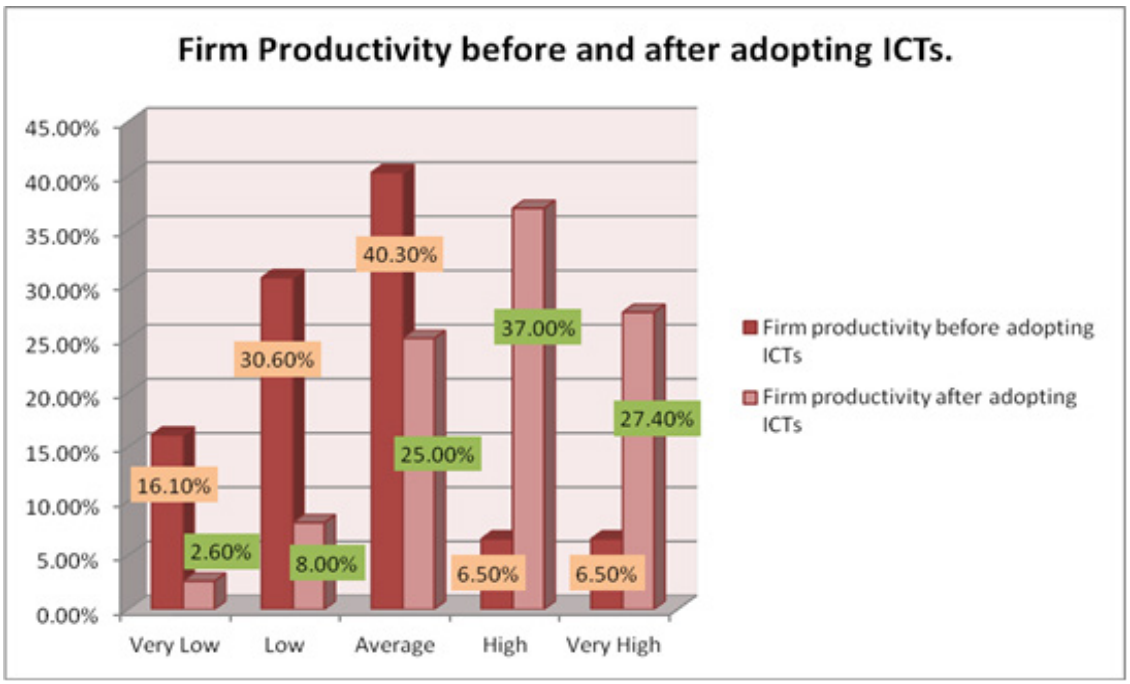

Figure 5. Firn productivity before and after adopting ICTs

Figure 3 above reveals how respondents described firm efficiencies before and after adopting ICTs. Before adopting ICTs, 12.9% of the respondents described productivity levels in their organisation as very low, 32.3% as low, 33.9% as average, 17.7% as high and another 3.2% as very high. After adopting ICTs the picture changed as follows: only 1.6% of the cases described productivity in their organisations as very low, 3.2% described it as low, 14.6% described it as Average, and 38.7% described it as high while 41.9% described it as very high. In the newspaper industries, digital prepress operations especially computer to plate technology has cut most of the photographic wastes from the process; this is how the respondents were able to determine changes in efficiency levels. Overall, respondents looked at how much they could produce with fewer raw materials. And with the adoption of ICTs many organisations realised that they could produce more products and services than before.

4.4. Productivity and Efficiency levels of Manufacturing and Business Firms in Zambia before and after Adopting ICTs

Figure 4 above reveals how respondents described firm productivity levels before and after adopting ICTs. Respondents realised that they could achieve the desired results in the quickest possible time frame and were capable of getting more done per specific period of time than before adopting ICTs. For example with the engagement of ICTs Airlines were able to check-in more people in a specific period of time than before. Printing plants were capable of producing more copies of printed newspapers and leaflets than before. Before adopting ICTs, 16.1% of the respondents described productivity levels in their organisation as very low, 30.6% as low, 40.3% as average, 6.5% as high and another 6.5% as very high. After adopting ICTs the picture changed as follows: only 2.6% of the cases described productivity in their organisations as very low, 8% described it as low, 25% described it as Average, and 37% described it as high while 27.4% described it as very high. IT related industries were able to use software to process data on least amount of hardware.

5. Conclusions

The research findings showed that there are significant levels of ICT adoption among manufacturing and business firms in Zambia. The higher the benefits in form of productivity and efficiency levels the more incentive there was for firms to adopt and invest in ICTs. The study revealed there was high level of utilisation of low cost ICTs such as computers, internet, intranet, phones and office applications compared to expensive high-tech software such as SCADA and CAD-CAM software. It was also realised that information processing intensive firms adopted and used more ICTs than others. The convergence of information technology, distributed computing and telecommunications has also contributed to the wide adoption and usage of ICTs among firms in Zambia.

From the research findings, it was established that ICTs have wide application not only in the production of goods and services but also in management and growth of organisations. ICTs found wide application in process operations, feeding operations Financial and administrative activities, internal and external communications, monitoring company progress and providing Support to company processes and operations. Overall ICT usage was deemed to be high in as many as 49.2% of the cases, while 14.8% of the cases had very high usage of ICTs.

It was found that firms were motivated by perceived benefits of adopting ICTs such as competitive advantage, Increased productivity and efficiency, Improved quality of service, cost reduction, achieving production flexibility and elimination human errors in production chain to adopt and use ICTs.

With regard to productivity and efficiency levels, it was found that after adopting ICTs firm's recorded high productivity and efficiency levels. And the more benefits firms accrued the more motivation they had to adopt and use ICTs.

In terms of sensitization of the public on the availability of ICT policy and Legal framework, it was discovered that there is a lot of work to be done as 43.3% of the respondents were still ignorant of the existence of ICT policy in Zambia. It was also realised that entrepreneurs and innovators are not taking advantage of the business opportunity the ICT possess, to create ICT related products.

In addition, ICTs help bridging communication gaps between suppliers since users and suppliers can communicate more easily through electronic mail and websites when sourcing raw materials (Kajogbola 2004). As a capital good ICT contributes to overall capital deepening of a firm consequently provides productive equipment and software to businesses which in due course improves labor productivity (Mouelhi 2009). Wide use of ICT increase the overall efficiency of a firm which in turn raises Multiple Factor Productivity (MFP) which measures the changes in output against every unit of combined inputs. Adoption and usage of ICTs in firms result in *inter alia* savings of inputs, general cost reduction, higher flexibility and improvement in production quality [11].

This changes the way society interacts, learn and access medical care through e-health, e-commerce, e-governance and e-education. E-Health is healthcare practice enabled by electronic processes and communication. The same principle applies to Ecommerce, Egovernance and E-education.

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