

**UTILIZATION OF PRINTING TECHNOLOGIES IN ENHANCING
PRODUCTIVITY AT THE KENYA LITERATURE BUREAU**

BY

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**A THESIS SUBMITTED TO THE SCHOOL OF INFORMATION SCIENCES,
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STUDIES IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
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DECLARATION

Declaration by Candidate

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DEDICATION

To God and Saviour, for His mercies, strength and grace throughout my studies as well as to my parents; late Mwalimu Christopher Menge Kiyaka and late mama Maria Kwamboka Menge for their prayers, love, care and upbringing that made me who I am today.

My late dad and mum would have loved to see the conclusion of this thesis and finally celebrate the graduation with me. Rest in eternal peace my heroes in the safe loving and everlasting arms of our Maker and Redeemer.

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ABSTRACT

Technological innovations, adoption and use of new printing technologies are key to the growth and development of the printing industry. They contribute immensely in terms of productivity where better quality print products, faster output and efficient printing processes and services can be achieved. Despite this fact, adoption and use of new or improved technologies in the printing industry in Kenya has been low. The aim of this study was to explore the kind of printing technologies being utilized to enhance productivity at the Kenya Literature Bureau (KLB) with a view to proposing measures for improvement. The objectives of the study were to: establish the range of printing technologies available at the KLB; determine the professional training levels of staff in using printing technologies at the KLB; assess perceptions of staff in using the printing technologies at the KLB; analyse the effect of new printing technologies on productivity; examine the benefits and challenges of the new printing technologies at the KLB and suggest measures for improvement. The study was guided by resource-based theory and Technology Acceptance Model. A mixed method approach was used in data collection, whereby both qualitative and quantitative data was obtained from a study population of 300 KLB staff, out of which, 56 respondents were purposively selected from Production Department to take part in the study. Questionnaires and interview guides were used to collect data from the respondents. Data was analysed using descriptive and inferential statistics as well as thematic analysis. The key findings were that KLB mainly uses the old conventional litho printing technologies which undermine productivity; they have little adoption to the new printing technologies and there is need to retrain/expose their staff. Despite the high perception rate (91.7%) on the usefulness of new printing technologies and staff concurrence that quality, effectiveness and efficiency are some of the key benefits they bring a long, there is a disconnect between “perception and the real situation”, meaning therefore that the printing technologies used in the organization’s printing press need improvement. The study concludes that customers demand convenience, better utility, and greater value for their money, which makes it necessary for the printing industry to keep on improving the quality, capacity and efficiency of their products and services and this depends on the kind of technologies used. The study recommends that KLB should replace the old equipment and the government should consider zero rating import duties on new printing technologies as a way of encouraging printing firms to adopt the new technologies. Also, staff training in the printing industry should be continuous and supplemented through exhibitions, workshops and seminars as a way of creating awareness of the new technologies and developments as well as an intensive educational experience in a short period of time, when the time for a more comprehensive effort may not be available.

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ACRONYMS AND ABBREVIATION

3D	- 3 Dimensional
4D	-4 Dimensional
CAD	-Computer Aided Design
CIM	-Computer Integrated Manufacturing
CTP	- Computer to Plate/ Press
DOIT	-Diffusion of Innovation Theory
DTP	- Desktop Publishing
GPD	- Global Partnership for Development
HR	- Human Resource
ICT	- Information Communication Technology
KLB	-Kenya Literature Bureau
MU	- Moi University
NACOST	- National Council of Science and Technology
PEOU	- Perceived Ease of Use
POD	- Print on Demand
PU	- Perceived Usefulness
RBT	- Resource-based Theory
SDG	- Sustainable Development Goals
SMS	- Short Message Service
STI	- Science Technology and Innovation
TAM	- Technology Acceptance Model
TQM	- Total Quality Management
TUK	- Technical University of Kenya
UK	- United Kingdom

CHAPTER ONE

INTRODUCTION AND BACKGROUND INFORMATION

1.1 Introduction

This chapter presents background information to the study, status of printing technologies in the printing industry in Kenya, statement of the research problem, the aim of the study, objectives of the study, the research questions that guided its undertaking, assumptions of the study and significance of the study. Additionally, the chapter presents the scope of the study, limitations of the study and ends with definitions of operational terms that were used in the study.

1.2 Background to the Study

Adoption and the use of new and/or improved technologies immensely improves productivity, creates opportunities for more people to be employed thus stimulating economic growth (Rifkin, 2012).

Foroohar & Saporito (2013) predicted that new technologies will be the main driver in the soon coming major technological revolution, which is expected to have a huge and profound economic impact on the manufacturing sector, (where printing also falls). Evidence from the Organization for Economic Co-operation and Development(OECD), including firms in the United States shows a widening gap between the most and least productive firms within industries, in the post-2000 period (Andrews *et al*, 2016). Within the printing industry, such a widening productivity gap could be the cause of increased frustration among printing service and product seekers, more especially in the developing world.

According to Hall and Khan (2002), the contribution of any new technology to a country for the purpose of growing her economy can only be achieved if and when it is accepted, used and widely shared. Technological innovations are key for the growth of the printing industry and by extension, the development of countries and the world at large. They contribute immensely in terms of better quality print products as well as faster and efficient printing processes and services (Pira, 2006).

As stated in the Sustainable Development Goals (UN, 2015), the use of new and improved technologies is a major driver in increasing the standards of living. For that reason, the Global Partnership for Development (UN, 2017) is of the view that developing countries would greatly benefit their economies by accessing and using new technologies and this includes the new printing technologies.

Ndemo (2018), in the *Daily Nation* argued that Africa has been and is most likely to continue having development challenges and lagging due to inadequate and/or poor technologies.

New technologies are regarded as geographical boundaries' extension tools for printing establishments thus very important. Of equal importance are information and communication technologies (ICT) that assist printing and publishing companies in extending control, as well as in the reduction of coordination costs within large networks of geographically dispersed subsidiaries, customers and suppliers (Chen & Kamal 2016). ICTs therefore foster the international expansion of both printing and publishing firms. For example, a printing firm with a piece of work that is time-consuming (100-150 hrs for one part) requires better equipment and experienced staff, in addition to strong ICT support. When a printing firm used new technologies in the production step through an installed robot for the same piece of work, the robot was

faster (20 hrs for one part, working 24/7), showing increased productivity thus giving that firm more flexibility and responsiveness (Dachs, Kinkel & Jager 2017).

1.3 Status of Printing Technologies in the Printing Industry in Kenya

The printing industry is facing a myriad of challenges and issues to do with technology and strategy such as inadequate exposure to new technologies and business models; insufficient quality production materials (and by extension work output); print production services and products of inferior quality and inadequate professional training for staff (Shiyoya, 2008). Other challenges include; resistance to change (reminiscence to the recent case where local media houses had to be forced to migrate from analogue to digital TV broadcasting through government intervention), continued use of technologies and/or equipment belonging to the old generation and inferior to those found in the developed world (Rotich, 2014), lesser quality publications – one of the reasons why many companies, including government agencies, go for printing services outside the country (case of the last general election materials from Dubai-based Al Ghurair printers being a good example), instead of sourcing them from within.

Kenya Literature Bureau (KLB) prides itself as the only publisher in the country offering commercial printing services through its full-fledged printing press (KLB Production dept., 2014). Their records further indicate that the establishment uses vintage Western printing technology, which can handle all processes (from start to finish) in-house in an efficient manner and that the department is fully equipped with complementary sections which handle jobs on a modular basis - right from origination, press and to bindery functions. However, the situation on the ground seems to suggest otherwise because of the many challenges the department is

currently facing. Most of these challenges at KLB's printing establishment (as well as in many other printing firms in the country) can be attributed to failure to adopt and utilize the new printing technologies.

For the country to overcome most of these challenges and achieve its development goals as laid down in the Vision 2030 blueprint (Kenya vision 2030, 2012), adoption and use of the new and/or improved technologies in all the economic sectors (including publishing and printing sectors) is paramount. Under the social strategy, for instance, it is clearly stated that there is need for "more efficient productivity" by the existing industries in the country through the exploitation of knowledge in science, technology and innovation (STI) in order to function more efficiently, improve social welfare, and promote democratic governance" (Kenyan Vision 2030, 2007, p. 18). In relation to this, there is need therefore to embrace new/improved printing technologies and this should also go hand in hand with adequate professional training in the printing industry in Kenya - for the latter to thrive and move along with the rest of the world.

1.4 Statement of the Problem

Kenya Literature Bureau is mandated to print and distribute publications such as school textbooks, periodicals, journals, and magazines at affordable prices. However, the organization is still grappling with the challenges bedeviling the printing industry in the country. In addition, KLB's printing unit is also faced with little production activity particularly in periodicals, magazines, and journals, as well as efficiency and capacity concerns, constant machine breakdowns, high maintenance and servicing costs, low staff morale among others. This, therefore, means that the department is not

fully meeting its objectives. Could this situation be attributed to the kind of printing technologies they use?

All the above challenges could put the delivery of quality publications and services to their customers in jeopardy as well as a recipe for grinding both the printing and publishing industry to a halt, given that it is the only book printing cum publisher in Kenya. Moreover, the country can be hindered from achieving her sustainable development goals. This study therefore aimed at exploring and answering the question: which printing technologies are KLB using to enhance productivity?

1.5 Aim of the Study

This study aimed exploring the kind of printing technologies being utilized to enhance productivity at the Kenya Literature Bureau (KLB) with a view to proposing measures for improvement.

1.6 Objectives of the Study

The objectives of this study were to:

1. Establish the range of printing technologies available at the Kenya Literature Bureau;
2. Determine the professional training levels of staff in using printing technologies at the Kenya Literature Bureau;
3. Assess perception of staff in using printing technologies at the Kenya Literature Bureau;
4. Analyse the effect of new printing technologies on productivity; and
5. Examine the benefits and challenges of new/improved printing technologies and suggest measures for improvement for enhanced productivity at the Kenya Literature Bureau.

1.7 Research Questions

- i) Which printing technologies do the Kenya Literature Bureau's pre-press, press and post press/finishing sections use?
- ii) To what extent are staffs using the printing technologies at the Kenya Literature Bureau professionally trained?
- iii) What are the perceptions of staff on the printing technologies they use at the Kenya Literature Bureau?
- iv) How do the printing technologies currently in use at the Kenya Literature Bureau affect quality, capacity and efficiency of print production?
- v) What are the benefits, challenges and measures for improvement for better productivity at the Kenya Literature Bureau?

1.8 Assumptions of the Study

The study assumed that:

- a) Continued use of conventional printing technologies undermines productivity at the Kenya Literature Bureau;
- b) Staff of Kenya Literature Bureau face various challenges due to the kind of printing technologies they use; and
- c) Use of new/improved printing technologies will enhance productivity at the Kenya Literature Bureau.

1.9 Justification of the Study

Because of the rapid technological changes taking place and with digital printing becoming common place, there is need to explore and understand how printing and publishing firms are strategically positioning themselves (Resource wise) towards realizing sustainable competitive advantages, out of proper development and utilization of new printing technologies. It is equally important to understand staffs'

perceptions about the technologies and changes taking place because it's those perceptions that determine whether or not, they will accept and/or utilize those technologies.

1.10 Significance of the Study

The study brings to the fore, issues surrounding adoption and use of new/improved printing technologies at the Kenya Literature Bureau. The findings are expected to be useful in guiding the formulation of strategies for addressing identified challenges. The main players in the implementation of the findings will be Kenya Literature Bureau as an organization, developers of new printing technologies/equipment together with those charged with their installation and maintenance, as well as other printing and publishing firms which are also expected to continually inform staff on new developments regarding printing technologies and training them on the same. Policy makers in the Ministries of Education and Finance can also use the findings to encourage adoption and use of new and/or improved printing technologies to enhance productivity. Hopefully, the study will also contribute new knowledge to scholars, more specifically those in institutions that teach printing and publishing.

1.11 Scope of the Study

This study was conducted at the Kenya Literature Bureau and sought to get a deeper understanding of the benefits as well as challenges presented by the kind of printing technologies used in the printing and publishing industries, developers of new printing technologies and those charged with their installation, use and maintenance.

1.12 Limitations of the Study

The researcher expected that some or all findings of this study would apply to other printing firms in the country although it was confined to only one commercial book

printing cum publishing organization, which cannot be a representation of the entire printing industry. Also, due to the wide geographical distribution of printing firms and the need for looking into the situation more deeply, the researcher thought it prudent to concentrate on one firm (so as to maximize on the limited time and finances at his disposal), and KLB in particular because of its convenient location as well as being within his area of interest (printing) as well as a publishing student. The researcher expects the study to provide interesting findings that can arouse curiosity for further research.

It was a challenge obtaining all the information required due to the confidentiality nature of organizations and/or individuals working within them. The researcher had to make several visits to the KLB's Human Resource and Production offices as well as use a persuasive language to be allowed to get this information.

Getting all the respondents available was also not easy as some were either off duty, on leave or out of the office on official assignments but the researcher had to persistently follow them up and employ other means such as personal contacts and booking appointments, social media (WhatsApp), telephone calls, emails and SMS to be able to get the information.

1.13 Summary of the Chapter

This chapter discussed and covered the background information to the study, status of printing technologies in the printing industry in Kenya, the research problem, aim and objectives of the study, the research questions, assumptions, significance, scope and limitations of the study before concluding with definitions of operational terms used in the study. It is clear that new technologies are the agents of change and printers have no choice but to embrace innovation and new technologies in all their operations

be it in planning, design, typesetting, plate making, printing and finishing. Print production using new or improved technologies is faster, economical, better, efficient and effective. The geographical distribution of printing firms and the services they offer should no longer be a barrier in this 21st century. Next chapter covers literature review.

1.13 Operational Terms Definitions

The terms used in this study apply to information relating to the research topic. These include: Utilization, effect, enhancing, conventional technology, printing technology and range.

Utilization: With reference to this study, the word means the use of old and new printing technologies.

Effect: In this study, the word refers to the change expected in the use of new or improved Printing Technologies.

Enhancing: This word means to increase, or further improve the quality, value, or extent of printing processes and/or products in this study's context.

Conventional Technology: With reference to this study, this means the traditional methods or processes of printing.

Printing Technology: In this study's context, this term refers to the methods used in performing printing activities beginning from graphic design, typesetting, film making, assembling of the elements, plate making, impression making/rolling of the copies on the machine and print finishing.

Productivity: The word as used the study stands for; quality, capacity and efficiency of print production processes and products.

Range: With reference to this study, the word refers to the various methods used in printing technologies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

To be discussed in this chapter is the theoretical framework upon which the study is based and a review of literature or what other scholarly works and other primary and secondary information sources say on printing technologies. The findings from the literature review are as follows: a range of printing technologies; training levels of staff in using printing technologies; perceptions of staff in using printing technologies; effects of the new printing technologies on productivity (quality, capacity and efficiency); benefits and challenges of using new printing technologies.

2.2 Theoretical Framework

The theoretical framework is “the plan or blueprint for the entire inquiry” (Grant, 2014). Also, a network of hypotheses advanced in order to conceptualize and explain a particular social or natural phenomenon is referred to as a theory (Gill and Johnson, cited in Pathirage *et al.*, 2007). A model is a representation of an idea, an object, process or system in diagram form so as to explain or describe a phenomenon or phenomena (Akoranga, 2014).

Both the resource-based theory (RBT) and Technology acceptance model (TAM) were applied in this study.

2.3 Resource-Based Theory (RBT)

This theory was put forward by Penrose (1959). The focus of the resource-based theory (Wernerfelt, 2004) is the internal strengths and weaknesses in the resources owned by an organization. It shows how a printing firm manages processes, allocates and deploys resources, all in order to improve her performance. For successful

implementation of strategies in firms, resources have to be strategic as well (Barney, 2003). RBT was developed to help in understanding how organizations realize sustainable competitive advantages out of the proper development of new printing technologies. This theory therefore gives an insight into the utilization of the new printing technologies and their advantages on print production processes at the firm level.

In a contemporary view, the resource-based perspective includes firms' publications (Barney, 2003). RBT proposes that the resources owned by a firm are the main determinant of how it performs and are likely to contribute to its sustainable competitive advantage (Wenerfelt, 2004). According to Barney (1991), the idea of resources is all that a firm owns in terms of; knowledge, information, assets, allotments, capabilities, processes within organizations, to name but a few. These are usually controlled by a firm to enable it to device and implement strategies that improve its effectiveness and efficiency (Barney, 1991).

The resource-based point of view means therefore that there is a concerted effort in looking at resources possessed by the printing firm as an entity or by its associates. This includes the various resources (and capacities) that can determine a firm's performance and long-term progress or growth, stagnation or decline (Mwailu & Mercer, cited in Wanjiru, 2018). The resource-based perspective aims at giving an idea of what a firm owns in terms of resources before and during decision-making processes and the business strategies to be employed within the firm. Its other goal is to describe possible needed adjustments in a company or organization (in systems and structures) in order to be able to implement business strategies. Also, this view has a definite focus on management, its finite access to information and its capability to

work effectively and efficiently with a business game plan (Mwailu & Mercer, 1983). Lastly, the resource-based perspective stresses the need for firms (printing firms included) to show how to change (in a compelling way) the ingredients (resources and capabilities) so as to achieve their full potential.

Both as an art and science, printing has become increasingly complex and sophisticated since the production of the first Bible on a movable-type by Johann Gutenberg's invention way back in 1455 (Adams & Faux, 1982). Consequently, there is a need to continually look at the resources involved, (including the technologies) which keep on changing.

Looking at it from an industrial point of view, the advent of new technologies has led to extensive changes in the design and capability of printing presses (Holusha, 1993). Additionally, each change of printing presses enables commercial printers to offer better and faster services in order to meet the needs and expectations of their customers (Rubenstein, 1988). Those that do not embrace innovation and changes do so at the risk of stagnation and eventual collapse.

2.4 Technology Acceptance Model (TAM)

Davis (1986; 1989; 1993) and Davis, Bagozzi, and Warshaw (1989) introduced the Technology Acceptance Model (TAM), which is presented in Figure 2.1, for modeling user acceptance of information systems. It begins with the proposition that external variables are the basis for finding the impact of external factors on two main internal beliefs - perceived usefulness (PU) and perceived ease of use (PEOU). These two affect each other over and above external variables (Taylor and Todd, 1995). Perceived Usefulness is defined as the extent to which a person believes that using something or a system will enhance his or her performance. Perceived Ease of Use is

defined as the extent to which a person using something or a system believes that the benefits of its use far outweigh the efforts of using it (Davis, 1993).

These two perspectives (perceived usefulness and perceived ease of use) both influence peoples' attitude toward using new or improved printing technologies. Attitude toward using sequentially also influences people's behavior of intention to use, which is the major factor in determining actual conditions of system use, while the belief of perceived usefulness also affects behavioral intention to use over attitude toward using (Taylor & Todd, 1995).

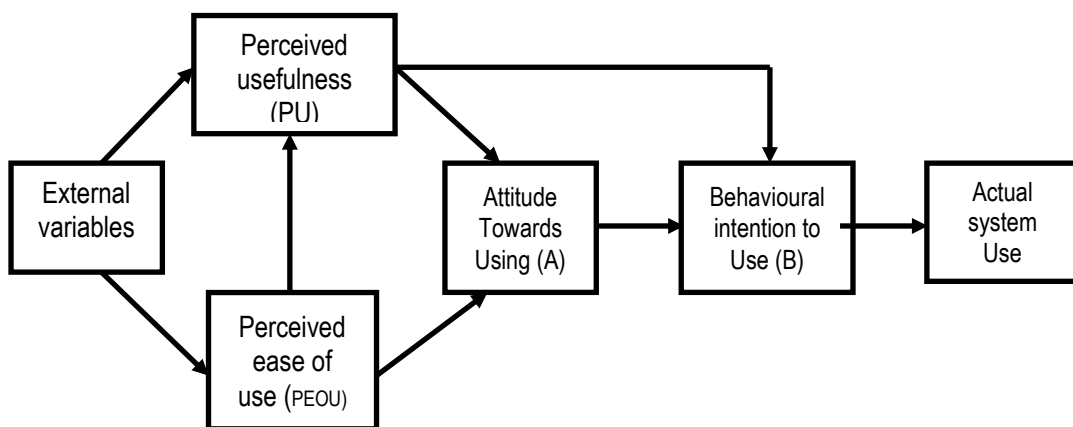


Figure 2.1: Technology Acceptance Model(Adapted from Wang and Liu, 2005)

The researcher reviewed three theories namely; diffusion of innovation theory (DOIT), resource-based theory (RBT) and technology acceptance model (TAM). He chose to apply two (RBT and TAM) because according to Pardiwala, (2016), two combined will give a better and complete understanding of the subject under study than using just one by itself. These two were chosen because they are more relevant and most appropriate for this study.

2.5 Range of Printing Technologies

Printing is the reproduction of something (which can be seen or perceived with our naked eyes) into larger quantities (Bruno, 1983).

According to Hoshino (2003), printing plays a significant role in our daily lives. At workplaces and elsewhere, people are always benefiting from the advantages of printed materials. For example, in an office set up, most of the work is based on the use of books, letters, notes, reports, memos, circulars and other documents (Hoshino, 2003).

Printing is usually achieved through three main process steps: pre-press, press and post-press (Gregory, 2019). Pre-press activities, also commonly referred to as origination are those processes that are carried out before the actual printing or rolling over the machine to produce copies takes place. They include; colour separation, generation and assembly of the visual elements, film making and lastly plate or image carrier making. Press activities are the actual reproduction of the copies and they include; washing or cleaning, machine settings to ensure proper registration, make-ready including sheet pass, machine adjustments and running of the press to the last copy. After the printing is the post-press/finishing whose activities include; cutting, trimming, folding/scoring, collating, gathering and binding as well as laminating or varnishing and packing (Kipphan, 2001; Smallbone *et al.*,2006; Graham, Kingsley and Owusu, 2015).

Anon (2009) observed that since the introduction of computers, printing has greatly improved over the years. For instance, digital printing (among the major developments brought about through the use of computers) presents excellent opportunities for producing newspapers in two areas: personalized newspaper which incorporates subscriber's personal content preferences, and distributed printing where small print runs are done at several locations (near the customers). This kind of printing (using digital presses) is commonly known as 'print on demand' (PoD). As an example, a printing press in Eldoret town can use a Kodak Versa mark for the

production of several British newspapers for local readers instead of flying the copies all the way from the United Kingdom (Anon, 2009).

Newspaper printing using ‘remote centers’ (also known as distributed printing- a new approach) could be the way to replace the current model of print and distribute (Smyth, 2008). To date, digital newspaper production has been restricted to mono color electrophotography. Color work production has been too slow and expensive but things are changing. The new inkjet color printers can produce over 1600 impressions per hour at a lower cost. This is most likely to present new opportunities for printers and publishers (Ward, 2017), as well as benefit the consumers. Already, digital printing is gaining momentum and is being used to produce short-run specialized magazines and books. Predictions are that publishing and printing of the same will remain strong in the coming decade (Smyth, 2008).

Digital printing is considered as the best way of improving customer service by combining versioned sections and personalized ones with those printed using the offset process (Anon, 2008). Magazines produced on demand (digital) by publishers could be availed and a web interface through which readers can choose their content, both editorial and advertising included (Silva, 2011).

The word “technology” is a wide concept, used in many ways: Some consider it to mean techniques, management, advertising or manufacturing while others equate its meaning to products, tools, equipment or machinery (Ali *et al*, 2009). According to Porter (1994), *technologies are comprised of the machinery, methods and equipment used to manufacture products*. However, some people also understand technologies in a wider sense of meanings such as patents, trademarks or licenses.

Printing Technologies are increasingly important in today's commercial world (Kubac, &Kodym, 2017). They have a wide application and are used to produce a long list of print by-products such as books (including religious materials), newspapers, labels, business cards, stationery, inserts, catalogues, pamphlets, advertisements, branding, carton & foil printing etc. Activities associated with printing technologies include data imaging and production, bookbinding, plate making, prepress services etc. (Government of Kerala, 2016).

Print production technologies are a build-up from a long list of inventions, some of which date as far back as 1540 when Johan Gutenberg discovered letter press printing. Engineering; physics and chemistry; information technology has contributed (positively) to printing technologies' development. However, computer and information technology have had and will continue to have a greater impact, not only on printing technologies but on the entire printing industry (Roos, 2019).

There are six main printing technologies and processes, namely; Lithography/offset, gravure/intaglio, flexography, screen, letterpress and digital (Pira, 2006). Within the digital printing technologies also lies the 3-dimensional (3D) and 4-dimensional (4D) both of which are generally considered as disruptive technologies, for advanced manufacturing systems (Kwon, *et al.*, 2015, Kubac, & Kodym, 2017). However, a significant number of printers argue that 3D and 4D fall within the printing industry as well (Services, Arts, & Package, 2017), making it an interesting and debatable subject.

Among these six technologies, the first five are considered as being strictly conventional and belonging to the old generation, although some can be (and /or are being) modernized or converted into digital through additions of peripherals. The

sixth and last one in the list (digital) is considered as modern and belongs to the new generation or part and parcel of the digital era (Pardiwala, 2016).

2.5.1 Lithography

Lithography which literally means “writing on stone” (also known as offset printing) was the invention of an author and actor of German origin by the name, Alois Senefelder way back in 1798. It was meant to be a cheaper way of publishing theatrical works (Feather, 1990; Norman, 2004). Litho uses a metal plate to transfer the image onto paper and/or other printing materials (commonly referred to as substrates) under high pressure via a rubber clothed cylinder commonly known as “blanket”, in printing terms. The name offset is derived out of a special blanket cylinder which was made and used to transfer ink from the printing plate on to the substrate or printing material (Gregory, 2019). It works as follows: the image (appearing on the printing plate as of right - reading) is pressed onto the blanket cylinder (as wrong- reading) first before getting onto the substrate (through impression) as right- reading again, just like it is appearing on the plate. Traditionally, offset printing is the most known printing technique for commercial printing (Viluksela, 2017; Kipphan 2001).

In terms of the working principle, both non-print and print areas are on the same level (planographic), whereby the print areas are oil receptive (oleophilic) and water repellent (hydrophobic), while the non- print areas are hydrophilic (water-loving) and oil repellent (oleophobic). Both ink (which is oil-based) and water are applied simultaneously to the plate, causing water to wet the arrears that should not print, thus preventing the ink from wetting them and getting into the image areas instead (Bruno, 1983).

Lithographic printing machines are categorized based on the maximum size of paper/substrate they can print, a number of printing units/ colors that can be printed at one go, the capability to print on one or both sides of the paper (non -perfecto and perfecto presses) in a single pass and how the paper is fed (Barnard, 2000).

The small offset printing presses that can print maximum sheet size of about 279.4mm x 431.8mm fall under the group of offset duplicators and these are mainly used for general, small and simple print and duplication jobs (Government of Kerala 2016).

Those that print on paper larger than 279.4mm x 431.8mm are called printing presses and they fall into two categories: sheet fed and web-fed or reel-fed presses. In sheet fed printing presses, the paper goes in one at a time (in single or stream feed systems) from the feed table on to the printing unit where it is printed and then channeled to the delivery unit (Government of Kerala 2016).

Web-fed or Reel-fed presses print on continuous lengths of paper fed into the printing machine from reels. They operate at a faster speed than that of sheet-fed presses and are normally fitted with other print finishing apparatus inline (Pira, 2006).

Reel-fed/web litho offset presses are also used to print other products, such as continuous forms, labels and cartons. However, for cartons, there is a limitation as to the substrate weight and length. It is not easy to accommodate the requirement for different print lengths and thicknesses, which is frequently necessary for these products (Pira, 2000).

Printing machines that can produce more than one color in a single print-run are called multi-color presses and contain a series of single printing units (ranging from two to ten), joined together in tandem to form one printing press. They could be

web/reel or sheet fed presses printing as from two to ten colors, depending on the make and customer requirements. Those that print on both sides of the substrate simultaneously are known as ‘perfecto presses’ while those that print on one side at a time are known as non-perfecto presses (Pira, 2000).

2.5.2 Letterpress

Letterpress, also known as relief printing or xylography is the oldest printing technology that was invented by Johan Gutenberg in the middle of the 15th century and remained the predominant printing technology for book printing and other uses until the last part of the 20th century (Berberovic, 2016). It is a mechanical technology which prints from raised images whereby highly viscous, paste-like ink is applied to the ‘raised’ images on a plate and then pressed against the substrate thus enabling the reproduction of the reversed image, turning it from wrong-reading to right-reading (Dittmar, 2009).

The printing master (plate) for the page would be made out of a block of wood (by pressing a hand-lettered page to its surface) so as to have character marks of ink remaining. Upon carving out the surface around the letters or characters, the raised surfaces which remain are then applied with ink and a piece of paper pressed onto it (Loubere, 2016). The plates were usually made of metal such as alloys of antimony, tin and lead but blocks of stone or wood which were carved were also used as alternatives.

The letterpress production process can be divided into two distinct approaches: Direct letterpress printing and letterset or indirect letterpress printing. With direct letterpress printing, the image to be printed is directly transferred to the paper (as right-reading) from the printing plate (which is wrong-reading). For indirect printing (letterset), the

image to be printed is transferred from the inked-up printing plate (which is right-reading) on to the substrate via a blanket cylinder. It gets to the blanket cylinder as wrong-reading so as to print on the substrate as right-reading (Pira, 2000).

Letterset printing is still used in special fields, particularly in packaging. The machines are grouped into: web/reel and high-speed presses, platen and hand presses - depending on the kind of pressing method used (Kipphan, 2001, Alberta, 2016).

Letterpress was mostly used for newspapers, books, business cards, posters, letterheads, billheads, forms and posters (Pira, 2006).

2.5.3 Gravure

Gravure printing technology (also known as an intaglio printing process) is where the print-image first gets formed by cells that are sunken into the surface of the image-carrier before they can be transferred onto the substrate (Print and Design Newsletter, 2018). Gravure printing was discovered in 1890 by a man from the Czech Republic by the name Karel Klíč. Before that, there was the copper engraving dating back to the 15th century. During that time, a motif was engraved (manually) into a copper plate in a process similar to gravure (Government of Kerala 2016).

Gravure works on the principle of ink's ability to adhere to a slight scratch or depression of a metal plate that is polished (Romano, 2004). It does not have a plate system like other printing technologies. Instead of a plate, the print image is directly formed in the outer surface of a copper-made cylinder. The print areas are therefore below the non- imaging areas. In other words, the image to be printed is buried into the surface of the printing master that is made through a photographic process. The cylinder is flooded with liquid ink, thus filling the recessed image cells in order to achieve printing. The excess ink is removed using a doctor blade and the non-image

areas are left clean for the material being printed onto to pass through without receiving ink while at the same time, recessed areas are able to transfer ink into it, under the impression. The tonal effect is achieved through varying the thickness of the ink of the printing surface by depressions of varying depths. Small points jointly form the clean surface that protects substrates such as paper from being pressed into the depressions (Pira, 2000).

The uniqueness of gravure as compared to the other printing technologies is that one can print the grey levels (grey scale) without using the halftone principle (screening).

Other major benefits include:

- Ability to produce very high-quality color work (when the right substrate is used)
- The ability to print at very high speed and achieve high volumes at less time
- The ability to achieve consistent quality throughout the print-run
- Quick to dry due to the use of volatile liquid inks
- Does not require a lot of energy to dry, thus less electricity used
- Has low waste levels

The main drawback of this technology is that the image-carrier of the gravure printing process is expensive to produce and therefore making it unsuitable for below 300,000 copies print runs. Other weaknesses of this technology include:

- It takes longer to prepare the image carrier (cylinder)
 - It is difficult and expensive to make corrections
 - Difficulties in the reproduction of line work as well as poor legibility of text.
- This is because cell patterns are visible in all line-work images.

- Poor quality print products when the surface roughness of paper is not as per the minimum specification requirements.

As a way of improving gravure as well as mitigating some of these limitations, there have been recent developments focusing on digitizing cylinder imaging and quickening changeover processes of gravure press cylinders.

Gravure technology is mainly for the production of large volumes, high-quality publications and packaging such as magazines and catalogues, flexible packaging and confectionery wrappings materials (Dittmar, 2009).

2.5.4 Flexography

Flexography, (also known as modern impact printing) is the modern fashion of the old Dickensian letterpress printing process. Another definition of Flexography is: a direct rotary printing method which uses resilient, raised-image printing masters that are fixed to variable repeat cylinders; inked by a roller or doctor-blade which wipes the engraved metal roll carrying paste type inks or fluid to virtually any substrate/printing material” Intergraf report (2016)

According to Gómez (2000), flexography has a rich history dating as far back as 1853 when J.A Kingsley was issued with a U.S.A patent for rubber plate compounds for printing. In 1890 the first printing press was built by Bibby, Baron & Sons. By then, it was known by the name “the aniline press”. The name “aniline” was changed to flexography in 1952 (Gómez, 2000).

The main features of the flexographic printing process are:

- Relatively soft or flexible plates (for printing) are used, unlike other processes. For contemporary higher-quality demands more especially in the production of packaging materials, photopolymer wash-off plates such as ‘Nyloflex’ from

BASF and 'Cyrel' from DuPont are used. These can accommodate screen resolutions of up to about 60 lines/cm

- Use of special inks that are fluid and fast drying.
- Can do both web and sheet-fed printing (for corrugated blanks).

The combination of these three features plus the possibility of variable repeat lengths printing is what makes flexography unique.

Flexo printing presses are operated using the following three steps: First, the printing plate (at the printing station) receives the low-viscosity ink. Secondly, printing takes place through the pressure of the impression cylinder and thirdly, drying takes place, quickly through evaporation (Pira, 2006).

Flexography is mostly used for high volume packaging materials' production such as paper sacks, corrugated boards, plastic bags and folding cartons. According to Intergraf report (2016) report on global printing, the only conventional process that is still steadily growing- majorly in packaging, production of labels, and printing of newspaper is Flexography. It states that... "by the year 2020, offset is expected to drop from 42%, flexo to rise from 22% to 24%, and gravure to hold steady, at about 12%" (Intergraf report, 2016).

2.5.5 Screen

Screen printing technology is also known as silk screen printing. It is a process common among artists, professional and commercial printers; large, small and medium-size. It uses a screen or stencil (instead of a printing plate) to have images printed onto various substrates through having ink deposited on the screen and forced through the image areas by a squeegee (Pira, 2000).

The first patent for screen printing was given to Samuel Simon of England in 1907 although by the 1600s; the technology was already developed in Japan and China.

In most cases, the screen that is used in this technology is a fine fabric made of metal or synthetic fibers, plastic or silk. These are very popular and commonly used nowadays (Dittmar, 2009).

Screen printing works on the principle of having ink imprinted or transferred onto the substrate through an image-specific open wire mesh which is uncovered by the stencil. A combination of stencil and screen is what makes the master - a printing plate equivalent. The printing properties and screen quality are dependent upon:

- ❖ The material that is used to make the screen
- ❖ The fineness of the screen (number of screen threads per centimeter of fabric length)
- ❖ Screen thickness
- ❖ Top and bottom sides' distances of the screen
- ❖ Screen apertures (degree of opening of the screen).

The three-screen printing methods are:

1. *The flatbed method*- This method (also known as flat-to-flat) works in such a way that both the printing master and the material to be printed lie flat and then ink pushed through the mesh apertures onto that material by squeegee movements.
2. *The flat-to-round method* – For this method, the transfer of ink onto the material to be printed is done using a cylinder that is rotating. The impression cylinder together with the printing master moves synchronously (in one

direction) and in the process, ink is pushed through the mesh apertures onto the material being printed by use of a stationary squeegee.

3. *Body printing.* - In this method, the form or printing master and squeegee both get adapted to the shape of the material to be printed on (i.e. maybe oval, cylindrical, curved, arched, square etc.). The form of printing master and the material to be printed on run synchronously (in one direction) against the squeegee that is in a fixed position. Balls, cans and on all curved surfaces are printed on, using this method.

Screen printing technology is the cheapest of all the six and is available everywhere including some private homes, villages, small and large towns. Its strength lies in the fact that it can be used in almost any shape of an object or substrate. It is commonly used for printing posters, banners, on glass, plastics, and textiles (more especially T-shirts) which oftentimes require a greater thickness of the ink to create interesting effects, some of which are not possible with other printing processes (Pira, 2006).

Some of the examples where screen printing is applied or used on a day to day basis include printing of T-shirts, caps and other apparel. For instance, logos or portraits are being printed day in day out using this technology (by even people with little technical knowledge) because it is easy to learn and operate. Anybody anywhere can be trained and be able to print for individuals and/or groups, more especially during special occasions such as; funerals, weddings, political rallies, religious, family and corporate events like Annual General Meetings, team building, roadshows etc. People are usually seen donned with quickly designed and screen printed attires during such occasions. In some cases however, this technology is being overtaken by digital, more especially the 3D because it is faster and of higher quality. This is happening more especially within the advertising and marketing (branding) industries where large

print posters and billboards are now being produced digitally, instead of by screen printing (Pira, 2006).

2.5.6 Digital

Digital printing starts from the point of digitization, which is simply converting data into binary digits or codes for reproduction as well as storage. Documents (both in text and graphics) are mostly digitized and transferred onto a digital device for storage as well as for output purposes.

According to Pardiwala (2016), digitization makes it possible for the production of text-based content for various media from a single source. Also, it enables the production of small print runs (in a more economical way) and offers printers the opportunity to get into customized printing such as direct mail (Pardiwala, 2016).

Digital printing technologies are alternative to traditional conventional technologies such as litho. They have taken over; more especially in short print run multi-color work, leaving the latter with only the high-volume and specialist color printing (Small bone *et al.*, 2013).

According to Pira (2016) extensive report on global printing, digital technologies are also doing much better than the more established “analogue alternatives” in the area of commercial print sector and labels. The report further indicates that globally in 2015 alone, they accounted for 2.5% of the print volumes and 14.6% in value respectively. This is projected to increase to 18.4% by 2020 as new applications especially in the packaging sector rise. The anticipated growth is attracting and stirring interest in some of the key stakeholders such as; the digital equipment manufacturers and suppliers of consumables (Pira, 2016; Pardiwala, 2016). The awareness of this motivation by all stakeholders (and more especially in the developing world) and

preparedness for the same would certainly help in creating a win-win situation for them all.

Digital printing technologies use toners or special inks. They are comprised of two major processes namely; inkjet and electrophotography or toner-based printing. Inkjet involves spraying tiny droplets of liquid ink with precision, mainly to enable the high-quality transfer of photo images onto paper and other substrates. It aims at achieving speeds that can match or even surpass those of conventional printing presses (productivity-wise). It is therefore providing foreseeable threats to toner-based printing (Romano, 2004). The high-speed inkjet printing has already reached and matched the offset litho quality, more especially on the same papers that offset printers and their customers are used to. Machines such as; Canon, Screen, Ricoh, Kodak and HP have so far joined Indigo and Xeikon and are being used to produce work to the same litho quality level, on standard offset papers (Ward, 2017). This has led to the common phenomena nowadays, of the mushrooming of ‘instant photo studios’ at every graduation ceremonies and funerals whereby photographs are taken (using digital cameras or even mobile phones), developed and sold to the attendees of such functions, although some eventually end up not being bought due to lack of prior contractual agreements.

Electrophotography or toner-based printing is used in photocopying machines, color and LaserJet printers, using the principle that produces images through causing light to pass through an electrostatic charge which attracts the tonner and is then transferred onto the paper, gets fixed to form the final image (Pira, 2006).

Digital printing is considered as mainly a short-run process. It is the most appropriate printing process for office stationery and is useful for the production of; letterheads, notepads, envelopes, official documents etc. (Swinden, 2006).

Included among the digital printing technologies is 3D and 4D printing, (also known as additive printing technology) which makes it now possible for manufacturers, printers and advertising agencies to develop three-dimensional objects from digital files and various printing materials such as ceramics, polymers and metals. Although a good number of organizations within the printing sector recognize and have adopted the 3D as part of their business, some do not because they see them as falling within the manufacturing and not the printing industry (Services, Arts, & Package, 2017). For the printing industry, we now have a new digital technique called “PR interior” which uses the latest digital printing technology to print (large format) on natural and synthetic fabrics.

A Summary of the printing technologies and their applications is shown in table 2.1

Table 2.1: Printing technologies and their applications Summary

Printing Technology	Applications
Lithography	Lithography is a method of printing using a metal plate (applied with water and ink at the same time). It is the most common type of printing process and is mainly used in printing of calendars, books, newspapers and business documents etc.
Letterpress	Letterpress is a method of printing from raised (metallic or wooden) images. It is widely used to print high quality adhesive labels. Other printing applications include business cards, letterheads, forms, posters, embossing and billheads.
Gravure	Gravure printing is a method of printing from a metallic cylinder with recessed images. It is widely used for printing of labels, flexible packaging, cartons, greeting cards, currencies, cheques, advertising campaigns and magazines.
Flexography	Flexography is a method of printing from flexible masters with raised images. It is used to print packaging material like corrugated boxes, folding cartons, paper and plastic bags, milk cartons, adhesive tapes, envelopes, newspapers, containers, food and candy wrappers.
Screen	This is a method of printing using a screen or stencil. It is used for printing using a wide variety of substrates such as; textiles, ceramic, wood, metal, paper, and glass. Its better quality enables it to be used in various industries from clothing to circuit board printing.
Digital	Digital is a modern method of printing from digital files. It is used for printing of booklets, journals, brochures, credit cards and graphic attachments. It is particularly good for short-run and large format printing.

Source: Pira International

2.6 Training Levels of Staff in Using Printing Technologies

According to Ali *et al.*, (2009), firms or countries with obsolete technologies and/or processes, poor management of technology, old ways of thinking, and obsolescent production processes cannot continue to exist in the current world which is highly globalized and technologically advanced. To survive the competition, they must combine the advanced technologies with proficient technical skills, capacity,

knowledgeable staff and good management. Furthermore, it is the proper use and control of the technology which brings profits and not the technology itself (Ali *et al.*, 2009) and within that management's mandate is to ensure that staff is properly trained.

According to Delaney & D-Agostino (2015) to get to the top and remain competitive in the current globalized economy, businesses (including print production enterprises) need to adjust to the ever-changing business conditions to satisfy customer needs and demands. Getting to the top and maintaining competitiveness means continuous evolution as an organization and making adjustments to both process and technology for a competitive advantage over business rivals. Firms must become more skillful when sourcing for new technology as well as in managing the challenges that come along with that technology like for example, implementation of the changes. He continues to say that technological changes can bring huge benefits to an organization although they can also carry along with them, many challenges that will require proper management in order to bring positive outcomes. Further, he notes that challenges arise when firms attempt to procure new technologies/equipment without proper management and training mechanisms in place for their staff (Delaney & D-Agostino, 2015).

Progressing through advanced technologies is far more than just purchasing the latest or state of the art piece of equipment. It includes enhancing the overall processes by which firms increase the value of products and services provided to customers. Nonetheless, the adoption and use of new technologies are transforming the industry's workforce and the way of doing business. The truth is that most firms now require less and less staff because many operations and printing processes can now be

handled more efficiently and effectively, using new technologies. Staff enrolment from different disciplines in similar courses appears to pose new challenges to an instructor more especially in the acceptance and use of new printing technology. For instance, it will require double time and effort to instruct them. The assumption that majority of them do not possess any hands-on experience on the use of new machines/equipment is not unreasonable because the technology is not readily available to the general public, more especially to people with high illiteracy in technical fields and those without skills in Computer-Aided Design (CAD). This also includes those with the ability to understand new subjects. Staffs do not have to wait until later years to acquire these skills. On the contrary, they can be acquired easily during high school years - at vocational colleges through technical courses or self-learnt before joining University (Loy, 2014). The three dimensional (3D) printing technologies or rapid prototyping technology/RPT (as also commonly known) is notably one of the main upcoming technology that can support staff training in addition to stimulating innovations in the field of printing. This technology is likely to be a game-changer within the printing industry and beyond. However, it comes with the challenge - mainly requirements of less staff that must be skilled, staff that possesses wide knowledge in printing processes and specialists in specific areas. Accessing training opportunities for staff in order to grow and be able to manage the emerging technologies is another challenge but the attainment of this, cost-effectively is the greatest of all these challenges (Pit, Lai, Fan & Cheng, 2015).

This predicament is not strange to the printing and related industries. A shortage of skills (which appears to be linked to the use of technologies) seems to cut across industries. Nevertheless, as labor-intensive and value-added production shifts to countries with lower labor costs and print-related services, the job-related mixture of

staff will undergo change considerably. Case in point; demand for general staff and machine operators is expected to get less and less while that for technicians is expected to increase. Changes in technologies will also reshape the central skills requirements within the printing sector. For instance, it will be mandatory for staff to have high-level basic skills in literacy, numerical proficiency, problem-solving and working in teams as a way of promoting a technology-rich environment (Smallbone *et al.*, 2013).

Within the printing industry, skill shortage is noticeable in two major areas: operating new printing machines that are complex and comprehending and leveraging the benefits brought about by the application of information and communication technology (ICT). Also found to be an important factor in influencing staff behaviors and attitudes towards technology adoption among printing organizations is the level of education of staff (Kostakis, Niaros & Giotitsas, 2015).

According to Abu-Shenab (2015), equipping staff with the necessary education and training will eventually lead to better understanding and adopting to use of new technologies. Education is much more effective in promoting a positive attitude than industrial practical exposure. This implies that printing staffs with appropriate education qualifications and/or training have better chances of understanding technology, how it works and when to use it. They will therefore find that new technologies are more useful, effective and fitting in their printing duties (Abu-Shanab, 2015, Kostakis, Niaros and Giotitsas, 2015) although the level of education of staff can also have a significant negative moderating effect on perceived behavioral control on the intention to use new technologies.

In Africa, some organizations are teaming up and supporting each other in narrowing the skills gap, particularly in the area of education for printers. A typical example of this is the Printing Industries Federation of South Africa which has partnered with the University of the Witwatersrand (one of Africa's leading universities) to offer academic courses to the printing and packaging industry. This is in addition to the technical trade theory courses it is already offering to the industry (Ryan, 2014).

2.7 Perceptions of Staff in using new Printing Technologies

Printing industries and some staff tend not to accept new technologies when they replace, rather than supplement human labor. In some cases, technologies are embraced eagerly when perceived to be in support of the desire for inclusivity, purpose, challenge, meaning and environmental friendly. This is despite them being thought of as being; cumbersome, expensive, constantly breakdown, and time-consuming (Loy, 2014).

The importance of new technologies cannot be overemphasized as it is regarded as an essential tool in enhancing performance as well as increasing the level of competitiveness in the printing industry. As new technology constantly emerges in the printing sector, new ways of conducting business can also be developed and this may affect the staff perception in utilizing them (Mutheu, 2016).

2.8 Effects of new Printing Technologies on Productivity

A measure of the rate at which outputs of goods and services are produced per unit of input is what is referred to as "productivity". This includes; labor, capital and raw materials according to Krugman (1994), although Romano & Romano (2004) considers it to also mean output per an individual worker. It is computed using the ratio of the amount of outputs to the same measure of the amount of inputs used

(Krugman, 1994). Print production processes and business in general has changed from being a craftsman's trade into an industrial venture and just like all other industrial sectors, computer-integrated manufacturing (CIM) is now of major importance (Szentgyörgyvölgyi, 2008) and part of the stimulus package of productivity.

The use of new printing technologies in Kenya has contributed to the mushrooming of printing firms, including start-ups and revival of old ones. For the last 15 years alone, firms have been attracting investments from within the country and abroad. In as much as some firms and technologies succeed navigating the printing industry mucky waters, some have neither survived nor continued with their operations. The rapid technological changes (which affect products and services) always render the earlier technology inadequate or in some instances obsolete and useless, while users of any technology will always go for the presumed best technology available (Kostakis, Niaros & Giotitsas, 2015).

The utilization of new technologies can be seen almost on a day to day basis. The uniqueness of improvements of technologies is that it always makes the new technology attractive to both the old and the new users, especially when the new features include performance, size, and location of the services. Productivity measures are used at the level of firms, industries and entire economies. Depending on the context and the selection of input and output measures, productivity calculations can have different interpretations. Improving productivity can have connotations of economizing on the use of inputs, for instance; adopting efficient production processes that minimize waste. Equally, improving productivity can have

connotations of yielding more output. For example, using resources in activities or with technologies that generate more output (Loy, 2014).

Printing is a sector that provides a combination of services and products to numerous customers. According to Frolova (2014), the actual production of the customers' requests in the plant is manufacturing while such other functions like; sales, marketing, ideas for developing new brochures, designing, typesetting and works of photographic nature are essential services. The printing sector relies heavily on computer technology. Adams *et al.*, (1988) describe printing as a process of manufacturing multiple copies of graphic images and argues that there are several activities or processes involved in getting the multiple copies. He further notes that these activities are grouped into three main processes namely; prepress, press and post-press. Prepress activities are carried out before printing and these include generation and assembling of visual elements either referred to as origination; color separation, film and plate making also known as reproduction. Press activity is mainly printing of the copies and it includes; make ready, adjustments and settings to ensure proper registration of the colors and satisfactory printout. Post-press includes all those steps like; cutting/trimming, folding, collating, gathering and binding, varnishing, laminating and packing, all of which are carried out after printing (Kipphan, 2001; Smallbone *et al.*, 2000).

According to Szentgyörgyvölgyi (2008), printing houses (also known as production centers) have a complicated structure. Controlling the workflow is a tall order even for experts in the three printing work segments (Planning, printing and finishing) whose tasks must be fulfilled in harmony (Szentgyörgyvölgyi, 2008). The achievement of harmony in these segments is only through an effective workflow

system. When we talk of process control within the print industry, it implies taking full charge of the entire production process (from the conceived idea, through to the finished product) as illustrated in figure 2.2.

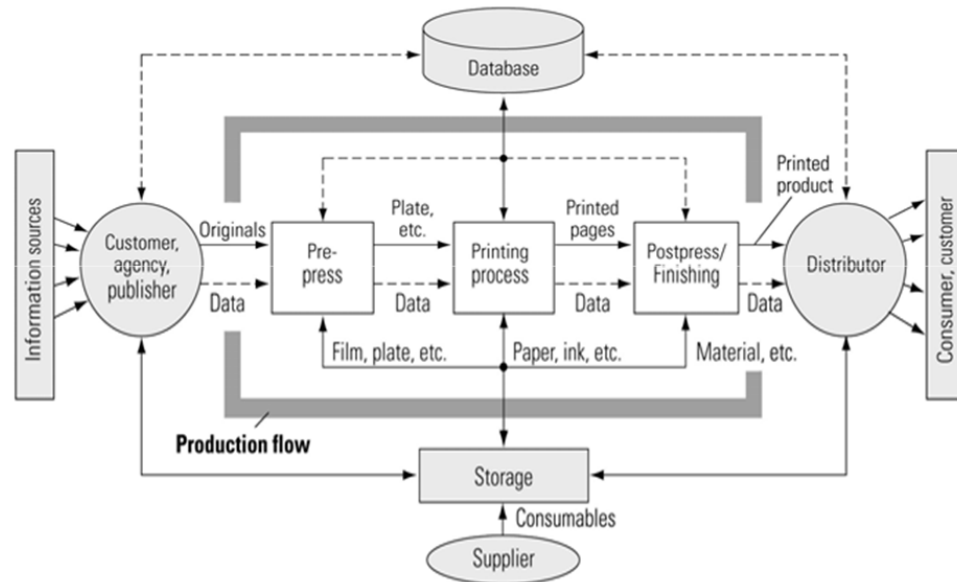


Figure 2.2: Print production flow chart(Adapted from *Szentgyörgyvölgyi, 2008*)

The environment in which the industry operates is that of high intensity in; materials, labor and capital requirements and with low entry barriers (Mutheu, 2016). This therefore is the reason why many printing establishments (more especially simple trade shops) specialize in one area of the business. Such trade activities range from simple jobbing print shops, publishing, special-purpose printing, quick small print services and commercial printing (Adams *et al.*, 1988). The structure of the industry is generally dominated by small and medium firms that mostly serve local and in some cases, national markets. However, there are a few large firms that serve national and international markets (British Printing Industries Federation, 1998 cited in Smallbone *et al.*, 2000).

2.8.1 Quality

Quality has many different definitions and just to mention but a few; Juran calls it fitness for use; Feigenbaum refers to it as the total composite of product and service characteristics in marketing, engineering, manufacturing and a maintenance channel through which the product and service in use will meet the expectation of the customer; Crosby defines it as conformance to requirements (Wille, 1992). According to Goetsch& Davis (2010), quality is a state (dynamic in nature) associated with products, services, people, processes and environments that meet the needs and expectations of customers, in addition to helping produce superior value.

Quality is globally recognized and appreciated among institutions, firms and individual customers thus for printing firms to deliver quality print products and services, they must ensure that all materials and printing processes are without defect (Graham and Owusu, 2015).

Simmons (2000) maintains that quality achievement or benefits can be in monetary and/ or non-monetary terms. Monetary benefits are typically gotten from or are directly associated with firms' books of accounts and will appear in accounts such as inventory or cash, and at the end of the financial year as profit and loss statement or balance sheet. Non-monetary benefits are those not found in the books of accounts, such as customer satisfaction or product quality indicators (Simmons, 2000).

According to Kellen (2003), organizational quality attainment is linked to the kind of inputs into a process and the evaluation of the performance (outcomes/outputs) of the process. The indicators may as well be connected to human performance, process performance, product performance or market conditions. According to Anderson *et al.* (1994), the degrees to which firms' clients perceive (continuously) that their needs

and wants are being met by what a firm produces (goods and/or services) is called customer satisfaction. Youssef (1992) contends that it is Total Quality Management (TQM) systems that help companies in meeting customer needs and wants intelligently. TQM's aim is to assure the delivery of quality goods and/ or services, at all times.

TQM assures maximum efficiency and effectiveness in an organization through the processes and systems that are in place. These in turn ensures that every aspect of a firm's activity is in line with its objectives and ability to satisfy the needs and wants of customers, without any wastage. Reismann (2008) infer that an efficiency measure is a reflection of the consumption of resources in order to complete a task. Therefore achievement of quality in this study is looked at in the context of publications or print products. Quality of services offered to customers, process quality within the firms and customer satisfaction are all looked at.

2.8.2 Capacity

According to the Encarta dictionary (2009) in the sense of productivity, capacity is the maximum output or produce from a given machine. For example, *bodaboda*, *matatus*, vans or commuter buses usually have a given number of people they can carry at any given time. Exceeding that number would be considered as overloading or overstretching their capacity and getting below that number would be underutilizing their capacity.

In the printing context, capacity is the maximum operating speeds and volumes that machines; equipment and/or technology can produce in a given time as per the manufactures' technical specifications.

The major determinant factor incapacity (output) is usually the mechanical condition of a machine, equipment/technology in terms of design and/or make, age and conditions of use. However, other factors such as; work or job categories, quality of inputs (materials), skills and abilities of the operators, environment, working and factory conditions are also important (Porter, 1994). A printing firm that does not have enough production capacity and capabilities cannot be able to effectively serve her customers. This therefore means that a firm must have enough and well maintained “right for the job” machines, capable of handling any anticipated, incoming and ongoing jobs. Printing firms must also ensure they have enough work to keep the machines running throughout. That way, they will avoid a situation of ‘idle capacity’.

2.8.3 Efficiency

Peale (2004) argues that outstanding efficiency in any firm (including printing firms and the environments in which they operate) is seen through its latest-type of technology and/or machinery and methods of production. Efficiency can be explained in the following three ways:

1. **Competence:** the ability of someone/something to accomplish a task, or excellently do something, or achievement of the desired result with no wastage of effort, time, money or energy.
2. **Use of resources productively:** a measure or extent/degree in which a task is well accomplished with no wastage of energy, materials, money or time.
3. **Machine’s energy effectiveness measurement:** the amount of work done or produced by a machine measured against the amount of energy and/or time spent on the task. For example, the number of copies produced per hour when

a unit of power has been used is a measure of a machine's efficiency (Definitions adapted from the Encarta dictionary, 2009).

This study uses the term efficiency in its third sense, as given above, though the latter meaning is related to the first two senses.

In this competitive age, printing firms have no choice but to consider efficiency as a key component of a viable printing business. Companies resort to various new technologies that can facilitate faster and cost-effective production processes in order to meet customer expectations. For instance, print jobs that are produced efficiently are less expensive to customers and this usually translates into better bottom lines for printing firms at the end. The opposite is true for those that are produced inefficiently.

2.9 Benefits and challenges of the new Printing Technologies

To get to the top and remain competitive in this globalized economy, printing firms in Kenya must adapt to the ever-changing business environment if they are to meet their customer's needs, wants and expectations (Osano, 2019). Competitiveness means continuous evolution as an organization and making adjustments to both process and technology for a competitive advantage over business competitors. Firms must become more skillful when sourcing for new technology as well as in managing the challenges that come along with that technology like for example, implementation of the changes (Delaney & D-Agostino, 2015).

Using new and/or improved printing technologies has both benefits and challenges.

2.9.1 Benefits

According to Alberta waste minimization manual (2016), one of the major benefits of using new printing technologies is the elimination of the entire photographic components of pre-press where direct imaging to plate or press is now offering printing firms a significant reduction in operating costs, time and waste thus translating into increased productivity. At the press section, Alberta waste minimization manual (2016) further observes that with additional features such as automated plate mounting/dismounting; continuous scanning & register control; double-sided printing or perfecto presses etc., printers achieve higher quality, efficiencies and increased production speed. This agrees with Hultén, P., Viström, M., &Mejtoft, T. (2009) who noted that printing firms which invest in new technologies and equipment obtain competitive advantage through higher quality products and services, reduced delivery times, increased customization of print products and services and other possibilities such as print on demand (PoD), and value addition to customers. Many new and/or improved technologies help in enhancing large scale production and therefore more established printing firms would naturally adopt them in order to benefit sooner than later. They enable them to seize the opportunities that arise from economies of scale (out of consolidated production) and reduced learning curve. This also helps in spreading this benefit to other fixed charge areas where adoption has been applied (Berkeley, 2003).

2.9.2 Challenges

Wamuyu (2015) while citing Rosenberg observed that the adoption of digital printing technologies is known by its obvious slowness in general on one hand, and the huge differences in the acceptance rates on the other. Slow adoption of new technologies at individual customer levels could be due to the inability of users to recognize and

appreciate the usefulness of those technologies. Not unless they are early adopters or they can see the benefits other adopters are enjoying, most customers would not necessarily be aware of its importance. Some hold strongly to Bowerset *al* (1994) argument that in as much as computerized systems and/or digital technologies are gaining more prominence, the conventional presses such as lithography and 'hot metal' should be maintained and not done away with. This point of view is however partly valid because they are still important for various forms of work.

Makhija (2014) while reporting on the challenges, opportunities and prospects of 3D printing in India said that securing initial funding for new technology is very difficult because most banks and/or investors are not well versed with this industry nor believe that the 3D printing can do what is being claimed. Other challenges he listed include: technologies are very expensive; they require huge capital investment; raw materials (which are also capital intensive) have to be imported from the developed countries, often at exorbitant prices; a significant number of designers are yet to believe in prototyping -they see it as an expensive venture rather than an investment. According to him, the cost could drastically come down if and only when materials will be designed and produced locally. This will result directly in a healthy demand and supply situation, although many products can be restricted (from being made at one go) by the size of the 3D printing equipment. Lastly, he notes that inadequate or limited knowledge of how 3D printing technology works is what makes some companies not to opt for prototyping. Some however finally either do away with it entirely or find other alternatives.

On the equipment side, Makhija (2014) observed that most of the newspapers do not post all equipment price lists for companies but only do so for cheap equipment which is not the same as an industrial-grade which are costly. Most of the companies do not

use them because they are costly, if this is put in place then it will also include; 3D printing in their design, research and even research cycle. Very few have knowledge on forms of 3D printing technologies which are used mostly and other companies do not support services such as design-prototyping manufacturing which helps to lower the 3D printing reach.

Clark (2001), believes that comprehension of technologies is of greater importance than equipment prices or inputs. Also of great importance is market research due to the fact that technology has limitations in terms of compatibility of inputs as well as target audiences.

A greater number of printers using new technologies have a very steep learning curve, and this is in addition to issues to do with maintenance and fears of multiple points of failure which can cause production problems. Therefore, printers need to invest a lot of time to study and understand all that can go wrong and be able to chart the way forward, for long term solutions. Dittmar (2010a), requested the investors of new printing equipment to take as much time as possible in studying how they can achieve the highest quality product before running to the market with new ideas.

Berkeley (2003) observed that new technology adoption is mainly expensive because firstly, firms have to purchase new machines, which are major assets that need heavy capital investment. Secondly, employees need to be trained or re-trained in order to operate them and if there are other network effects such as the need for supplementary machines, updating or replacement, costs and expenses will skyrocket. Thirdly, operations would be closed down (during installation) thus with cost implications and possible losses in output, customers and income for that time.

2.10 Conceptual Framework

This study was conceptualized (Figure 2.3) on the idea that a highly integrated and strategic employee performance management practice is that which brings continuous success to a firm through improving its productivity in terms of quality, efficiency, capacity, profitability, service delivery, cost reduction and allows the creation of new products and services. Such an employee management system can only achieve high organizational productivity through improved performance of the people, whose efforts are linked to the corporate objectives of the organization through practices such as; goal setting, rewards and recognition, training and development and performance appraisal.

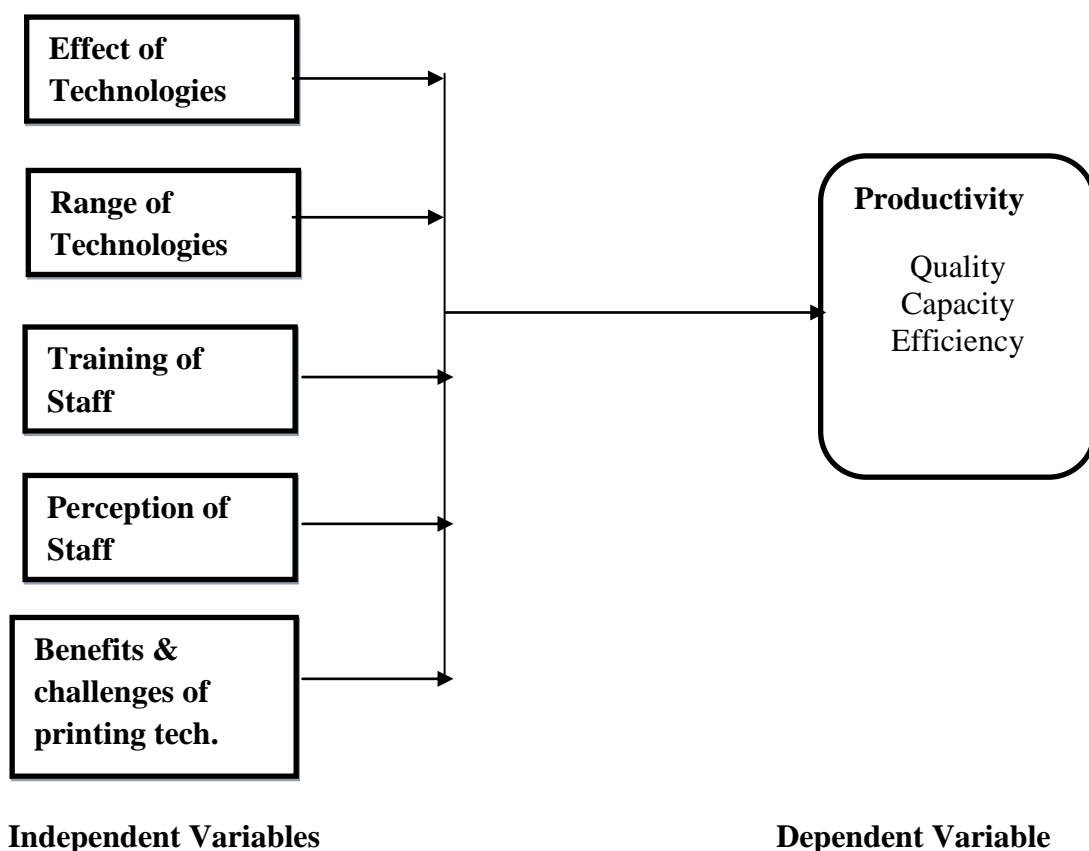


Figure 2.3: Conceptual Framework(*source: Researcher, 2018*)

Figure 2.3 illustrates the relationship between the dependent and independent variables. Productivity in terms of quality; capacity and efficiency mainly depend on

the range and effect of printing technologies that an organization has adopted; professional training levels and perceptions of staff in using those technologies as well as the benefits and challenges of using those technologies.

2.11 Summary of the Chapter

This chapter has reviewed the literature on the utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau. Similar studies have been conducted in the UK (Smallbone *et al.*, 2006), Hungary (Szentgyörgyvölgyi, 2008), Sweden (Hultén *et al.*, 2009), India (Pardiwala, 2016), and the USA (Wang, 2016). However, not much research has been done on this topic of utilization of printing technologies to enhance productivity among printing firms in Kenya. An attempt to fill this gap is made through his study.

Sub-topics discussed in this chapter include the range of printing technologies, professional training levels of staff in using printing technologies, perceptions of staff in using new printing technologies, effects of the new printing technologies on productivity and benefits as well as challenges of the new printing technologies. The chapter introduced and explained the resource-based theory and the Technology Acceptance Model (TAM), both of which guided the study. It concluded with the conceptual framework. The next chapter discusses the research methodology.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Presented in this chapter are the research design, location or the place where it was conducted, study population, procedure that was used in sampling and size of the sample, pilot study, validity and reliability of data collection instruments, data collection procedures, data analysis, dissemination of findings and ethical considerations.

3.2 Research Design

Research design is the blueprint that shows how a problem under investigation will be solved (Ngechu, 2006). It is also referred to as an overall strategy that researchers or a researcher decide to use for the integration of different components of a study in order for it to be coherent and logical in such a way that it ensures effectiveness in addressing a research problem. It includes the plan for data collection, measuring and analyzing the same. A research problem is what will determine the type of research design to be used by a researcher but not the other way round (Trochim, 2005; Creswell, 2006; Tashkkori, & Teddle, 2003; Ivankova, 2006; Kupzyk, 2010).

According to Kumar (2011), the research design is a procedure and plan that a researcher adopts and uses to answer questions in a valid, objective, accurate and cheaper way. A case study design was used in this study because it is the best when one wants to get a deeper understanding of the situation (Creswell, 2006). The situation in this case is the utilization of new printing technologies to enhance productivity at the KLB. This case study with a mixed method design of data collection and analysis was conducted in a detailed way, through an in-depth data

collection using questionnaires and interviews in order to report a case description and/or case-based themes (Creswell, cited by Rondón, & Vera, 2016). A case study method is the best when it comes to studying complex organizational processes (printing technologies being one of them) which require collective participation and interaction of chain of events like for example, organizational change and implementation of technology projects in large-scale (Bhattacharjee, 2012).

The mixed method approach that the researcher used in data collection and analysis is that of integrating both quantitative and qualitative forms (Andrew and Halcomb, 2009).

This method was chosen because of its complementarity nature which allows for a deeper comprehension of the problem and/or clarity of findings. According to Hesse-Biber (2010), this is achieved because of utilizing both qualitative and quantitative data and not just the explanations or numbers alone. To fully understand this social story, the researcher had to use both questionnaires and interviews to capture the divergent views of users of the printing technologies. Data were obtained by the researcher using questionnaires and interviews which were administered to the participants in person. A semi-structured questionnaire which had both open and close-ended questions was used. The closed-ended questions were to guide and restrict the response to the study area of interest. Open-ended questions were also used to enable respondents to express their opinions on issues under study. Semi-structured interviews for managers and section heads were also done to supplement the questionnaires and as a way of getting as much information as possible.

3.3 Location of the Study

This study was conducted at the Kenya Literature Bureau, Nairobi. KLB was chosen for the study because of its long history in both printing and publishing and unique position as the only publisher in the country offering commercial printing services through their full-fledged printing press and its claim of being among the few printers that use some of the new printing technologies.

KLB was originally established as the East African Literature Bureau by the British High Commission in 1947. It is governed by the management board and operates under the State Corporations Act, Cap 466 provisions that require state corporations to enhance efficiency in their operations as well as initiate and apply for appropriate staff development programs, among other requirements (Kenya Literature Bureau, 2013).

3.4 Study Population

The word population means a group of people or classification of subject matter, fickle, substance, concepts, occupants or Phenomena (Wimmer and Dominick, 2011). The population is also the specific collection of elements to be studied but a study population is the aggregation of elements where a sample is chosen from (Baxter 2003). A particular population has some characteristics that are different from others (Mugenda and Mugenda, 2003).

The study population was 300 KLB staff comprising: Publishing Department (22); Production Department (56 permanent plus another 110 temporary, usually contracted during peak seasons); Business Development Department (5); Human Resource Department (5), Finance Department (11); Information Technology Department (5); Administration Department (35); Sales and Marketing Department (13); Internal

Audit Department (4); Legal Services Department (1); Quality Assurance Department (4), Supply Chain Department (10) Customer Service (14) and Corporate Communication Department (5).

3.5 Sampling Procedure and Sample Size

The sampling procedure is a process in research for selecting participants (Creswell, 2014). It is about choosing the number of individuals who will represent the larger group from which they were chosen for a study, (Mugenda & Mugenda, 2003). The aim of sampling is to obtain a representative section of the population that is analyzed to get results that can be generalized to the entire population (Bhattacharjee, 2010).

56 respondents were purposively selected from the Production Department for the study because they are deemed to have the required information, given that they are the ones using printing technologies. According to Reinard (2006), purposive sampling is a process that entails picking a sample out of subjects selected deliberately or on purpose by researchers usually because they think certain attributes are representative or typical of the population.

Key informants from production, publishing, human resource (HR), and procurement departments were consulted for the provision of the pre-study information.

This study utilized purposive sampling because it gives a sample which possesses the required characteristics for the study. In selecting all production staff (employed on a permanent basis); right from managers, heads of sections, machine-operators and only those involved in print production operations, the researcher hoped to get data and information necessary and relevant for the study. The sampling frame from which the sample size was derived is as presented in table 3.1.

Table 3.1 Sampling Frame

Departments	Population	Sample
Operations		
Publishing	22	-
Production	56 + 110 (temp staff at peak season)	56
Business	5	-
Development		
Support departments		
Human Resource	5	-
Finance	11	-
IT	5	-
Administration	35	-
Sales and Marketing	13	-
Internal audit	4	-
Legal services	1	-
Quality assurance	4	-
Supply chain	10	-
Customer service	14	-
Corporate communication	5	-
Total	300	56

3.6 Pilot Study

According to Robson (cited in Samuel, 2016), piloting allows researchers to test their confidence in identifying obstacles and /or difficulties that could affect useful data's actual collection. In this case, the pilot study was conducted at Georgian Printers in Eldoret town. The aim was to establish whether or not, there were any weaknesses in the data collection tools that the researcher had developed. Its other aim was to check for clarity of the asked questions or feedback from the participants which would assist in the modification or improvement of the data collection tools, for enhanced reliability and validity. Through the pilot study, the researcher was able to detect and correct flaws in the administration of the research tools. All corrections and

alterations (both typographical and content) were discussed with the supervisors and other experts in the area of printing and publishing and approval sought & received before going to the field to collect data. Results for the pilot study were not used in the main study.

3.7 Validity and Reliability of Data Collection Instruments

The validity and reliability of data collection instruments for this study were checked as illustrated below:

3.7.1 Validity of the data collection instruments

Piloting assisted in the identification and selection of the most appropriate and relevant tools which could give valid results for this study. Validity was about drawing meaningful and useful interpretations from scores on the instruments and ensured research was validity tested. In this study, the content was reviewed by research supervisors to ensure respondents understood each item on the questionnaires to avoid misunderstanding and that answers were in line with research questions (Wanyonyi, 2015). Thus, the research tools were scrutinized and content validated by supervisors and other experts from the School of Information Sciences, Department of Publishing, Journalism and Communication studies. Their recommendations were incorporated in the final questionnaires so as to enable the collection of data that were valid for analysis.

3.7.2 Reliability of the data collection instruments

The reliability of the research instrument for this study consisted of two elements namely; internal stability and internal reliability. The first element of internal stability was administered test to a group of respondents and then re-administered on another time to measure the relationship between two groups of respondents. The reliability of

the instruments was established after a pre-test in order to find out the fitness of the instruments in the study. The procedure for conducting the test-retest was as follows:

1. The prepared questionnaires were given to three targeted groups of individuals: manager, section head and machine operator.
2. The filled in questionnaires were manually scored.
3. The very same questionnaires were administered to the same group of individuals (manager, section head and operator) after two weeks and their responses manually scored again.
4. Answers obtained in roman (ii) and (iii) above were compared.
5. A formula (Pearson's product-moment) for test-retesting was used for the computation of the correlation coefficient as a way of establishing the questionnaires' consistency in eliciting the same responses each time they are administered. 0.75 correlation coefficient was recorded and that was enough proof that the tools were reliable.

The second element of internal reliability was used in multiple indicator scales such as the Likert scale and a Cronbach's alpha (α) of 0.781 was found. A Cronbach's alpha of 0.65 and above indicates that a research instrument is reliable (Wanyonyi, 2015). The reliability of the questionnaire was considered reliable.

Table 3.2: Reliability Statistics

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.781	.746	18

3.8 Data Collection Procedures

The collection of data is the gathering of information from a selected subject or subjects of an investigation (Sekaran, 2003). Both primary and secondary data were needed for this study. Primary data were obtained by the researcher using questionnaires and interviews which were administered to the participants in person. Secondary data were received from the key informants, in the form of documents containing the number of work and process stations, plant list, staff list, product range information and information on the age of equipment. Research instruments were developed and tested in a pilot study before the real investigation started. A semi-structured questionnaire was developed after discussions with the supervisors. It had both open and close-ended questions, mainly to guide and restrict the response to the study area of interest as well as to enable respondents to express their opinions on issues under study.

The first section (A) sought information on the respondents' background information. The second section (B) sought information on printing technologies and/or equipment available at KLB. The third section (C) asked respondents questions on staff education and training/skills on the use of printing technologies while the fourth section (D) was used to find out staff perceptions on the use of printing technologies. The fifth section (E) sought information on the effects of printing technologies on productivity; the sixth section (F) covered benefits and challenges of the technologies in use and lastly (G), areas of improvement. The questionnaire was used because of its convenience in obtaining answers from a large number of respondents devoid of influence from the researcher. A questionnaire enables a researcher to get first-hand information about the work situation (Mugenda & Mugenda, 2003). It also provides an opportunity for anonymity to promote a high response rate. Questionnaires were

administered to the respondents and collected by the researcher once filled. Semi-structured interviews for managers and section heads were also done to supplement the questionnaires and as a way of getting as much information as possible.

3.9 Data Analysis

Before processing the responses, data from the completed questionnaires were compiled, edited/cleaned and coded, while the one from the interviews were transcribed. The quantitative data collected were analyzed using descriptive statistics such as frequencies, percentages, mean and standard deviation, pie charts, bar graphs and contingency tables. The descriptive statistical tools help in describing the data and determining the respondents' degree of agreement with the various statements under each variable. Thematic analysis was done for the qualitative data that were obtained from the interviews.

3.10 Dissemination of the Findings

It will be necessary to use different techniques to communicate the findings of this study. To ensure that the outcome of the research on utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau is disseminated to the relevant audiences, the researcher will employ local, national and international channels. The channels that will be used include:

- Conference presentations,
- Publishing in a journal,
- Availing copies of this thesis to the school of Information Sciences and Margaret Thatcher Library (Moi University), Kenya Literature Bureau, National Council of Science and Technology (NACOST) and the Ministry of Education,
- Presentation at seminars and workshops.

3.11 Ethical Considerations

The researcher first sought clearance from the School of Information Science, Moi University (MU) before proceeding to the National Council of Science and Technology (NACOST) to obtain a permit to conduct research. Upon obtaining the necessary authority to conduct research, the researcher followed appropriate channels of authority by obtaining permission from the KLB management before proceeding for data collection. The researcher cooperated with the research subjects freely so as to collect the required information without coercion or bribery and instructions were provided in every instrument. To enhance the anonymity of information given, the names of respondents were not included in the research instruments.

3.12 Summary of the Chapter

This chapter has described the methods used in the study. Also discussed here is the research design which is a case study with a mixed method of data collection and analysis. This design was used because of its suitability in helping to answer the question: which printing technologies are KLB using to enhance productivity? The instruments used in the study were also found to be appropriate and enabled intensive and extensive data collection. The chapter has also covered: location of study, study population, sampling procedure and sample size, pilot study, validity and reliability of data collection instruments, data analysis, dissemination of the findings and ended with ethical considerations. The next chapter deals with data presentation, analysis and interpretation.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents analyses and interprets data that was collected from 48 respondents and 4 interview participants from the production department of the Kenya Literature Bureau with respect to the utilization of printing technologies in enhancing productivity at KLB. Also covered in the chapter is the response rate, respondent categories, range of printing technologies available at the KLB, professional training levels of staff in using printing technologies at KLB, perception of staff in using new/improved printing technologies at KLB, the effect of the new technologies on productivity, benefits and challenges of the new printing technologies, measures for improvement for enhanced productivity at KLB and chapter summary.

In order to streamline the understanding of the issues under study, data was presented systematically according to the specific objectives of the study on utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau. The research question of the study was answered through the presentations.

4.2 Response Rate

The response rate is the total number of respondents who took part in the study and it is presented in percentage. This study had 48 respondents from the production department for both questionnaires and interviews of which the response rate was presented in tables 4.1 and 4.2 below.

4.2.1 Response Rate for Questionnaires

The study used a one-part questionnaire that was distributed in-person to the sections and later collected as shown below in table 4.1.

Table 4.1: Response Rate for Questionnaires

Section	Questionnaires issued	Returned	Percentage %
Pre-press staff	18	14	77.8
Press staff	19	18	94.7
Post-press staff	19	16	84.2
Totals/average	56	48	85.7

Out of the targeted 56 respondents, 48 participated in the study, giving a response rate of 85.7% for the questionnaires. The response rate for pre-press was 14 (77.8%), press was 18 (94.7%) and post-press was 16 (84.2%), making the total of 48 responses, out of the total questionnaires that had been issued.

4.2.2 Response Rate for Interviews

The researcher had an interview schedule for four section heads as shown below in table 4.2.

Table 4.2: Response Rate for Interviews

Section	Response Received	Percentage
Head of Estimating & planning	1	25
Head of Pre-press	1	25
Head of Press	1	25
Head of Post-press	1	25
Total	4	100

Initially, the plan was to interview three respondents, that is, three heads of the three main sections in printing (pre-press, press and print finishing). However, on reaching the ground, the researcher was informed that pre-press have two subsections, each one run by a head. So, in total, the researcher interviewed four (4) heads of section and obtained a response rate of 100%.

It was not possible to meet the 100 % response rate for the entire study because some of the targeted respondents especially for the quantitative part were either on off duty, leave or out of their work stations on official assignments. Although that was the case, according to Mugenda & Mugenda (2003) the response rate of above 70% is excellent. This response rate can, therefore, be said to be above average since more than 70% of the respondents were interviewed, filled questionnaires and returned them, giving an average response rate of 92.9% (excellent) for the study.

4.3 Respondent Categories

The study sought personal information of the respondents as shown below in figures 4.1, 4.2 and 4.3.

4.3.1 Gender and Age

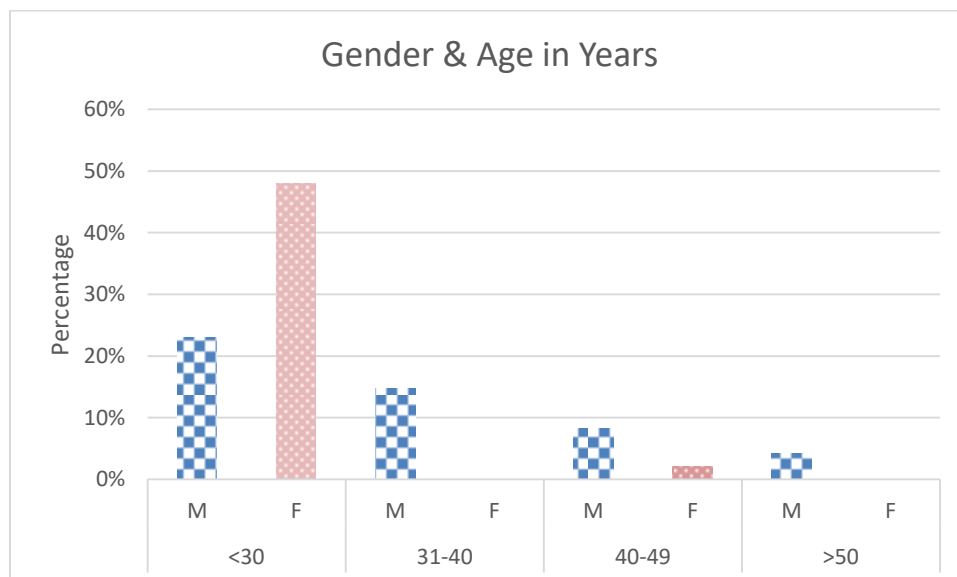


Figure 4.1: Gender and the Ages of the respondents in Years

The respondents were asked to indicate their age categories, gender, level of education and whether they had received any kind of specialized training since joining KLB or not. In addition, they were to provide personal information pertaining to their work sections as well as ranking or employment position. The reason for asking these

details was to give credibility and the reality of the responses. The socio-demographic characteristics of the respondents for the questionnaires were described using a bar graph (Figure 4.1).

In the personal information, out of the total 48 questionnaire respondents, 11 (23%) were male and 23 (48%) were female, all aged less than 30 years. This is an interesting finding given that traditionally, printing (more especially in pre-press and press sections) has been dominated by males but now the situation seems to be changing. More young females are coming on board, to the extent of even surpassing their male counterparts. This could be due to society focusing more on the “girl child” and/or advocacy for gender affirmative action. This phenomenon may be a subject for further inquiry and/or debate. There were only 7 male respondents aged 31-40 years representing 14.67% of respondents and these could be those working in the press section as machine operators and their assistants. The press or machine section is traditionally known to be a “male-only” section but with the current trends, things could be different in the near future.

For the age bracket of between 41-50 years, majority of the respondents 4 (8.3%) were males while the female was only 1 (2.1%). In the age bracket of above 50 years, only 2 males were representing 4.2% and no female. This age bracket is presumed to be of the senior-most members in the department (in terms of age and probably experience) and represents those nearing retirement. In most printing firms, these seniors are stationed in the press and post-press sections because of their wide knowledge and experience. However, in some printing firms (especially those with a long history and/or with the old conventional technologies), it is not unusual to find such staff still in employment or just about to retire. It is prudent for such

organizations to have a backup of younger staff (mentees) and succession plans to avoid being in a crisis when the time of exit finally comes.

For the interviews, three males (the heads of costing and estimation, pre-press and press sections) and one female head of post-press took part in the study. The social demographic characteristics of these interview participants were not captured because they make an insignificant interpretation.

4.3.2 Level of Education

The respondents were asked to indicate their highest level of education as presented in figure 4.2 below.

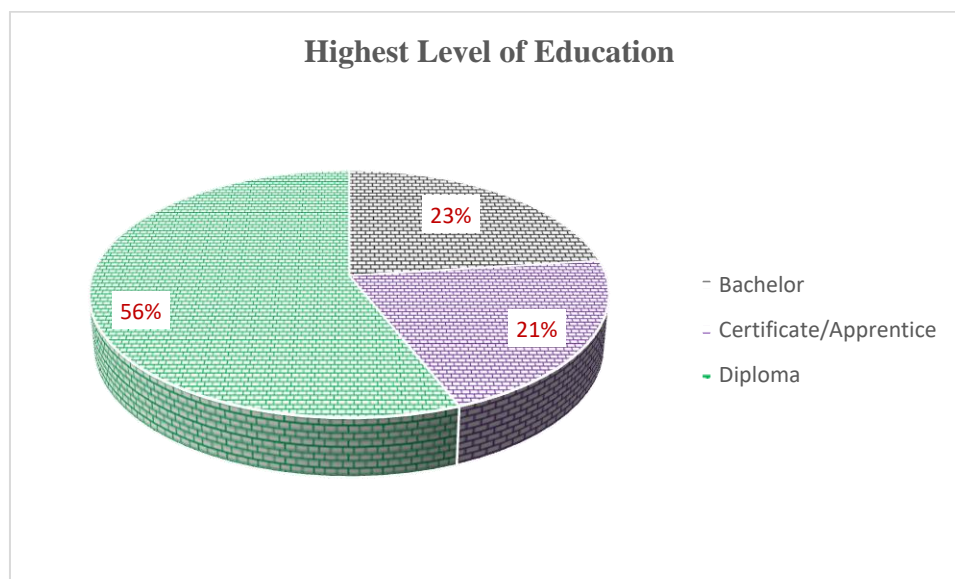


Figure 4.2: Highest Level of Education

From these findings, the respondents with the highest level of education were those with a bachelor's degree. They were 11 (23%) while those with the second-highest level were those with a diploma - 27 (56%). Those with the lowest were 7 (15%) with certificate qualifications and 3 (6%) had apprentice qualifications. The certificate and apprentice were combined to make the 21% shown in the pie chart (figure 4.2) above.

The interview participants' highest level of education was not recorded again for the simple reason that they make an insignificant interpretation. Besides, the researcher assumed that their position and/or rank corresponds to their level of education.

The head of the pre-press section in the interview reported that:

most of the staff in the pre-press section have diplomas in printing technology and every year staff appraisal is done, where for example a supervisor talks with machine operators and the manager is given the report to recommend further training on the machine or in other fields.

The following was an interview report from head of estimation and planning section:

All the staff in the planning and estimation section are graduates in printing courses in which they must have done units in estimation and planing. Staff from other sections have background experience and easilly catch up with estimation and planning. However, new membersof staff are inducted to estimation and planning and where necessary training is outsourced.

4.3.3 Specialized training by KLB

The respondents were asked to list any specialized training(s) obtained after joining KLB as presented in figure 4.3

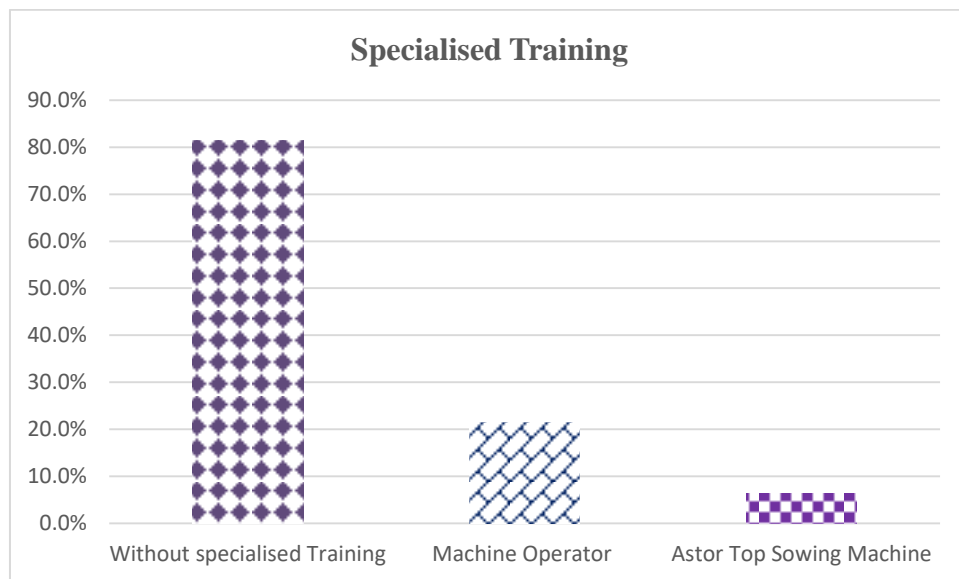


Figure 4.3: Specialized Training by KLB

It shows that a small number of the respondents, 6 (21.5%) have been trained internally (by KLB) as machine operators while 3 (6.3%) have been trained as Astor top sowing machine operators. The majority 39 (81.3%) of the respondents have not had any specialized internal training since joining KLB.

In this regard, many may be working without an opportunity and/or the possibility of updating their skills. This situation could be due to: heavy workloads, lack of time for specialized training, lack of resources for specialized training, lack of specialized trainers locally or internally, lack of self-initiative or simply unwillingness of individual staff to undergo specialized training, among many others reasons. These staffs are most likely those with certificates or apprentice skills who (as in the past) are taken straight from school or other non-professional areas, taken to printing and given training on the job.

For the sake of the organization and national development, KLB should offer specialized training to its employees (besides the initial one) especially in the utilization of new printing technologies in order to be more innovative, entrepreneurial and dynamic in skills.

For those individuals trained by the organization, it is usually a great privilege to gain hands-on skills and experience because it offers them a chance to try out new methods and fail in a safe situation. Failure is often the best teacher, and failure in this instance doesn't carry a cost. At the same time, feedback, from both the trainer and peers in the group, helps in understanding what can be done to avoid failure or underperformance in a real work situation.

4.3.4 Employment Position

The respondents were asked to indicate their employment position based on their duties as shown in table 4.3

Table 4.3: Employment Position

Gender	Support Staff	Operator Staff	Mid-Level Management	Top-Level Management	Total
Male	6	14	3	1	24
Percentage	12.5	29.2	6.3	2.1	50.1
Female	20	2	2	0	24
Percentage	41.7	4.12	4.12	0.0	50.0
Total	26	16	5	1	48
Percentage	54.16	33.33	10.41	2.10	100

From the questionnaires, the respondents' employment position was recorded and 26 (54.16%) are support staff, 16 (33.33%) are at the operator level, 5 (10.41%) middle management level and 1 (2.1%) at the top management level. The total number of employee respondents in the department is 48, shared equally among the two genders (24 male and 24 female).

This 24 for each gender (almost equal in terms of percentage, 50.10% and 50% respectively), is very good as far as gender parity is a concern. However, in terms of cadre and ranking, females are more at the lower level of 20 (41.7%) compared to males 6 (12.5%). This again is an interesting finding given that traditionally in most printing establishments, males have been more than females even at that level.

At the operational and mid-management levels, males are more than females, representing 14 (29.2%) against 2 (4.12%) and 3 (6.3%) against 2 (4.12%),

respectively as shown in table 4.3. This is quite normal and common in most printing firms.

There is only one male (2.1%) at the top management level and no female, an indication that females are yet to get to this level which is common in most printing establishments in the country. With the new trend of more young females coming on board, this is likely to change in the near future.

4.4 Range of Printing Technologies/Equipment available at the Kenya Literature Bureau

The respondents were asked to state which printing technologies they use in their respective work sections. The main reason for asking this question was to establish what range of printing technologies the organization is using and whether they are enhancing productivity.

Table 4.4: Compiled list of range of Print Production Technologies/ Equipment available at KLB as per the respondents

Pre-Press	Press	Post-Press/finishing
<ul style="list-style-type: none"> • Desk-top computers • Calculators • Guillotine • Computer to Plate (CtP) system • Print down frame, 	<ul style="list-style-type: none"> • Speed master (2 col) printing machine • KBA Rapida 105(4 col) printing machine • SORD I, II and III (single col) printing machines • Kord II Machine • Print on Demand (PoD) digital printing machine (black & white). 	<ul style="list-style-type: none"> • City line binding machine • MBO folding machine • Three Knife trimmer • Gang stitcher • Astor top sewing machine • Hand stitcher • Perforator • Wire binder • Communication Technologies.

All the respondents 48 (100%) listed the kind of technologies/equipment in their respective sections and their answers were captured and compiled as shown in table 4.4 above.

4.4.1 Range of Technologies/Equipment in Pre-press

In the pre-press section, the respondents reported to have the following technologies: Desk-top computers, calculators, Guillotine, Computer to Plate (CtP) system and Print down frame.

During the interview, the head of pre-press section reported as follows:

“Before 2014 we were using printing down frame but now the section uses CTP which is a chemical free machine”.

The head of costing and estimating section also said that:

We are in the process of improving our technologies from the manual estimation to automated estimation. We are in the process of installing software, print estimation software which is in progress but not finished, we have not yet started, so we are now using the normal which is manual.

From these findings, only the desktop computers and the computer to plate (CtP) system can be grouped under the new/improved (digital) technologies which can enhance productivity. The rest in this section (the manual calculators, guillotine and print down frame) belong to the old generation and could be undermining productivity. Besides, the print down frame which is no longer used or needed (because of the CtP) could be occupying space unnecessarily. In an ideal situation, KLB's pre-press should be fully equipped with high speed, less space occupying and energy-saving equipment and software. Examples of such include: costing and estimation software, dedicated scanner, digital proofing system, computer to press system, mobile CtP control APP (like the one from KODAK) for checking CtP devices from anywhere at any time. The APP (among the latest developments) is useful in controlling jobs remotely. For instance, it notifies one when jobs are done

running or if the CtP system or device abruptly stops for any reason. Additionally, among the staff in this section, there should be someone with special ICT skills as recommended by Smallbone *et al.* (2000).

4.4.2 Range of Technologies/Equipment in Press

The respondents of press listed their equipment as follows: Speed master (2 color) printing machine, KBA Rapida 105(4 color) printing machine, SORD I, II and III (all single color) printing machines and a black and white digital printing machine for print on demand (PoD).

Like in the case of pre-press section, all these equipment (except the Rapida and PoD) are too old and fall under the litho technologies. Additionally, black and white printing is no longer used for most publications; the latter having “shifted to color reproduction” (Romano, 2004, p. 5).

This, therefore, means that all the single- and two-color machines should no longer be needed and could be taking too much space as well as flooding the section with many operator staff unnecessarily. Instead, there should be for example, a 5/6 color-digitally controlled litho press, (like say, Heidelberg Speed master) and/or a direct 5 color digital press as recommended by Smallbone *et al.* (2000), to supplement what they have thus enhanced productivity in the section.

4.4.3 Range of Technologies/Equipment in Post-Press

In the post-press section, the respondents reported to have the following equipment: City line binding machine, MBO folding machine, Three knife trimmer, Gang stitcher, Aster top sewing machine, Hand stitcher, Perforator, Kord II machine and wire binder and communication technologies. Table 4.4 shows the full list of items as provided by the respondents and compiled by the researcher.

For enhanced productivity in this section, KLB should endeavor to acquire modern, state of the art binding equipment such as Morgana Auto Creasing/scoring, Stich master ST350, Auto bond B1 laminator, Duplo Du-Binder, to mention but a few examples.

The processes of printing technology are now moving towards the “one-man presses” by increasing automation (Romano, 2014). Hence, the range of printing technologies used at KLB should be one that is modern and creates an enormous potential for innovation in the field of machinery and equipment. The respondents were asked to list the kind of technology/equipment used in their sections because in the current world of fast-changing technologies, all stakeholders need to know. For instance, most print buyers would not place any work with printers before seeing their “plant lists”.

4.4.4 Pre-study information received

The key informants (from production, publishing, HR and procurement departments) were consulted before data collection. Among the prior information obtained was the number of work and process stations and plant list from production (as shown in appendix IV), staff and departmental data from HR, product range information from publishing and information on the age of equipment from procurement.

A plant list is a record of all equipment a firm has on the factory floor- those acquired mainly for use in all their operations. On taking a closer look at the plant list that was provided, the researcher found the following discrepancies: Some equipment appears in the plant list but were not in the respondents’ list of equipment used in their respective sections. These were:

- Film maker (no name or make)

- Plate maker (no name or make)
- MOZ machine
- STAHL I, II and III folding machines
- WOHLBERG trimmer
- KORD UV vanishing machine

Also appearing in the respondents list but missing in the plant list was the following:

- Computer to plate (CtP) system
- Black and white digital printing machine (PoD)
- Wire binder
- Communication technologies

Apart from this discrepancy being a subject of further discussion or debate, it supports the findings that indeed KLB's printing press needs a total overhaul in terms of their range of technologies, in order to enhance productivity.

4.5 Professional Training Levels of Staff in Use of New Printing Technologies

The respondents were asked to state whether in their opinion they are adequately professionally trained in the use of new printing technologies. This question aimed at establishing the professional training levels at KLB. The findings were as presented in figure 4.4.

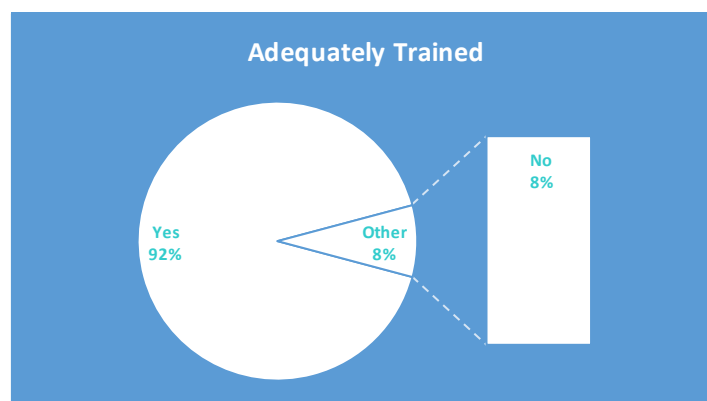


Figure 4.4: Adequately trained in using Technologies

Every effective printing firm which seeks the best patronage for its products and services has the end-user in mind right from the pre-press to the post-press. This

depends not only on the inputs and processes but on the training given to the employees as well. The respondents were requested to state the training levels in using printing technologies in their various sections and 44 (92%) said they are adequately trained and only 4 (8%) said they are not adequately trained (Figure 4.4).

From this finding, KLB has adequately trained staff, probably due to its long history of collaborative ties/relationship with the Technical University of Kenya (TUK), where they sponsor their staff for training. However, there seems to be a contradiction in the respondents' statement that they are "adequately trained" but again indicated training as among the areas that need improvement most. This shows that perhaps they did not understand that part of the question, or they meant that they need further exposure through training, which will be re-training in that case. The researcher assumed the latter, thus the reason for including it in the recommendations.

4.6 Perception of Staff in using the new Printing Technologies

The respondents were asked whether or not, they are aware of the usefulness of the new/improved printing technologies and therefore the need for proper utilization in order to enhance productivity in their organization.

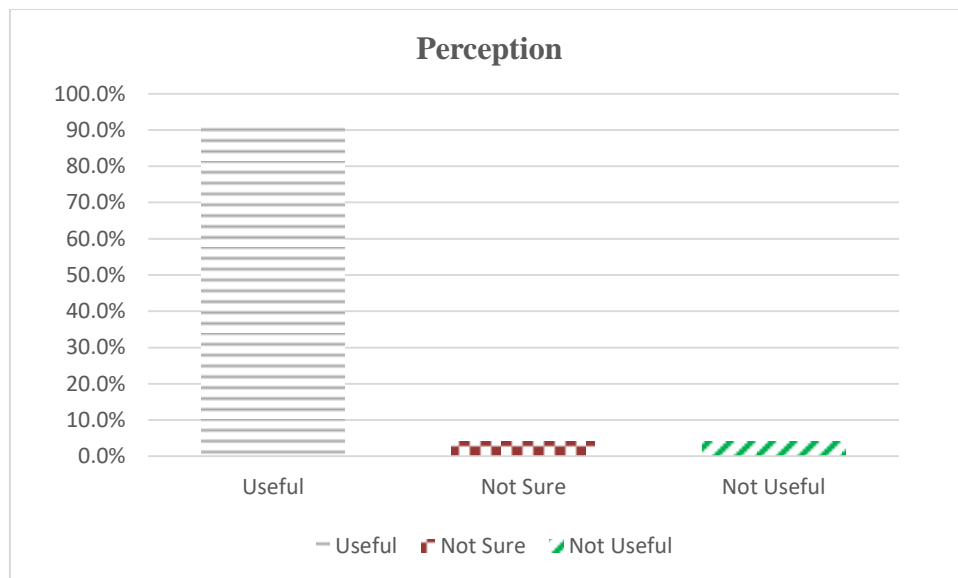


Figure 4.5: Perception about the usefulness of the new Technologies

Most respondents 44 (91.7%) perceived that the new technologies are useful while 2 (4.2%) were not sure whether they are useful or not. Almost the same number 2 (4.1%) said they perceived they were not useful.

An interview of the head of the section when reacting on the perception about the usefulness of the new technologies went as follows:

I feel the new printing technologies are very useful since the printing industry is very dynamic. In KLB though it will take a while to move from computer to press, like it took three years to move from computer to plate. Currently, we have acquired PoD machine, a digital printing technology which can handle A3 but black and white.

The current study findings match other findings that suppliers of new technologies assume that staff knows in advance what the total value of a technology is, which is not always true. What staff really knows is their perceived value of the new technology, which could be lower than the potential value provided by it according to the vendors. The adoption decision by staff will not happen unless there is a positive difference between the perceived values of the new technology versus the value of the existing technology (Tanev & Frederiksen, 2014).

4.7 Effect of the Printing Technologies on Productivity

The respondents were requested to tick where appropriate, in the boxes provided and include other responses in relation to their section. The responses were rated on a five-point Likert scale as follows: 5-Strongly agree, 4-Agree, 3-Not sure, 2-Disagree, 1-Strongly disagree and also scored on the same scale.

The findings were as presented in tables 4.5, 4.6 and 4.7.

4.7.1 Quality

The respondents commented on the quality of work output from pre-press, press and post-press as shown in table 4.5

Table 4.5: Quality of work output

Effects	Statement	5	4	3	2	1	\bar{x}	SD
Quality of work output from	pre-press depends on technologies	28	17	1	0	0	4.4	.90
	press depends on technologies	24	17	7	0	0	4.4	.73
	post-press depends on technologies	27	19	2	0	0	4.5	.58
	Average Score						4.4	.74

Their responses were that quality depends on technologies with equal mean scores of 4.4 (SD=.90 and .73). Most of the respondents agreed that quality of the work depends on technologies being used. Quality of work output from post-press depends on technologies as respondents scored a mean of 4.5 (SD=.58) and this showed that they agreed to the statement. Slow adoption of new technologies has been studied at the consumer level by Peres *et al.* (2010 cited in Wamuyu, 2015). Most companies are generally unaware of the new technologies' products' benefits for their organization or they consider them to be expensive.

One of the heads of the pre-press sections made the following comments during the interview:

Printing technology affects the quality of the product, like the CTP machine detect non-conforming parts and record images 100% without making mistakes. The machines also do make checks and balances and indicate alerts.

4.7.2 Capacity

Staff responses on capacity (quantity of output per hour) from pre-press, press and post press all said this depends on technologies being used as shown in table 4.6

Table 4.6: Capacity

Effects	Statement	5	4	3	2	1	\bar{x}	SD
	pre-press depends on technologies	29	18	1	0	0	4.6	.54
Capacity from	press depends on technologies	22	18	8	0	0	4.3	.74
	post-press depends on technology	27	17	3	1	0	4.5	.71
	Average Scores							.66

A mean score of 4.6 (SD=.54) was found indicating that most of the respondents agreed that capacity of the work in pre-press depends on technologies being used. Staff from print section scored a mean of 4.3 (SD=.74) and 4.5 (SD=.71) post press respectively which implied that capacity from the sections was affected by the kind of technologies being used.

4.7.3 Efficiency

Staff responses on efficiency from pre-press, press and post press said this depends on technologies being used as shown in table 4.7

Table 4.7: Efficiency

Effects	Statement	5	4	3	2	1	\bar{x}	SD
Efficiency in	pre-press depends on technologies	27	15	5	1	0	4.4	.77
	press depends on technologies	28	17	3	0	0	4.5	.62
	post-press depends on technologies	28	18	2	0	0	4.5	.58
	Average Scores						4.5	.66

The respondents gave an almost equal mean score for all the sections; 4.4 (SD=.77) for pre-press, 4.5 (SD=.62) press and 4.5 (SD=.58) post press. This is a clear indicator that technologies' being used is a function of efficiency and great determinant in the printing industry.

The head of the pre-press said the following concerning efficiency:

Printing technologies affects the efficiency of operation since the production time is reduced. In technologies like CTP, the time of producing one plate is reduced by 85%. This is because we no longer do film make layout, then exposure, developing it manually and drying it. In fact, CTP produces by itself in three to five minutes.

Also, the head of bindery department reported that:

The departments are trying to phase out the old machines in order to improve on the quality and efficiency. The aged machines affect the quality of the products because if the camera for example is not working some pages will be missing. So the department is undergoing modernization in order to improve efficiency for instance with the current trimmer machine, binding is not operational until cutting is complete.

Other studies found that way back in the 1980s when Desktop Publishing (DTP) was introduced and data began to be digitized; technology depended on the powerful informatics principle. DTP allows the compiling of text, image, and graphics elements digitally into complete pages using layout programs and the output of these by laser imaging units on film. The transfer of quality of work from prepress and the work preparation for make-ready and control of printing and finishing systems and shipping

processing play a vital role in introducing CIM in the printing industry (Szentgyörgyvölgyi, 2006).

4.8 Benefits, Challenges and Measures of Improvement for Better Productivity

The printing department at KLB has been undergoing enormous structural and technological changes aimed at modernizing it. In this study, the respondents were requested to state some of the accrued benefits, challenges and measures that can be taken to improve productivity in their sections. The findings are as presented in figures 4.6, 4.7 and 4.8.

4.8.1 Accrued Benefits of the new/improved Printing Technologies

Improvement of quality of print products, the effectiveness of print operations, efficiency in production processes and a combination of all these three were the benefits of the new/improved printing technologies listed by the respondents.

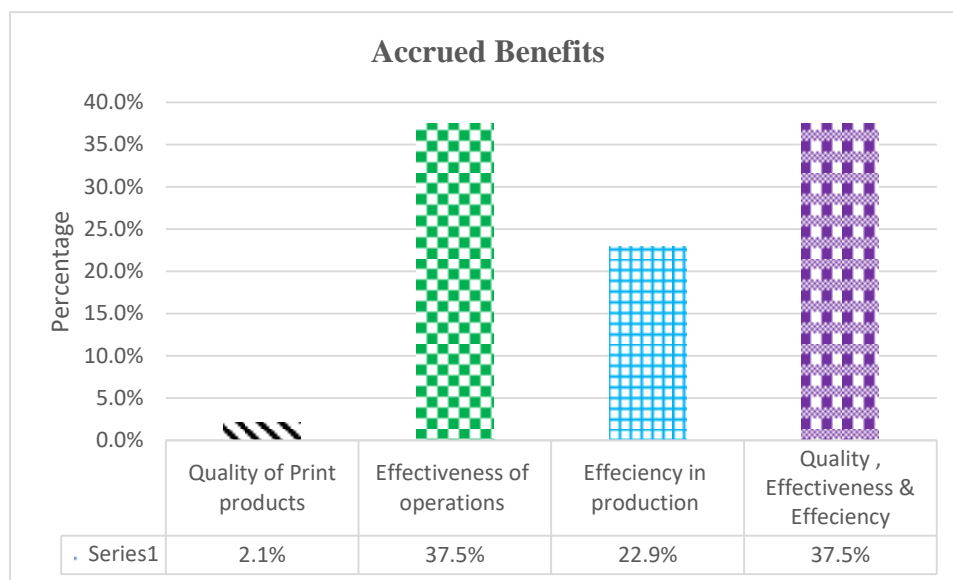


Figure 4.6: Accrued Benefits of the kind of Technologies in use

The study generated three themes out of the open statement falling under quality of print products, effectiveness of operations and efficiency in production. Higher

quality of print products was mentioned by 1 (2.1%) respondents as a benefit of the new technologies. Effectiveness of operations and efficiency in production were stated by 18 (37.5%) and 11 (22.9%) respondents respectively. Some of the respondents, 18 (37.5%) stated that all the three (quality of print products, effectiveness in operations and efficiency in print production) are benefits accrued from using new technologies in their sections.

In the qualitative part of this study, the head of pre-press section said:

Some of the accrued benefits of the CTP technologies are the mass production. CTP technologies has reduced health risks from dust and chemicals which were encountered from manual operations and were neither user nor environmentally friendly.

4.8.2 Challenges of the Printing Technologies being used

The participants were asked to state some of the challenges associated with technologies used in their section as shown in figure 4.7

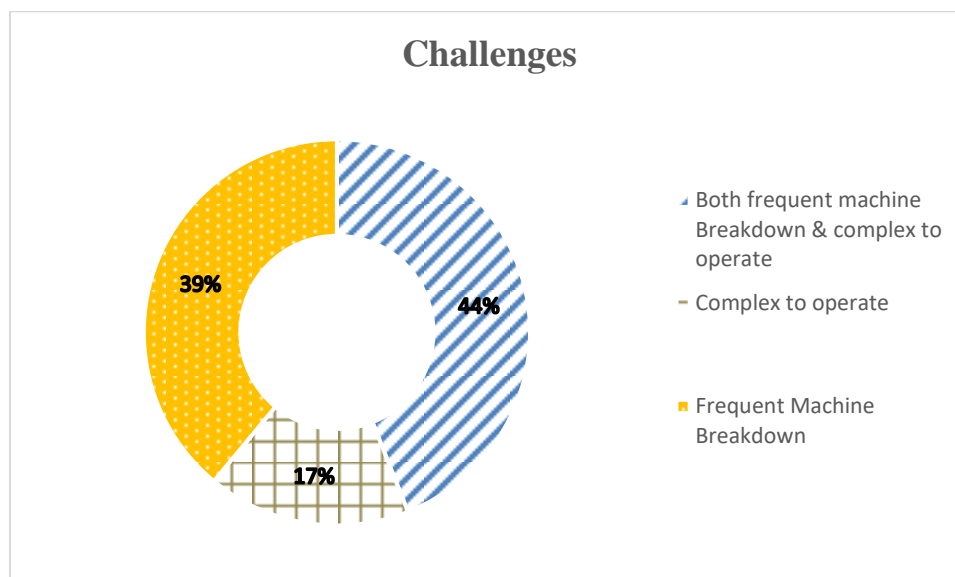


Figure 4.7: Challenges of the Printing Technologies in use

The main challenges identified were: Frequent machine break down, 19 (39.6%); complex to operate 8 (17%); frequent machine break down and complex to operate combined, 21 (43.4%), (Figure 4.7). High cost and heavy taxes in acquiring new or

improved technologies, high levels of unpreparedness in many printing firms can also be considered a major challenge and reason for the slow acquisition of new/improved technologies (Cragg, Caldeira, & Ward, 2011, Makhija, 2014). Wamuyu (2015), while citing Uzoka, Seleka, & Shemi also attribute the slow pace of acquisition of new technologies in the printing industry to social beliefs and cultural practices where managers feel more comfortable with the old technologies.

Both frequent breakdown and complex to operate were stated by the majority of the respondents' 21 (43.8%) as a challenge associated with the technologies they use in their section. Complex to operate came second in the list of most significant factors that determine whether or not, a printing firm will acquire new technologies. It negatively affects adoption as most previous research findings (Al-Gahtani, cited in Pardiwala, 2016) indicate. They suggest that the machine printing section staff's perception is that complexity is the major roadblock to the acquisition of new technologies. This implies therefore that printing staff with the perception of new technologies as being complex are most likely not to adopt them. Included in this category are those with the perception that new technologies are difficult to understand and utilize and those with the belief that such technologies require an advanced workforce that has exceptional skills.

4.9 Areas of Organization's Printing Press that need Improvement most

Opinion on the areas of improvement in the organization's printing press was sought from the participants, as shown in figure 4.8

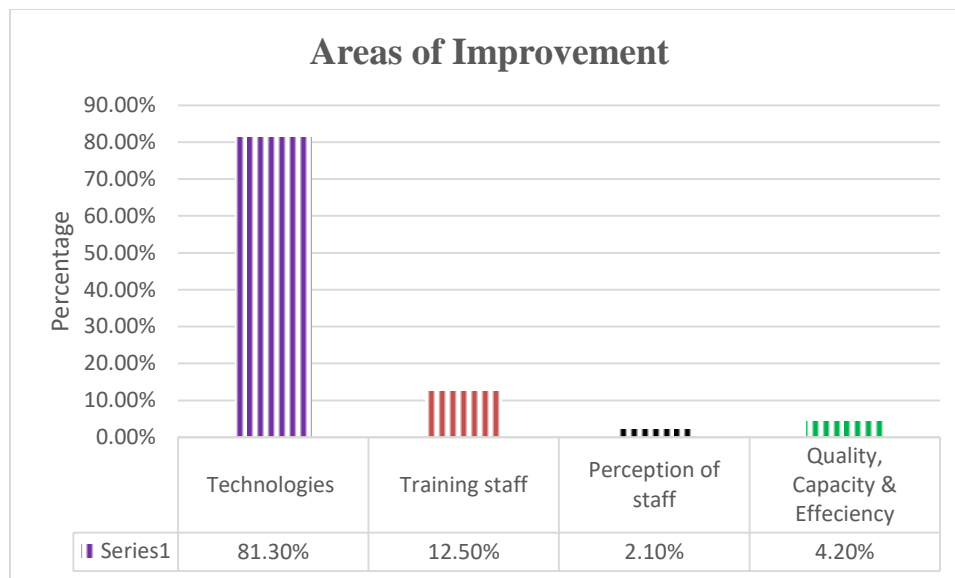


Figure 4.8: Areas of Printing-Press which need Improvement

Most respondents 39 (81.3%) indicated that the printing technologies being used in the printing press need improvement. 6 (12.5%) indicated staff training as the area needing improvement most. Productivity in terms of quality, capacity and efficiency all combined was opined by 2 (4.2%) of the respondents while 1 (2.1%) indicated a perception of staff as the area that needs improvement most.

These findings show that the growing acquisition of new/improved technologies have the potential to improve those core mission elements of printing firms like for instance; quality of print production, efficiency, capacity etc. Additionally, other studies have argued that the only way to achieve breakthroughs in these gap areas is through the combination of process redesign and technology (Abel, 2007).

To achieve differentiation and competitive advantage in the printing industry, having a skilled workforce is also extremely important (Rahim, 1988). The head of the estimation and planning section was interviewed. His work entails the calculation of materials, labor, overhead machines and power costs from the origination to the finishing point: pre-press to the post-press. He had the following to say:

The area of printing press which needs improvement most is improvement to the most current technologies though expensive and fact that it will take a little bit of time. Secondly is the exposure of our machine operators. The organization has challenges on the side of the maintenance. Our local engineers need some training since they don't have the know-how. Right now, in case of any failure in the technologies, the organization depends on engineers from abroad to service this kind of machines and this groans the operations.

This was consistent with the findings of Drupa (cited in Wamuyu, 2015), which indicated that shortages in recruitment and skills are what holds back the printing industry from progressing. It also agrees with Pardiwala's (2016) study and suggestion that printers and their services suppliers should prioritize education and training that are in line with new/improved technologies, more especially digital.

With many printing firms managing aged staff who are about to retire and the perception that the industry is on the decline, the recruitment of the next generation workforce (more especially those with new energy and better skills in information technology) is of great importance, challenges notwithstanding (Pardiwala, 2016).

4.10 Summary of the Chapter

In this chapter data is presented; analysis and interpretation for the same concerning Kenya Literature Bureau's printing section are also given. Data collected related to the utilization of printing technologies in enhancing productivity in Kenya Literature Bureau in order to understand the subject under study. The chapter has also covered: response rate, respondent categories, range of printing technologies available at the KLB, professional training levels of staff in using new printing technologies at KLB, perceptions of staff in using the new printing technologies at KLB, benefits and challenges of the printing technologies being used at KLB and measures for improvement.

The study established that KLB mainly uses the old conventional litho printing technologies, with a little adoption to new ones, more specifically computer to plate and black and white digital printing, meaning therefore that the printing technologies used in the organization's printing press need improvement. Measures for improvement are presented as suggested by the respondents and informants. If the suggestions can be taken in and implemented, productivity will be enhanced at KLB's printing plant.

The study ends with a summary of findings, conclusion and recommendations as presented in the next, final chapter.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the researcher discusses the findings of the study and provides a conclusion and recommendations.

The purpose of this study was to explore the utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau (KLB) with a view to proposing measures for improvement. The study had the following research questions:

1. Which printing technologies do the Kenya Literature Bureau's pre-press, press and post-press sections use?
2. To what extent are staffs using the printing technologies at the Kenya Literature Bureau professionally trained?
3. What are the perceptions of staff on the printing technologies they use at KLB?
4. How do the printing technologies currently in use at the Kenya Literature Bureau affect the quality, capacity and efficiency of print production?
5. What are the benefits, challenges and measures for improvement for better productivity at the Kenya Literature Bureau?

The study targeted production staff to obtain answers for these questions because they are the ones on the ground, using the technologies and therefore deemed to have the information. A total of 56 respondents comprising pre-press staff (n=18), press staff (n=19), post-press staff (n=19), made up the sample for the study. Data was collected through questionnaires and interviews.

5.2 Summary of the Findings

5.2.1 Which printing technologies do the Kenya Literature Bureaus pre-press, press and post-press/finishing sections use?

It is clear from the findings that Kenya Literature Bureau is mainly using the old conventional litho printing technologies and the few new ones they have adopted in pre-press and press sections - mainly computer to plate and black and white digital press are not adequate in enabling them to enhance productivity in their printing press. This study findings are in agreement with the finding of Rotich (2014, p.13) where he states that “Most of the printing machines available in Kenya are of an older generation than those found in developed nations like the UK”.

Delaney & D-Agostino (2015) also noted that any serious business-minded printing firm must not be inept in bringing in new technologies and managing the challenges that advancement brings along. This is in line with the Resource Based Theory’s (RBT) suggestion that the resources (printing technologies in this case) possessed by a firm are the primary determinants of its performance and /or productivity.

5.2.2 To what extent is staff using the printing technologies at the Kenya Literature Bureau professionally trained?

The study findings indicate that 44 (92%) of the staff is adequately professionally trained and only 4 (8%) are not adequately professionally trained. Despite the positive move of having adequately trained staff, there is still a need for more training/retaining and exposure to new developments and technologies in the printing industry. This will strengthen as well as encourage departure from the traditional norms where printing skills were only acquired through apprentice training at the workplaces and nothing beyond that.

Some printing firms in the country still prefer employing unprofessional staff and argue that printing is a manual job that does not necessarily need skilled labor and therefore to them, unprofessional or unqualified staff is cheap labor. However, this has changed with time and firms are now hiring trained personnel or sending them for training at institutions such as the Technical University of Kenya (TUK) or abroad. Until as recent as 2012, it used to be up to higher diploma level, but nowadays one can be trained up to undergraduate degree level. The Resource Based Theory again supports this.

5.2.3 What are the perceptions of staff on the printing technologies they use at the Kenya Literature Bureau?

It was necessary to ask the respondents what their perceptions are, concerning the printing technologies they use at KLB because that is what determines their accepting or not accepting; using or not using the new/improved printing technologies.

The study revealed that a good number of staff 44 (91.7%) perceived new/improved printing technologies to be useful, 2 (4.1%) perceived them not be useful and 2 (4.2%) were not sure of whether they are useful or not.

With the high perception rate (91.7%) on the usefulness of new printing technologies and staff concurrence that quality, effectiveness and efficiency are some of the key benefits they bring a long while at the same time continuing to use the old printing technologies shows a serious disconnect between “perception and the real situation”.

According to Taylor and Todd (1995), attitude toward using sequentially must be commensurate with the behavior of intention to use, which is the main factor to be considered when determining actual conditions of system use. The belief of perceived usefulness also affects behavior of intention to use over attitude toward using

technology, as advanced in the Technology Acceptance Model (TAM) used in this study.

5.2.4 How do the printing technologies being used at the Kenya Literature Bureau affect the quality, capacity and efficiency of print production?

Productivity is all about quality of output (in terms of print products and services), the quantity of output as well as the speed and cost-effectiveness of output.

It was necessary to ask the respondents this question in order to determine the effect of the new printing technologies on productivity. The study established that most respondents had an average mean score of 4.4 (SD =.74) on quality of work, 4.5 (SD=.66) for capacity and 4.5 (SD = .66) for efficiency. However, all these depend on the technologies being used thus confirming what Hultén, P., Viström, M., & Mejtoft, T. (2009) said about the role of new technologies on achieving higher quality, efficiency and capacity. The newer the technology/equipment, the higher the productivity and vice versa. This, therefore, implies that KLB can and should do better in acquiring new/improved printing technologies in all the three sections according to the RBT and as recommended below.

5.2.5 What are the benefits, challenges and measures for improvement for better productivity at the Kenya Literature Bureau?

Ordinarily, people do not stop to think about the benefits and/or the challenges of a system, technology or machine until when something goes wrong or they are prompted to talk about it. The researcher thought about asking the respondents this question in order to provoke them to give information concerning the kind of benefits as well as the challenges of the technology they are using. Majority (37.5%) of those

using new technologies gave a combination of effectiveness, efficiency and quality of print products as the main benefits.

The study findings therefore established that the utilization of new/improved technologies brings a combination of effectiveness, efficiency and quality of print products as key benefits. Again this agrees with the resource based theory (RBT) and what the study of Makhija (2014), found. On challenges, the study found both frequent machine breakdown and complex to operate (43.8%) as the main challenges. For frequent machine breakdown, it could be due to the old age of the machines. Complex to operate may be resulting from their few newly acquired technologies/equipment which require more time to learn as Ditmar's (2010) study found.

5.2.6 Are there possible measures for improvement for enhanced productivity at the KLB?

Most respondents 39 (81.3%) said printing technologies used in the organization printing press needed improvement (Figure 4.8). Other studies have contended that the only way of achieving significant breakthroughs in these gap areas is by combining process redesign with technology (Abel, 2007).

To achieve an advantage in the printing industry, a skilled workforce is extremely important. Consequently, one area needing improvement most was the training of staff 6 (12.5%) and the perception of staff 1 (2.1%). Quality, capacity and efficiency were opined by 2 (4.2%) respondents.

The head of the estimation and planning section whose work entails the calculation of materials, labor, overhead machines and power costs from the origination to the finishing point had the following to say:

The area of printing press which needs improvement most is improvement to the most current technologies though expensive and will take a little bit of time. Secondly is the exposure of our machine operators. The organization's printing has challenges on the side of the maintenance. Our local engineers need some training since they don't have the knowhow. Right now, in case of any failure in the technologies, the organization depends on engineers from abroad to service this kind of machines and these grounds the operations.

This agrees with the Resource Based Theory and what Drupa (cited in Wamuyu, 2015) research found out, which indicated that slow uptake of new technologies, shortages in recruitment and skills are what hold back the printing industry from progressing. Since many printing firms manage aged staff who are about to retire (and with the industry widely being perceived as in decline), the recruitment of the next generation (more especially, information technology savvy staff who can come in with new energy and better skills is of great importance. However, this is most likely to continue to be a big challenge.

5.3 Conclusions

The researcher had assumed that old printing technologies have serious shortcomings and limitations in production speed and quality of products (as in the current situation at KLB, which led to this enquiry) thus he set out to explore the utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau (KLB) with a view to proposing measures for improvement.

From the findings, it is established that indeed KLB mainly uses the old conventional litho printing technologies which undermine productivity; they have little adoption to the new printing technologies and there is a need to retrain/expose their staff. Despite the high perception rate (91.7%) on the usefulness of new printing technologies and staff concurrence that quality, effectiveness and efficiency are some of the key benefits they bring a long, there is a disconnect between "perception and the real

situation” meaning therefore that the printing technologies used in the organization’s printing press need improvement.

Adoption and use of new printing technologies for the printing industry are inevitable in this technological era. The slow uptake of new technologies can result in some of the printing firms winding up and such will not be beneficial to the government, the printing industry, workers and the general public. Besides that, clients always want convenience, usefulness, and greater value for money. This makes it necessary for the entire industry to continuously improve on quality, capacity and efficiency of processes, products and services which all depend on the kind of technologies used.

5.4 Recommendations

An attempt has been made to recommend some measures out of the findings and conclusions of this study. If taken into consideration, they will help in improving the situation not only at the KLB but in other printing and publishing firms as well. The study examined the range of printing technologies available at the KLB; the professional training levels of staff in using printing technologies at KLB; perceptions of staff in using printing technologies; the effect of new printing technologies on productivity; the benefits and challenges of new printing technologies and measures for improvement at the KLB printing press.

5.4.1 Allocation of adequate financial resources to the Printing Department

Although financial resources are limited in every organization, KLB Board and management should consider allocating more funds to the department for the purchase of new technologies and/or equipment and training of staff. Given that the department offers printing services on a commercial basis, it will be a good investment that should bring in good returns after some time.

5.4.2 The old printing technologies/equipment should be replaced by new or improved ones

The Management of KLB should ensure those old printing technologies/equipment are replaced by new or improved ones. For instance, the print down the frame, SORD I, 2 and 3 single color machines as well as the hand stitcher should be phased off because they are too old and purely fall under the old conventional litho technologies which undermine productivity and therefore, should no longer be used by any serious printer. Some of them can be sold to scrap metal dealers for recycling or to those with other interests. Such action will be a replica of what is happening in the developed world. The printing industry in Kenya should also follow suit by encouraging those printing firms with equipment more than 10 years old to dispose of them, although such decisions come with investments and financial implications as well as other concerns like; dumping, waste disposal, safety and the environment. However, with careful planning and implementation, the merits far outweigh the demerits.

Although according to Makhija (2014), new/improved technologies and/ or equipment are extremely expensive, capital intensive and require retraining of staff, KLB should acquire a new computer to press system, modern 6 color litho printing machine (if possible, a perfecto with full automation and connections with other peripherals such as perfect binding and/or sewing lines) and/or 5 color digital machine, to supplement what they have, so as to improve productivity.

Other printers should borrow a leaf and also come up with new creative and innovative ways of dealing with old technology printing equipment like for example, reconfiguring them for other uses. Some of the former letterpress printers are already converting their old platen Heidelberg machines into die cutting ones, to serve the

packaging sector with products such as boxes and cartons. Setting up a museum for old machinery and equipment is another way of finding good use of them. This will not only generate extra income but will also be preserved for future generations which will need to see and appreciate the advancements in printing.

5.4.3 Some of the old printing equipment should be traded in, for new ones

KLB management can discuss (with manufacturers or suppliers of printing machines) on the possibility of trading in their black and white digital printing machines for a new full-color one. This will not only save them money but make it possible to acquire the most modern print on demand machines for further improvement in productivity. Again, this model could be adopted by not only KLB but other printing firms in Kenya as well as in other developing countries.

The advantage of trading is twofold: first, it eases the printers' 'burden' of raising the often high capital required for investing in newer technology/equipment. Secondly, it can encourage or enable manufactures/suppliers to release more new technology/equipment into a ready market, thus enabling them to get into a win-win situation with the printers.

5.4.4 Staff should be continually trained and retrained on new printing technologies

The Human Resource Manager of KLB and indeed all other printing firms should encourage, recommend as well as make budgetary allocations for their staff to be trained in formal training institutions as well as through workshops, seminars and print exhibitions. Such initiatives will go a long in contributing toward re-equipping and updating staff skills in the use of new printing technologies. This will yield results in the form of a motivated workforce that can enhance productivity.

5.4.5 Zero-rating import duties on new printing technologies

Given the heavy capital requirements and high cost of printing equipment (Makhija, 2014), the Government should consider zero-rating import duties of new machines as a way of encouraging printing firms to acquire new/improved technologies. Such a request can be made by the management of printing firms to the National Treasury through the ministry of education, under which KLB falls.

5.4.6 Printing equipment policy formulation

KLB's board and indeed many other printing firms' board of management should liaise with the industry's technical experts and consider coming up with policies regarding disposal of old equipment as well as acquisition and utilization of new printing technologies/equipment.

5.5 Suggestions for Further Research

This study looked at the Utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau and point out that further research can be conducted on other printing organizations as well. Studies can also be carried on subjects such as the:

1. Factors that determine a printing firm's ability or inability to adopt new/improved technologies.
2. Role of management and other key stakeholders in decisions that pertain to acquiring new/improved printing technologies.
3. Cost implications for new/improved printing technologies.
4. Printing press ownership versus outsourcing of print production services and technologies

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APPENDICES

Appendix I: Letter to Respondents

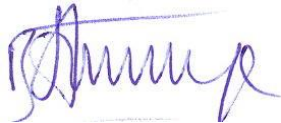
Joseph O. Menge
P. Box 72495 -00200
Nairobi

Dear respondent,

RE: INTRODUCTION

I am a Post Graduate student in Moi University, School of Information Sciences, carrying out a research entitled '**Utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau**'. Kindly assist by filling in the attached questionnaire with utmost honesty. Your response will be treated with absolute confidentiality and will be used for academic purposes only.

Thanks in advance.



Joseph O. Menge

Appendix II: Questionnaire

I am a Post Graduate student in Moi University, School of Information Sciences, carrying out a research entitled “**Utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau**”. You have been chosen as one of the respondents in the study. Kindly spare a few minutes to fill in the questionnaire with utmost honesty.

The information provided will be treated with confidence.

SECTION A: PERSONAL INFORMATION

(i) Please indicate your age bracket by tick

30 years and below () 31-40 yrs () 41-50 yrs () 51-60yrs ()

Above 60yrs ()

(ii) Please indicate your gender by tick

Male () Female ()

(iii) Highest level of education, (kindly tick appropriately)

a. Apprentice ()

b. Certificate ()

c. Diploma ()

d. Bachelor’s degree ()

e. Master’s degree ()

f. Any Other (please Specify) ()

(iv) Training, (Please list any specialized training(s) obtained after joining KLB)

(v) What is your department/work section: (Please tick)

Pre-press () Press () Print finishing/bindery ()

other (please specify) _____

(vi) How would you rank your employment position based on your duties? (Please tick)

Support staff () Operator staff () Mid-level Management staff ()

Top- level Management staff () Other (Please

specify)_____

SECTION B: PRINTING TECHNOLOGIES/EQUIPMENT AVAILABLE

(i) What technologies/equipment (list) is used in your section?

Prepress_____

Press_____

Print finishing/Binding_____

Other (Please specify)_____

SECTION C: STAFF TRAINING ON USE OF PRINTING TECHNOLOGIES

1. In your opinion, do you consider yourself adequately trained/skilled in the use of the technologies/equipment in your department/section?

Yes

No

If your answer for the above is No, what kind of training/skills do you need?

SECTION D: STAFF PERCEPTION ON USEFULNESS OF PRINTING TECHNOLOGIES/EQUIPMENT

1. What are your perception/ feelings about the usefulness of the technology/equipment that you are using? (Please tick)

I feel they are useful { } I'm Not sure { } I feel they are not useful { }

Kindly use your own words to briefly describe your perception/feelings about their usefulness, if your answer is different from the above

2 Do you feel the technologies/equipment you are using is easier to use?

Yes

No

If your answer for the above is no; what would you like your organization to do to improve your perception/feelings about ease of use?

SECTION E: EFFECT OF PRINTING TECHNOLOGIES ON PRODUCTIVITY

Please tick where appropriate, in the boxes provided and include other responses in relation to your section/ work station. The ratings appear as follows: 5-Strongly agree, 4-Agree 3-Not sure, 2-Disagree, 1-Strongly disagree

Quality

		5	4	3	2	1
1	Quality of work output from pre-press depends on the kind of technologies/equipment being used					
2	Quality of work output from press depends on the kind of technologies/equipment being used					
3	Quality of work output from print finishing depends on the kind of technologies/equipment being used					

b)Capacity

		5	4	3	2	1
1	Capacity (quantity of output per hour) from pre-press depends on the kind of technologies/equipment being used					
2	Capacity (quantity of output per hour) from press depends on the kind of technologies/equipment being used					
3	Capacity (quantity of output per hour) from print finishing depends on the kind of technologies/equipment being used					

c) **Efficiency**

		5	4	3	2	1
1	Efficiency in pre-press depends on the kind of technologies/equipment being used					
2	Efficiency in press depends on the kind of technologies/equipment being used					
3	Efficiency in print finishing depends on the kind of technologies/equipment being used					

SECTION F: BENEFITS AND CHALLENGES

a) State some of the accrued benefits of the kind of technologies/ equipment that you use

b) State some of the challenges you face with the kind of technologies/ equipment that you use

SECTION G: AREA(S) OF IMPROVEMENT

In your opinion, what area(s) of your organization's printing press need change or attention most? (Please tick)

- a. Technologies/equipment
- b. Training/skills of staff
- c. Perception of staff
- d. Quality, capacity & efficiency

Any other? (Please specify) _____

Appendix III: Interview Guide for Departmental/Sectional heads

My name is Joseph Menge, a postgraduate student at Moi University carrying out a research on "**Utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau**". The purpose of this research is to fulfil the requirements for the Award of the Degree of Master of Science in Publishing Studies of Moi University.

The findings will be used to guide the formulation of strategies for addressing challenges associated with adoption and use of new printing technologies to enhance productivity.

In conclusion, the researcher wishes to assure all respondents taking part in this study that all information provided in this interview will be kept confidential and used only for the academic purpose. You are encouraged to respond to the questions asked in this interview as honestly as possible.

I take this opportunity to thank you in advance for accepting to take part in the study.

Name (Optional) Mr./Mrs/Ms _____

Rank _____

Department/Section _____

- 1) What technologies/equipment does your section use?
- 2) (i) To what extent are your staffs trained in the use of this technologies/equipment?
(ii) How are training needs determined and addressed?
- 3) (i) What is your perception on the usefulness of this technologies/equipment?
(ii) What is your perception on the ease of use these technologies/equipment (i.e. are they easily usable)?
- 4) How does the technologies/equipment affect quality, capacity and efficiency of the operations of this section?
- 5) (i) What are some of the benefits of this technologies/equipment?
(ii) What are some of the challenges of this technologies/equipment (iii) what areas need improvement most in your view, and what should the organization do about that?

Appendix IV: Plant List as provided to the Researcher during pre-study

Machine/equipment	Function
Film maker	Pre-press
Plate maker	Pre-press
POIAR 115 EMC (COMPUTERIZED) Guillotine	Paper cutting/trimming
POIAR 115 EC (AUTOMATIC) Guillotine	Paper cutting/trimming
KBA RAPIDA 105 Printing machine	Four colour printing
SPEEDMASTER Printing machine	Two colour printing
MOZ Printing machine	Two colour printing
Mann Roland printing machine	Two colour printing
SORD 1 Printing machine	Single colour printing
SORD 2 Printing machine	Single colour printing
KORD Printing machine	Single colour printing
STAHL 1 Folding machine	Single fold
STAHL 2 Folding machine	Three folds
STAHL 3 Folding machine	Four folds
STAHL 4 Folding machine	Five folds
MBO Folding machine	Six folds
MULLER MARTINI Gang stitcher	Stitching
WOHLENBERG City line binder	Binding
WOHLENBERG Trimmer	Two knife trimming
ASTER 3 (220C/51) Book sewer	Sewing
ASTER 4 (220C) Book sewer	Sewing
Three knife trimmer	Trimming
KORD UV vanishing machine	Vanishing

Source: Kenya Literature Bureau, Nairobi, (2018)

Appendix VI: Budget

ITEM	Cost in Ksh.
Transport, Accommodations & Meals	35,000
Printings, stationery & Photocopies	15,000
Communication	5,000
Scholarly papers publications	30,000
Total	85,000

Appendix VII: Letter Seeking Authorization from KLB

Joseph Oigo Menge
P.O. Box 72495-00200,
Nairobi.
Tel: +254722335090
E-mail:
joemenge@gmail.com

10th July, 2018

The Managing Director Kenya Literature Bureau (KLB)

Bellevue Area
Popo Road, Off Mombasa Road
P.O. Box 30022-0100, GPO
Nairobi

Dear Sir,

RE: PERMISSION TO UNDERTAKE RESEARCH IN YOUR ORGANIZATION

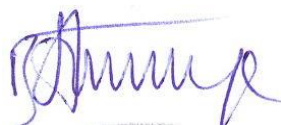
I am a postgraduate student at the School of Information Sciences, Moi University, pursuing a master's degree in publishing.

As part of the requirements, I am to undertake a research whose proposal I have entitled "Utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau".

Kindly grant me permission to undertake it in your organization.

It will be purely for academic purposes.

Yours faithfully,



Joseph O. Menge

Appendix VIII: Data Collection Letter

Joseph Oigo. Menge,
P.O. Box 72495-00200,
Nairobi.
Tel: +254722335090
E-mail:
joemenge@gmail.com

18th February, 2019

The Managing Director Kenya Literature Bureau (KLB)

Bellevue Area
Popo Road, Off Mombasa Road
P.O. Box 30022-0100, GPO

Nairobi

18-2-2019

Dear Sir/Madam,

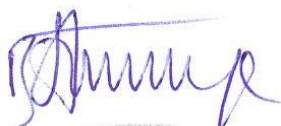
RE: DATA COLLECTION LETTER

My sincere thanks for granting me permission to undertake the research entitled “Utilization of printing technologies in enhancing productivity at the Kenya Literature Bureau”.

To facilitate data collection, I have designed a questionnaire for sampled 56 members of staff and interview schedule for various heads of section. Kindly allow me to collect data from the sampled population. Attached are copies of the questionnaire, interview guide and introductory letter from Moi University for your reference.

Thanking you for your continued assistance and remain,

Yours faithfully,



Joseph O. Menge

Appendix IX: Authorization Letter from KLB



Publishing and Printing for YOU

KENYA LITERATURE BUREAU
PUBLISHERS AND PRINTERS

HEAD OFFICE AND PRINTING PRESS

Belle-Vue Area, Popo Road, Off Mombasa Road • P.O. Box 30022-00100 GPO, Nairobi • Telephone: +254 (20) 3541196/7, +254 (20) 2048136
Mobile: +254 711 318188/ +254 732 344599 • E-mail: info@klb.co.ke
Website: www.klb.co.ke

SALES AND CUSTOMER SERVICE BRANCH

Kijabe Street • Telephone: +254 (20) 2684941-4 • Mobile: +254 733 666055/ 724 256629 • E-mail: customer@klb.co.ke

KLB/2/08: 2.II/ (35) **19th July, 2018**

Please quote our Ref Date :

Mr. Joseph O. Menge
P.O. Box 72495-00200
NAIROBI

Dear Mr. Menge,

RE: PERMISSION TO UNDERTAKE RESEARCH

Reference is made on the above-mentioned subject dated 10th July, 2018.

Your request to carry out research on “Adoption and use of new printing technologies to enhance productivity at the Kenya Literature Bureau, Nairobi Kenya” has been approved. Your report shall be used solely for academic purpose and a copy of the same submitted to the Human Resources Manager. Please report to the Human Resources Manager with your questionnaire.

We wish you all the best in your studies.

Yours faithfully,



Roselyn Mugavana (Mrs.)
For: MANAGING DIRECTOR



Kenya Literature Bureau is ISO 9001:2015 Certified.



MOI UNIVERSITY
ISO 9001: - 2008 CERTIFIED INSTITUTION

Tel No.: +254 053 43720, 43597, 43620
 Fax: +254 053 43047, 43360
 Telex No.: MOIVERSITY 35047
 Email [_hodpublishing@mu.ac.ke](mailto:hodpublishing@mu.ac.ke)

P.O. BOX 3900
 ELDORET
 KENYA

Direct Line (053) 43041

SCHOOL OF INFORMATION SCIENCES
DEPARTMENT OF PUBLISHING AND MEDIA STUDIES

Ref. No.: IS/MS/15/13

21st February 2019

The Executive Secretary
 National Commission for Science Technology & Innovation
 (NACOSTI)
 P O Box 30623
 NAORIBI

RE: JOSEPH OIGO MEMBE: IS/MS/PUB/01/16

The above named is our Master of Science (MSC) student in the Department of Publishing and Media Studies, School of Information Sciences Moi University.

Mr. Joseph is intending to carry out research work entitled "*Adoption and use of the new printing technologies to enhance productivity at the Kenya literature bureau.*" which is a requirement to MSc Programme in Publishing Studies.

We are kindly requesting you to issue him with a research permit to enable him proceed with research.

Thank you.


MR. K.S BUIGUTT
 Ag: HEAD: PUBLISHING AND MEDIA STUDIES
 /mkm





MOI UNIVERSITY
ISO 9001: - 2008 CERTIFIED INSTITUTION

Tel No.: +254 053 43720, 43597, 43620
 Fax: +254 053 43047, 43360
 Telex No.: MOIVERSITY 35047
 Email _hodpublishing@mu.ac.ke

P.O. BOX 3900
 ELDORET
 KENYA

Direct Line (053) 43041

SCHOOL OF INFORMATION SCIENCES
DEPARTMENT OF PUBLISHING AND MEDIA STUDIES

Ref. No.: IS/MSc/15/13

21st February 2019

Managing Director
 Kenya Literature Bureau
 P. O. Box 30022-0100, GPO
 NAORIBI

RE: JOSEPH OIGO MEMBE: IS/MSc/PUB/01/16

The above named is our Master of Science (MSc) student in the Department of Publishing and Media Studies, School of Information Sciences Moi University.

Mr. Joseph is intending to carry out research work entitled "*Adoption and use of the new printing technologies to enhance productivity at the Kenya literature bureau.*" which is a requirement to MSc Programme in Publishing Studies.

We are kindly requesting you to allow him processed with his research.

Thank you.


MR. K.S BUIGUTT
 Ag: HEAD: PUBLISHING AND MEDIA STUDIES
 /mkm

Appendix X: Research Authorization from NACOSTI



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 3310571, 2219420
Fax: +254-20-318245, 318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. **NACOSTI/P/19/91654/28676**

Date: **25th April 2019**

Joseph Oigo Menge
Moi University
P.O Box 3900-30100
ELDORET.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “*Adoption and use of new printing technologies to enhance productivity at the Kenya Literature Bureau, Nairobi Kenya.*” I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **25th April, 2020.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

**GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO**

Copy to:

The County Commissioner
Nairobi County

The County Director of Education
Nairobi County.

Appendix XI: Research Permit


THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014.

CONDITIONS

1. The License is valid for the proposed research, location and specified period.
2. The License and any rights thereunder are non-transferable.
3. The Licensee shall inform the County Governor before commencement of the research.
4. Excavation, filming and collection of specimens are subject to further necessary clearance from relevant Government Agencies.
5. The License does not give authority to transfer research materials.
6. NACOSTI may monitor and evaluate the licensed research project.
7. The Licensee shall submit one hard copy and upload a soft copy of their final report within one year of completion of the research.
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice.

REPUBLIC OF KENYA



National Commission for Science, Technology and Innovation

RESEARCH LICENSE

Serial No.A 24343

CONDITIONS: see back page

National Commission for Science, Technology and Innovation
P.O. Box 30623 - 00100, Nairobi, Kenya
TEL: 020 400 7000, 0713 788787, 0735 404245
Email: dg@nacosti.go.ke, registry@nacosti.go.ke
Website: www.nacosti.go.ke

THIS IS TO CERTIFY THAT: Permit No : NACOSTI/P/19/91654/28676

MR. JOSEPH OIGO MENGE Date Of Issue : 25th April,2019

of MOI UNIVERSITY, 0-200 Nairobi, has Fee Received :Ksh 1000

been permitted to conduct research in

Nairobi County

on the topic: ADOPTION AND USE OF


NEW PRINTING TECHNOLOGIES TO

ENHANCE PRODUCTIVITY AT THE KENYA



LITERATURE BUREAU, NAIROBI KENYA

for the period ending:

25th April,2020



Applicant's Signature

Director General

National Commission for Science, Technology & Innovation

Appendix XII: Plagiarism Report

UTILIZATION OF NEW
PRINTING TECHNOLOGIES IN
THE PRINTING INDUSTRY IN
KENYA: A CASE OF KENYA
LITERATURE BUREAU

by Joseph Oigo Menge

Submission date: 09-Jun-2020 10:14AM (UTC+0300)

Submission ID: 1340587357

File name: Joseph.doc (664K)

Word count: 21633

Character count: 119841

UTILIZATION OF NEW PRINTING TECHNOLOGIES IN THE PRINTING INDUSTRY IN KENYA: A CASE OF KENYA LITERATURE BUREAU

ORIGINALITY REPORT

11%	7%	4%	9%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

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3	Handbook of Print Media, 2001. Publication	1%
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5	www.tandfonline.com Internet Source	1%
6	Submitted to Maastricht School of Management Student Paper	<1%
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