

**IMPACT OF PRINT MANAGEMENT INFORMATION
SYSTEM ON THE DIGITAL PRINTING
ENTERPRISE IN NIGERIA**

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NIGERIA, NSUKKA

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IN NIGERIA**

**A THESIS PRESENTED TO THE DEPARTMENT OF FINE AND
APPLIED ARTS, UNIVERSITY OF NIGERIA,
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**IN FULFILMENT OF THE REQUIREMENTS
FOR THE AWARD OF DOCTOR OF
PHILOSOPHY DEGREE IN
ART EDUCATION**

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CERTIFICATION

This is to certify that Yibis Muripshaka Gotar a postgraduate student in the Department of Fine and Applied Arts, University of Nigeria Nsukka with registration number PG/Ph.D/10/58151 carried out the work contained in this thesis and satisfactorily completed the requirements for the award of Doctor of Philosophy in Art Education. The work embodied in this thesis is original and has not been submitted in any part or full for any other diploma or degree of this or any other University. References made to published literature have been accordingly duly acknowledged.

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APPROVAL

This thesis has been examined and approved for the Department of Fine and Applied Arts, University of Nigeria, Nsukka.

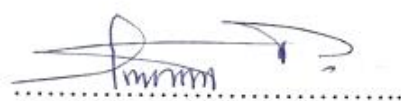
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DEDICATION

This project is dedicated to my beloved mother - Matwok Matgaram Gotar.

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DEFINITION OF TERMS

Acronyms

CIP4:	International Cooperation for the Integration of Processes in Prepress, Press and Postpress
CTF:	Computer-to-Film
CTP:	Computer-to-Plate (Computer to Press)
DAM:	Data Asset Management
DD:	Daily Docket
DTP:	Desktop Publishing
DPE:	Digital Printing Enterprise
DI:	Direct Imaging
HCD	Human Capital Development
JDF:	Job Definition Format
JCC:	Job Control Card
JMF:	Job Messaging Format
PDF:	Portable Definition Format
PJTF:	Portable Job Ticket Format
PPF:	Print Production Format
SFDC:	Shop Floor Data Collection
VDP:	Variable Data Printing
WIT:	Works Instruction Ticket

Definitions of Terms

Amendments to orders: A Designed form usually in distinctive colour attached to WIT containing full details of amendments required to job which the works instruction ticket has been prepared and issued to production department.

CIP4: In stands for International cooperation for the integration of processes in Prepare Press and post press. It was initiated by Adobe, Agfa, Heidelberg

Druck Maschinen AG and ManRoland. CIP4 is an open organization where all members are welcome to actively participate. Its main work is to public the JDF specification and develop a number of tools that can be used for building systems that use JDF

Computer to Film (CTF). A system of processing and sending information direct from a personal computer to film base materials

Computer-to-Plate (CTP): A system of processing and sending information direct from a personal computer to Plate/Press

Daily Docket (DD): A designed form meant for production where workers are to enter all the details operations inclusive of time spent, machine use/hand operational activities, time of materials used and issuing officer (s).

Desktop Publishing (DTP): A system of producing print electronically where the images are created on a PC which are then output on a printer or image setter or transmitted directly to the press for mass production.

Despatch Book: The document links to print finishing department to record details of all transactions on complete printed job before delivery

Digital Printing: An electronically controlled process of producing prints without image carrier on myriad surfaces (substrates). It is also called non-impact printing (NIP)

Digital Printing Enterprise (DPE): A business firm that engages in the print production and other value added services using digital printing technologies.

Direct Imaging (DI): Refers to the process of transferring images directly from the computer to fixed image carriers (Plate) on the press rather than offline for printing. DI is a term that replaces ôhybrid Pressô

Estimate Form: A designed form used for entering details of job specifications for production such as number and types of colours, quantity, quality, materials to be used, method(s) of production and machines to be used.

Flexography: A relief printing process that uses flexible printing plates made from rubber or plastic to print on several substrates.

Gravure: A printing process that prints from a recessed surface. The image to be printed is cut into the surface that retains the ink to be transferred onto the paper.

Job Definition Format (JDF). JDF is an industry standard designed to simplify information exchange between different applications and systems in and around the graphic arts industry.

Job Control Card (JCC): A designed Card where details of job specifications are entered.

Job Cost Sheet: A designed form that is used to record all cost incurred on production of each job which may include cost of artworks and other indirect expense on a daily basis

Job Messaging Format (JMF): JMF is used in the Print Production Work flow to communicate job tracking information; monitor the various production systems such as prepress equipment, printing presses and to some extent it controls the production system

Letter Press: A relief printing process that prints from raised image surface

Loading Board: A display board where the progress of every jobs are displayed to be easily seen which is strategically located within the production workshop.

Materials Release Cutting Ship: A designed form that usually carries brief information on material requirements for production of print jobs

Offset Lithography: A process of printing where an image is first printed onto an intermediate rubber cover roller from an image carrier and then finally transferred unto the paper.

Order Book: Document containing all the preliminary information about the job to be printed usually supplied by the client to the Desk Officer of the Printing firm

Perfecting Press: A machine that prints on both sides of a sheet or web of paper at a go

Portable Document Formation (PDF): A file formation used to represent a document independent of the application software, fonts, hardware and operating system used to create it.

Portable Job Ticket Format (PJTF): It is used as a proprietary job ticket format for exchange of processing instructions between systems in prepress.

Post Press: A production unit of the printing enterprise that does work on printed sheets to bring the printed job to final form for the print consumer.

Pre-press: A production unit that deals with processes of preparing a printing pieces prior to printing (Ink on paper)

Press: A production unit between the prepress and post press that carries the activities of putting ink onto the substrate

Printing industry: An industry that utilizes graphic communications technologies and other techniques and processes to produce prints on substrates with the use of pigments (ink)

Print Management Information System (Print MIS): A computerized Data System that make available information for use in Managerial problems solving and decision-making in day-to-day activities of print production business.

Print Production Format (PPF): PPF is used as a storage and transferring Information system that is generated at different production in steps in prepress, press and post ñpress.

Production Programme: A list of production sequence usually issued daily (or as the case may be) to each production unit to ensure that works are carried out according to the overall programme of the production schedule.

Screen Printing: A process that involves printing through a stencil that adheres to a silk or nylon screen onto a variety of flat or round substrates.

Shop floor Data Collection (SFDC): A system of recording (gathering) information on everything observed about the job and on the production in the print workshop by the workers

Spoilage Ticket: A document that usually carries record of work or job spoiled through error, accident or customer rejection or any form of bad print work that does not meet up the standard so that a make-up quantity of materials or printed matter be added or replaced.

Variable Data Printing (VDP): A digital Printing Process of Producing four ñ colour at time using PC to paper devices which are capable of reproducing variable content from copy to copy.

Web-fed Press: A technology that prints on paper fed into it from a large roll (or web) rather than on individual sheet of paper.

Works Instruction Ticket (WIT): A designed form where customer's reference, job instructions and basic requirements are entered and conveyed to each unit for production

ABSTRACT

The study assessed the impact of Print MIS systems on digital printing enterprise in Nigeria.

Four purposes and four research questions were formulated to guide the study.

Descriptive survey research design was adopted. The researcher conducted the study in six cities selected from the six geopolitical zones of Nigeria namely: Jos, Kaduna, Abuja, Enugu, Port Harcourt and Lagos. The selection was based on the fact that the cities have high concentration of printing firms and therefore have beehive of printing activities. The population of the Study was 1315 print managers. The sample size of 306 was used. This sample was statistically obtained using Taro Yamane's formula. The instrument adopted for data collection was a 60-item structured questionnaire on a 5-point Likert Scale of Strongly Agree, Agree, Undecided, Disagree and Strongly Disagree. The instrument validated by three experts; one from the Department of Fine and Applied Arts, University of Nigeria, Nsukka, another one from the Department of Art Education, University of Nigeria, Nsukka and the last one from the Department of Printing Technology, Kaduna Polytechnic. Mean and standard deviation were adopted to analyze the data, and the calculated mean score of 3.00 as the cut-off point of either to reject or accept any rated opinion. The findings - human capital development, capacity building and organizational restructuring strategies identified were all required for the implementation of the Print MIS with mean ($\bar{x}$) rating score of 4.1. The effects of utilization of Print MIS on workers who had no computer skills was rated with mean ($\bar{x}$) score of 3.9. The impact of implementation on the DPE was high, with mean ($\bar{x}$) rating score of 4.1. The major conclusion drawn from this study is that the DPEs were found not to have the full understanding of Print MIS and therefore did not implement it as a core communication tool in the workplace. This is a serious setback for the printing industry in Nigeria and therefore the industry has to come to terms with realities in the sector to address these issues by embracing the technological changes going on globally in the print industry.

CHAPTER I

1.0 INTRODUCTION

1.1 Background to the Study

Printing Industry is a communication service industry that produces print media which is at the core of all human communication especially in education and training institutions, industries, commerce, governments, religious institutions, the arts and sciences. All rely on the products of the industry (books, newspapers, magazines, brochures, newsletters, paper bags, cartons, packs, labels, fabrics, paper currencies and coins) to communicate and fuel the economic, social and technological development of a nation (PIA, 2000). The products of the printing industry have been manös important tool of communication from generation to generation (Rodman, 2006; Bugi, 2007). These products form the entire mass communication print segment of manös information society. Karsnitz (1993) pointed out that much of our progress, both socially and technologically, is directly linked to the exchange of printed information. These communication print media are usually customized and client initiated. Akinsoyinu (2004) categorized these communication print media into:

- i. *Mass communication media* (books, journals, magazines, newspapers, brochures, newsletters, pamphlets, flyers, etc)
- ii. *Packaging media products* (Paper bags, packs, cartons, plastics, metals, labels, confectionery, etc).
- iii. *Fabrics* (textile print products)
- iv. *Currencies* (paper currencies and coins)

Speirs (1994) and Kipphan (2001) pointed out that although printing industry was a ñclosedö craftñbased industry (highly restricted skill practicing profession for print

media production) but today, it has become part of the wider multi-media communications industry where publications, documents and records can be produced in so many different ways apart from the traditional forms of print production (Speirs, 1994; Kipphan, 2001). Printing industry has become one of the largest manufacturing industries and the largest employer of labour (Speirs, 1994; Luttrupp & Greenwald, 2009). The industry employs different practicing professionals such as graphic designers, technicians, technologists, engineers, scientists, marketers, educators, and business managers all performing complementary roles to produce the print information. Printing industry is notably different from other industries in:

- i. its long history as a communication industry;
- ii its structure which includes relationships between print workers, employers, customers and the states;
- iii the internal relationships as in trade unions which develops its social factors;
- iv its external significance to the society; and
- v The overall fact that these features have been in existence for over five hundred years, (Parnell, 2006).

Printing industry is highly structured having many different processes and sections that each can engage a good number of workers to make it operate maximally. Some of these printing processes include: offset lithography, letterpress; flexography, gravure and screen printing (Prust, 1989; Karnitz, 1993). However, due to technological changes especially in Information and Communication Technology (ICT), the industry has witnessed tremendous technological changes. These changes include Computer-to-Plate (CtP), Direct Imaging (DI) and Digital Printing Technologies. These are considered

new technologies and are seen to be having some serious impacts in the industry leading to restructuring and integrating digital work flow system. This integrated workflow system uses electronic information-based working tools such as Print Production Format (PPF), Job Messaging Format (JMF), Job Definition Format (JDF), Job Production Ticket Format (JPTF), Portable Job Format (PTF) and International Co-operation for Integrated Processes in Prepress, Press and Postpress (CIP4). These tools are fast changing the conventional printing industry that is characterized by mechanically analogue technologies to digitally integrated print manufacturing technologies (Kipphan, 2001; Romano, 2004). These evolving technologies provide the basis for this study on the Impact of Print Management Information System (Print MIS) on the Digital Printing Enterprise.

Print MIS is a planned system of collecting, processing, storing and disseminating data in the form of information that is needed to carry out the functions of management. Therefore Print MIS was explored here in historical perspective of printing industry as discussed below.

History of printing can be traced back to the invention of writing which was the first revolution in human communications. This event took place in ancient kingdoms of the Middle East when the rulers were using written word to publish declarations, while the merchants used it to keep track of their trade activities, myths and tales (Simeon, 2004; Thompson, 2009). Mayor (1976) said that Walter Ong called this period as Scribal Culture (manuscript culture) when human communication transited from the oral to the written culture.

The second revolution in human communication history was the transition from the scribal culture to print culture that took place in China around 800 A.D. (Irvine, 1999). The Chinese engraved characters in reversed for block printing including the production of seals and stamps impressed upon locally made paper. While the Chinese continued with this practice of creating literary and scholarly works using wooden blocks, the Koreans by 13th Century have replaced wood block printing with movable metal types (Thompson, 2009; Berthold, 1973).

Parnell, (2006) and Simeon, (2004) pointed out that from this point, not much progress in printing took place until in the 15th Century when Johann Gensfleisch Gutenberg through his ingenuity combined the existing technologies at that time (the wine press, textile and paper making devices) to achieve the technology that has been attributed to him ñ the invention of movable type and the production of the first commercial printing press.

Much progress in the printing industry was not recorded after Gutenberg's invention until the period of Industrial Revolution in the 18th century (1780) which brought about some significant changes in the industry. These changes were the replacement of the wooden press with the iron press, utilization of steam power (steam press), perfecting press, rotary printing press, web machine and the prepress equipment (intertype, monotype and linotype) composing machines (Clair, 1965; Child, 1966; Smith, 2014; Parnell, 2006; Walker, 2008).

In a study conducted by the Printing Industry America (PIA, 2000), it reported that between 1950s and 1960s, prototype setting machines were introduced into the industry to generate types for print production. The application of these machines

gradually replaced the hot metal typesetting technologies and in the 50s and 60s, the advancing technology led to computerization of the prepress in which type composition was completely done electronically in the 80s. This marked the beginning of the computerization (or otherwise called digital technology) of the printing industry and this provided the basis for the study which is to assess the impact of Print MIS on digital printing enterprise in Nigeria.

The evolution of Print MIS in the printing industry can be traced back to the time when the first generation keyboard of phototypesetters were introduced in the 50s which replaced the typewriters and the manual estimating functions (Chakravarty, n.d; Rodriquez, Gogula, Kharalkar & Kamar, 2006). The growth and development brought in by ICT, made the industry witness a paradigm shift. The conventional system of mechanical print production was changed to a digital system of print production in the early 80s. Thus the technology of converting print jobs into electronic form evolved which ushered in a new trend of print manufacturing and information management system for printers in the industry. Consequently Romano (2004) and Walker (2008) identified the following as the evolving trends in the printing industry:

1. Digitization of data in the industry:
 - i Digital Colour Separation
 - ii Computer-to-Film
 - iii Computer-to-Plate
 - iv Computer-to- Press (Direct Imaging)
 - v Digital Printing
2. Hybrid Printing (conventional + digital printing)

3. Cross-media printing (from one media to another media)
4. Variable data printing (print on demand)
5. Integrated digital workflow print environment (eg Web2Print)
6. Enhanced general systems integration: the enhanced general systems integration, according to Canadian Printing Industries Sector Council (CPISC, 2008) is divided into two:-
 - (a) *Technical integration* which enables one machine to communicate with other machines and is largely the purview of equipment manufacturers
 - (b) *Business-level integration* that involves taking several system components ñ from prepress all the way through the client billing and linking them together to create larger systems (e.g use of Print MIS solution)

The change in technology is continuously making the printing industry to evolve into new and exciting electronic image-driven by digital technology. According to Thompson (2009), digital technology, economic restructuring, global competition, marketing changes, emerging new media and other market forces are combining to dramatically change printing industry operating environment. The study into the competitiveness of the UK Printing Industry conducted by British Printing Industries Federation (BPIF, 2002), concluded that printing industry trend is fast moving towards computer integrated manufacturing (CIM) system. This new digital system is characterized by digitally integrated workflow system using information working tools such as the JDF, PPF, and JMF.

These emerging digital technologies in the print industry are complete transformation from an analogue printing system and therefore require new skills, knowledge and competency. According to Frey, Sorce, Amendariz, Gargiulo and Searles (2009), the print industry is becoming more involved in digital and production services hence new skills sets and competencies are inevitable. These are making the printing enterprise redefining its businesses to one of identifying customers' changing print media communication needs. These have been brought about by the digital processing, storing and delivering of information through the internet as the most effective distribution channel (Thompson, 2009); hence the need for acquiring new digital skills and knowledge for the transformed print media industry. This trend makes it necessary for this study to explore the Nigerian Printing Industry to determine its current technological position. This provided the basis for exploring the historical perspective of the Nigeria printing industry as briefly considered here.

The history of the Nigerian Printing Industry can be traced back to the early Christian Missionaries who came and established the first printing press mainly for the publication of religious literature (Agbebi & Fadina, 1995). Akinbobola (1993) in his submission pointed out that the first printing press ever to be operated in Nigeria was established in 1846 in Calabar by Rev. Hope Waddel who was accompanied by Samuel Edgerly of the Presbyterian Church of Scotland. This printing press was used for the production of religious, educational and indigenous literature for the purpose of promoting christian faith evangelism. In 1854 the second printing press was established in Abeokuta for Newspaper production which commenced production

five years (1859) after its establishment. It came out with the first Newspaper in Nigeria called *Ólwe Irohin Fun Awon Egba Yoruba* (Fagbemi & Olukesusi, 2003). Between 1900 to date, several commercial and newspapers printing enterprises including government printing presses have been established.

Printing and publishing enterprises and the types of print works they are engaged in vary in sizes. The entire industry provides print services that include newspaper and book publishing, light industrial packaging, tobacco and textile packs, labels for breweries, household packaging products, confectionery, other food and beverages packages (Akinsoyinu, 2004). The channel of communication in the print workshop especially in conveying detail instructions in the workplace for planning and coordinating work to enable the production of the print media was the paper-based information system such as works instruction ticket (WIT), loading cards, estimate forms, order entry forms, shop floor data collection (SFDC), standardized report and other forms of paper-based information media in the print workshop (Adeniyani, 2006). The utilization of these types of instructional media and documents was to ensure effectiveness of information dissemination in the workplace to enhance productivity and efficiency through the stages of administration, production, and post-production in the printing organization.

However, with the introduction of digitization in the industry, the paper-based information system of communication in the workplace metamorphosed into computer-aided information system. This was as a result of change from the use of analogue printing machines to digital printing technologies. Curlay (2012) observed

that Nigerian printers are gradually moving out of mechanical printing to computer-to-film, computer-to-plate and digital printing. Okunola (2012) also pointed out that the Nigerian printers should be encouraged to use these new improved technologies to increase productivity and enhance their profitability. It is against this background that this study x-rayed the Print MIS impact on the printing industry in Nigeria. The information stated above is indicative of the fact that, printing industry in Nigeria is undergoing transformation from the traditional to digital printing and communication technologies particularly the digitization of data and information dissemination in the workplace. Relevant literature have revealed that in today's world of print business, Print MIS is vital in the workplace for automation of the entire print production process. It is the Print MIS that makes printing enterprise stand out amid enormous competitions in the global printing market (Mariam, 2012).

The implementation of Print MIS (equipping an organization with digital working tools) requires that the traditional printing industry first needs to be transformed into digital printing enterprise (DPE) to provide:

- i. A Network of computers
- ii. Digital printing machines/hybrid printers
- iii. Integrated Print MIS enabled work environment
- iv. Digitally skilled and knowledgeable human capital

The implementation of Print MIS in the DPE enables it to perform many other functions including: ease of accessibility of information, gearing toward customized and client initiated products, stages of print media production that are

highly structured requiring good information management for effective production system (i.e the use of JDF System) and effective production of the bulk source of information in the society (Romano, 2004)

1.2 Statement of the Problem

Paper-based Information System (e.g. Job Tickets, Works Instruction Tickets, Loading Cards, Estimate Forms, Job Cost Sheet) is the most widely used communication media for conveying details about the requirements and specifications for a print job as it progresses through the stages of administration, production and post-production in the printing workplace (Adeniyi, 2006; Smith, 2014). These information tools provide detail instructions for the production of all kinds of print products and have been in use in the industry for quite a long time (Speirs, 1994). However, recent empirical studies revealed that the Paper-based Information System is causing a lot of delays in production and wasting of materials in the workplace (Parnell, 2007). Paper-based Information System is error-prone and time consuming for re-entering of information when a job moved between systems (Buckwalter, 2006). With the Paper-based Information System, information is not easily accessible and they are not interactive to provide effective and timely information to workers in the workplace to enhance print productivity and print management efficiency (Kipphan, 2001; Efi, 2005; McWilliam, 2007). This situation is also overburdened with the over-widely continuous use of traditional printing technologies consisting mostly of offset printing machines, characterized by use of craft or

trade workers (Xerox Corporation, 2011). Coupled with this is the haphazard transformation to digital printing which is evolving but is not backed with new skills, knowledge and competencies of human capital. This made it almost impossible for the industry to meet up print production capacity required for Nigeria. It is on record that there has always been a large volume of outsourcing print jobs abroad for production and quantum of volumes of printed products are being imported into the country to meet the print consumption needs of the citizenry.

Documented evidence shows that the Nigeria print media industry is facing a big challenge of print production needs in the country despite the several efforts made by government to solve the problem. Although studies on print production in Nigeria abound, it is arguable that any addresses the impact of Print MIS on the digital printing enterprise, hence the need for this study. This study therefore sought to assess the impact of Print MIS implementation on the digital printing enterprise in Nigeria.

1.3 Objectives of the Study

The general objective of this study was to assess the impact of Print MIS on the DPE in Nigeria. Specifically, the study sought to:

1. identify the strategies used for the implementation of Print MIS in the DPE
2. identify the effects of Print MIS utilization on workers with no computer skills
3. investigate the effects of Print MIS utilization on the print business operations for the production of print media
4. assess the effects of Print MIS implementation on the DPE in the study areas

1.4 Significance of the Study

The findings of the study will be of significance to print media investors by providing them with information that could assist in getting appropriate Print MIS and other information-based workflow tools required for implementation. Once the Print MIS is implemented, it will reduce bottlenecks in production, meeting up delivery dates, increases productivity and the organization efficiency. This will make the entire print organization to be effective and efficient.

The study will be of significance to print consumers through the provision of high quality print media for information dissemination. Print media serve as repository of culture and as a basis for knowledge acquisition for the development of mankind. Information is knowledge and access to it will lead to more development in all sectors of the Nigerian economy.

Institutions involved in training will find the study of high significance through the provision of information on types of Print MIS and skill needs of DPE workers. It will also serve as a reference reading material for students and researchers in graphic communications and other print production related fields.

The secondary beneficiaries of the study are business men and women, manufacturers, print advertising agencies and other information service providers whose medium of information dissemination is the print. The availability of the medium serves as their communication channel to reach out their potential customers as well as using it to sustain the existing ones. They always use the print media to reach their target audiences as well as creating awareness for numerous products to enable sales, sustain businesses growth and development.

1.5 Research Questions

This study on impact of Print MIS on the DPEs in Nigeria was guided by the following research questions:

1. what are the strategies used for the implementation of Print MIS in the DPE?
2. what are the effects of Print MIS utilization on workers with no computer skills?
3. what are the effects of Print MIS utilization on the print business operations for the production of print media?
4. what are the effects of Print MIS implementation on the DPE in the study areas?

1.7. Scope of the Study

The scope of this study was delimited to Print MIS in the DPEs in Nigeria. The study explored DPEs in Nigeria and determined the level of utilization of Print MIS and its impact. Printing processes outside the digital printing technologies were therefore not part of this study.

CHAPTER II

2.0 LITERATURE REVIEW

2.1 Introduction

Impact of Print MIS in the digital printing enterprise in Nigeria was reviewed in this chapter under the following sub-headings:

- i. Conceptual and Theoretical Framework of the Study
- ii. Print Management Information Systems (Print MIS)
- iii. Digital Printing Technologies
- iv. Technological Changes in the Production of Print Media
- v. Strategies for Implementing Print MIS
- vi. Related Empirical Studies on Print MIS
- vii. Summary of Related Literature Review

2.2 Conceptual and Theoretical Framework of the Study

2.2.1 *Conceptual Framework*

Function of information and record keeping in the operation of print business is a concept that has existed for centuries (McWilliam, 2007). In the information age, record keeping has evolved into a computerized system of documentation. And in the printing industry, this system has been described by the name Print Management Information System, (Efi, 2005; Vision in Print, 2006). Print Management Information System (Print MIS) is a key factor in controlling human activity in the printing industry's workplace. DPS Staff, (2010) pointed out that, when focusing on specific requirements of print business, several areas are improved through the effective implementation of Print MIS which is essential for productivity and efficiency of any digital printing enterprise. The

study conducted in Canada by Efi (2005) on ABCs of Print MIS revealed that the impact of Print MIS in the industry has not only affected the organizational workflows but also had several impacts on print productivity and on the human workforce. Cline and Clark (2000) submitted that, model of a conceptual framework is a description of the major variables operating within the arena of the problem being pursued. Figure 1 shows how different types of Print MIS have evolved due to advancement in digital technology.

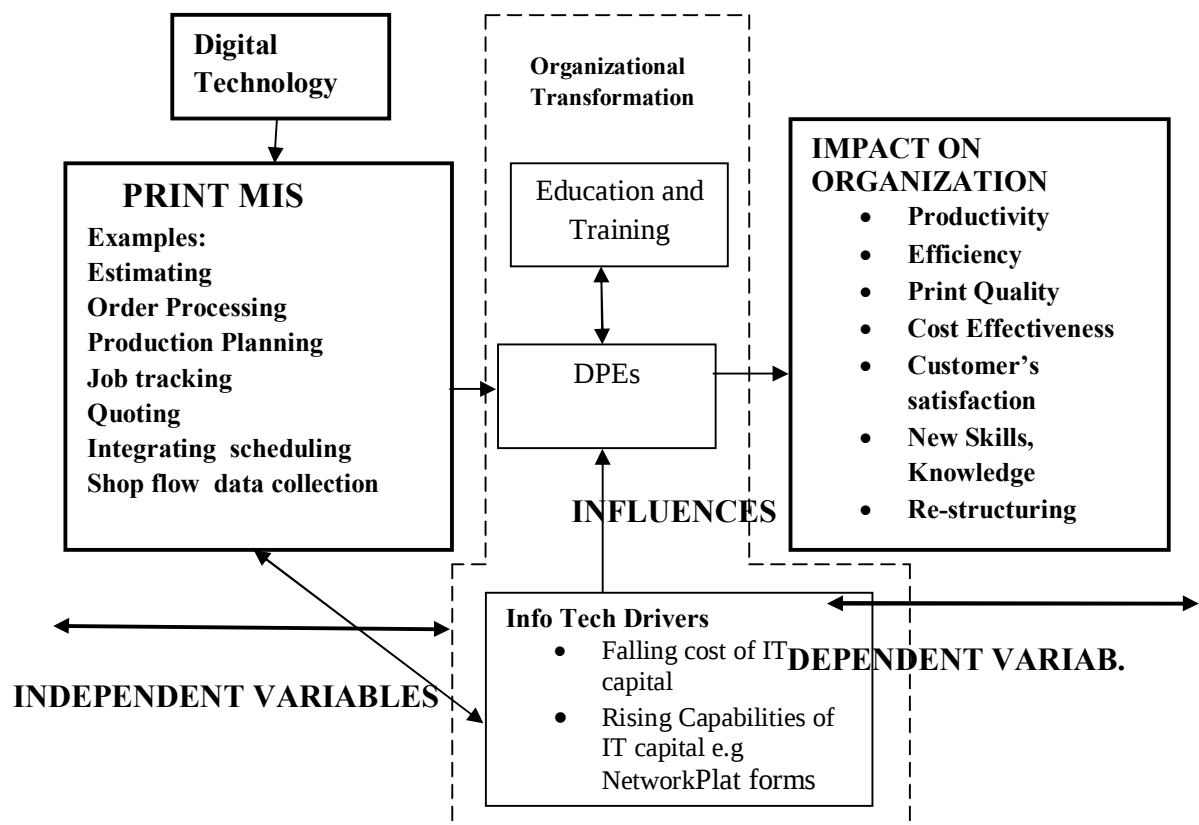


Figure 1. Conceptual Framework. Adopted and modified from "Information Technology and Recent Changes in Work Organization Increase the Demand for Labour" by T.F. Bresnahan, E. Brynolfsson, and L.M. Hitt, 1999.

The conceptual framework posits that the implementation of Print MIS in the digital printing enterprises creates impact on human capital development and organization's productivity. The schema shows that the driver of Print MIS is the digital technology. However, the organizational transformation in DPEs is a function of Print MIS, information technology drivers and education and training inputs.

2.2.2 Theoretical Framework of the Study

Print MIS involves people, technologies and procedures whose functions are targeted toward producing print product to meet human communication needs. The system is generally responsible for both the production planning and job control which has to be connected with the production processes (Baumgartnar, 2005). Print MIS system is a computer-aided technology. Gupta and Ramakrishna (2003) developed a Print MIS component Model for Printing Presses. The authors used this model to explain how the Print MIS relates to the theory of technological determinism in a digital printing enterprise as seen in figure 2.

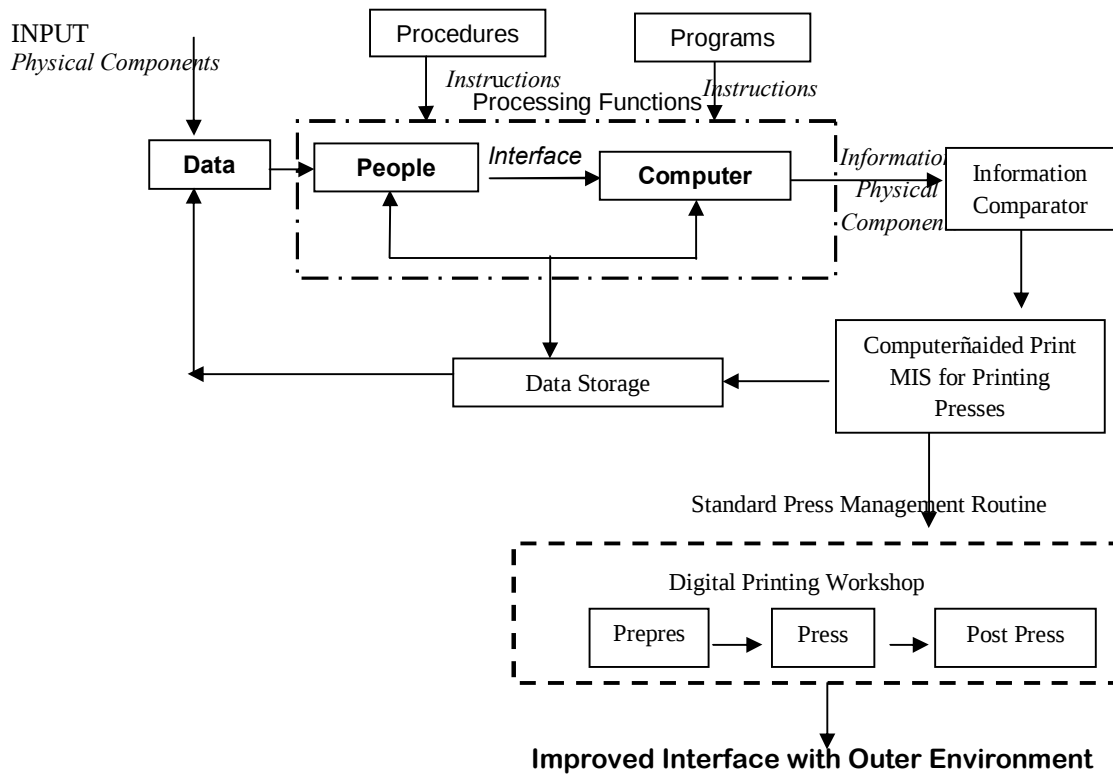


Figure 2: Print MIS components model for printing presses, Adopted for the study from Gupta & Ramarkrishna, DESIDOC Bulletin of Info Tech, 2003, 23(3).

The schematic organization in figure 2 illustrates how Print MIS receives data, processes it and outputs the information according to the given instructions. The data normally is collected automatically through a network of computers, links to an organization's central database unit, as soon as it is known rather than at the end of a specific time frame (Speirs, 1994; Gupta & Ramarkrishna, (2003).

2.2.3 Theory of Technological Determinism

The theory of technological determinism (TD) states that, "technological determinism is the concept that technology will continue to develop, based on previous systems and human system will adapt as technology changes" (Parnell, 2007, p. 52; Rodman, 2006, p. 40; Mullins, p.609, 2002). TD is the single most influential theory of

the relationship between technology and society. This theory claims that change in technology is the most important cause of change in society (Mackenzie & Wajcman, 1985). Again Mullins (2002, p. 609), on his part argued that the form of technology used by a particular organization (largely) determines the level of job satisfaction experienced by people working with the technology. Thus the Print MIS is now more an ideal technology than the paper-based information system in print industry. Gordon (2007) points out that Print MIS is an essential tool for helping printers transition from a craft industry to modern manufacturing. Efi (2005) submits that Print MIS is a *paradigm shift* from running a printing business on *guts and instincts* to running it base on the availability of real-time business information. Obviously, this change in technology has changed the way print media is being produced as TD theory explains here that, *we learn and feel and think the way we do because of the messages we receive through the current technology that is available.* Print MIS has become a fundamental tool for today's print operation. Figure 4 shows the evolution of the Print MIS in the print media industry. The concept of print production workflow has been affected as a result of technological changes in the printing organization. The printing organizations are gradually embarking on implementing Print MIS systems due to its numerous benefits that far outweighed the paper-based information systems.

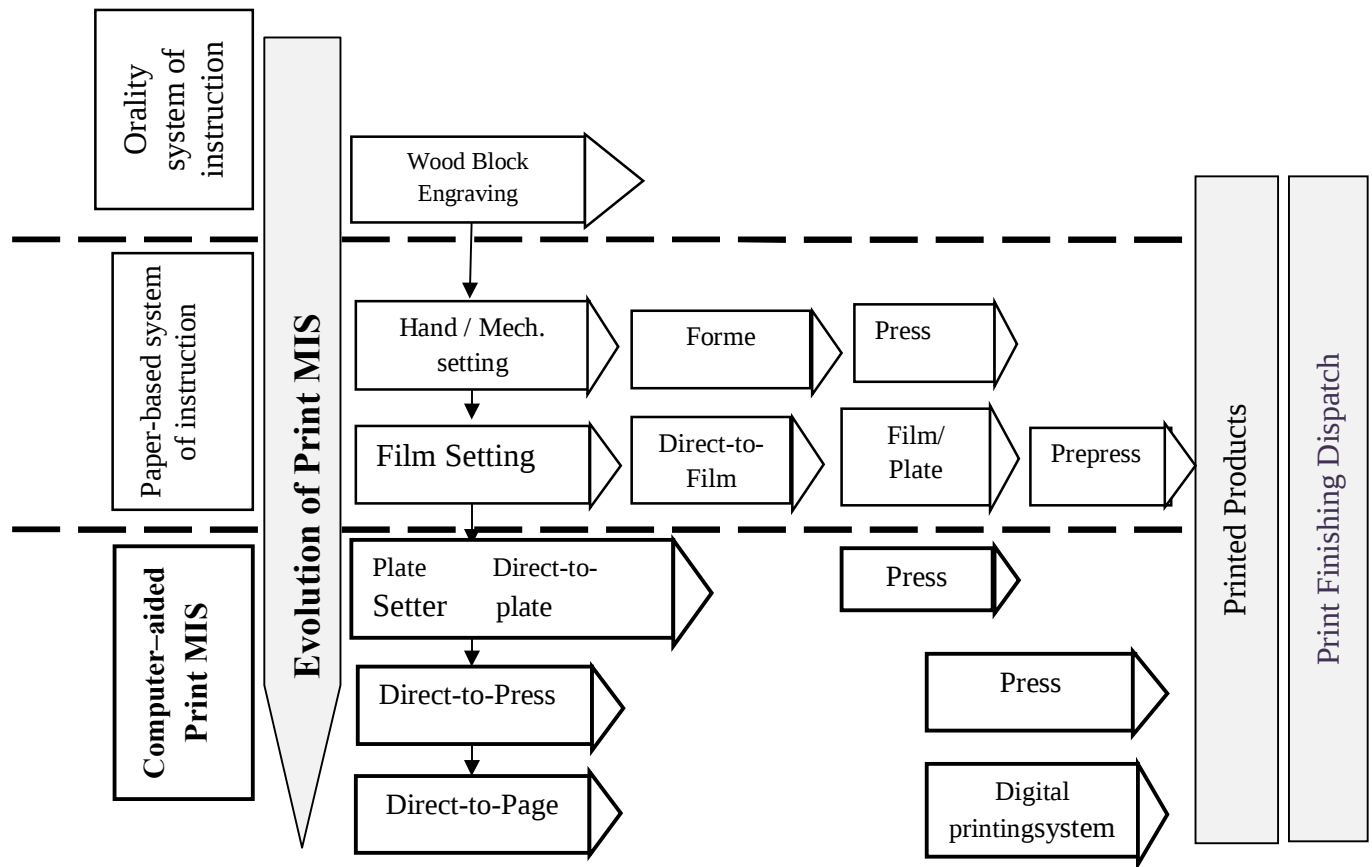


Figure 3. The Evolution of Print MIS in the Print Media Industry, 2012

The emergence of Print MIS system ushers in production workflow tools such as job definition format (JDF), job messaging format (JMF), print production format (PPF) and Job production ticket format (JPTF). These production workflow tools make possible a complete integration of the entire press production system.

2.3 Print Management Information System

The concept of Print Management Information System (Print MIS) evolved from an analogue information system into a dynamic technology of today's communication in the print workplace. The electronic Print MIS evolved from paper-based Print MIS. It

was merely a workshop system of communication between workers but today it has wider coverage that include all elements of the print business even outside the the print organization, for example ñ Web-to-Print (W2P), scheduling, customer relationship management, as well as all lines of business including print production, creativity, data services, marketing companies, mailing and packaging. Current practices in the industry has revealed that Print MIS is the nucleus of today's digital printing operations. It is evolving and expanding to become the main communication tool in the print media industry.

Print MIS Systems are systems to which all production activities are reported and by which the printers's business operations are managed and controlled. It essentially the starting, the central, and the end point in the business and production of print workflow. Buckwalter (2006) pointed out that, 'very important concept in a JDF-enable workflow is the MIS system'. The JDF specification defines an MIS as 'the overseer of the relationship between all of the units in a workflow' – in effect, a macroscopic controller. The Print MIS is responsible for dictating and monitoring the execution of all of the diverse aspects of the workflow by making easy access to information (CIP4, 2009).

2.3.1 The Evolution of Print Management Information System

To understand the evolution of Print MIS, historical perspective of paper-based information system is paramount. It provides how the Print MIS system has evolved over the decades (Harsh, 2006). Paper-based information system was developed mainly for managers to share information in print organizations. Therefore the pioneering managers of printing business in Nigeria deemed it right to adopt the paper-based information

system to enhance productivity hence laying a solid foundation on what the present edifice of modern Nigerian printing had been erected (Akinbobola, 1993). The pioneers were Rev. H. Waddel and Rev. H. Townsend who recruited and trained apprentices that were Nigerians. Thus, the apprenticeship scheme was established in the early 19th century (Adeniyen, 2006). This provided avenue for imparting sound practical skills on apprentices to perform credibly in the industry.

This enabled Rev. Townsend to start production in Abeokuta five years after the installation of his printing press in 1954 with the publication of the first Nigerian Newspaper called *óIwe Irohin Fun Awon Egba Yoruba* (Fagbemi & Olukesusi, 2003). Also in 1913, the Church Missionary Society (CMS) established printing press and started production in 1917 with a publication known as *óIn Leisure House*. Rev. G. A. Oke, a Nigeria Missionary established the Isaiye Printing Press for the publication of Newspaper called *The African Gleamer* (Sambe, 2008). However, from 1920 to date, many publishing and printing houses have been established with many, providing even electronic news through the internet. These newspapers are; *The Guardian*, *ThisDay*, *The Nation*, *The Daily Trust* and *Punch*; while commercial printing houses include: *The Academy Press Plc*, *Planet Press Ltd*, *Yaliam Press Ltd*, *The Heritage Press Ltd*, *Hamtul Press Ltd*, *Baraka Publishers Ltd*, *Colorfeathers Ltd*, *Clear Impressions Ltd*, *African Newspapers Ltd* and many others as presented in appendix C.

In the production shop floors of these organizations, the use of paper-based information system enables the managers see and coordinate how every job is carried out right from the start to the end; thus controlling the performance of each worker in the workplace. These paper-based information systems are categorized into three (Adeniyen,

2006): office works (works instruction ticket), production (loading cards & works instruction ticket) and estimating (estimate form). According to Speirs (1994), these are production control systems for handling/provisioning and controlling of print media production. The author emphasizes that, as production control systems, they must be able to facilitate profitability of the organizations, increase customer satisfaction services, maintain delivery dates and workflow to ensure the highest possibility of utilization of all production facilities. Figure 4 shows an example of a typical estimating form while figure 5 is an example of works instruction ticket which were selected from Paper-based Information Systems used in the conventional printing industry as presented in figures 4, 5, 6, and 7.

Paper-based Information Systems used in the Conventional Printing Organization

Listed below are some typical printing industry job documents used as paper-based information systems:

Job Jacket	Job Cost Sheet
Customer Log Book	Production Schedule Card
Original Artwork	Department Cost Sheet
Job Specifications Sheet	Quality Assurance Form
Estimate Form	Purchase Orders
Credit Application Form	Proof Form/Jacket
Pricing List/Work Paper	Production Report
Quotation Form	Variance Report
ProductionSchedule Form	Shipping Schedule
Sales Invoice	Delivery Ticket

A Typical Example of an Estimating Form

ESTIMATING FORM					
Client _____			Date _____		
Job title and description _____					

Quantity _____			Working size _____		
Finished size _____ - other specification regarding finishing _____					
	<i>Qty</i>	<i>Unit Cost</i>		<i>Total Amount</i>	
		₦	K	₦	K
Visual					
Artwork					
Board					
Paper					
Sticker Fabric					
Plate ____ Positive ____ Negative ____					
Impressions					
Impressions on special ink-Gold. Silver					
Ink/Vanishing ink					
Die form					
Die cutting					
Cutting/Trimming					
Collating/Folding/Stitching					
Spiral Binding					
Perforating/Number/Creasing					

Figure 4. An Example of an Estimating Form Adapted from 6an approach to printing managementô by G.A. Adeniyani, 2006 Copyright 2006 by G.A. S Adeniyani

WORKS TICKET				JOB NO:	QUALITY
Customer's Name: _____				ESTIM No	TRIMMED SIZE
Address: _____					
Customer's LPO _____ of _____					
Description _____				DELIVERY BY:	TRIMMED SIZE
Reprint No Change With Changes					
No of Pages Text _____ Cover _____ Inset _____					
PAPER STOCK					
Total sheets test _____ Total sheets cover _____ Description _____					Guillotines
_____ TONS _____ gm ² _____ WEB _____					
_____ SHEETS _____ gm ² _____ SHEET SIZE _____ x _____					
_____ SHEETS _____ gm ² _____ SHEET SIZE _____ x _____					
_____ SHEETS _____ gm ² _____ SHEET SIZE _____ x _____					
SPECIAL INSTRUCTIONS – ALL DEPARTMENTS					
MATERIAL RECEIVED					
No of Mss _____ Measure (cm) _____ x _____ Series _____ Bromide ☐					
FILM SETTING Text (pts) _____ Leading _____ Proof's Reqd _____ Keep Spools ☐ Film ☐					
ARTS-MAKE-UP					
COLOUR SEPARATION from _____ Trans _____ Opaque tt _____					PROOFING
CAMERA Halftones fof sheet f tt _____ Webs tt _____ Brom ☐ Straight ☐					
PATCHING					
_____ M/S _____ up. ☐ Work & turn ☐ work & tumble ☐					
_____ M/S _____ up. ☐ Work & turn ☐ work & tumble ☐					
_____ M/S _____ up. ☐ Work & turn ☐ work & tumble ☐					
OzalidInt Ext _____ Impose for _____ Web(s) Run as ☒ ☒ ☐ ☐					
PLATES					
Total Plates: _____			Total plates Text _____ Cover _____		
Wbneg: _____ pos _____ burned in _____			Sheet-f neg _____ pos _____ burn in _____		
PRESS:					
Test _____					
Cover: _____					
Test Printed _____ Sides(s) _____ Total impression tests: _____ Cover Printed _____ Sides(s) _____ Total impression tests: _____					
Press Proof _____ Proof M/S _____					
Cutting/Creasing _____					
Trimming _____					
BINDING Saddle Stitched ☐					
Thread Sewn ☐					
Perfect Bound ☐ Spine _____					
FOLD: Tabloid ☐ Double Par ☐ Quarter ☐ INK _____					

Figure 5 An example of a typical works instruction ticket. Adapted from óan approach to printing managementô by G.A.Adeniyan, 2006. Copyright 2006 by G.A.S.Adeniyan

Figure 6. An example of a typical specimen of daily docket. Adapted from óan approach to printing managementó by G.A.Adeniyán, 2006. Copyright 2006 by G.A.S.Adeniyán

MATERIAL RELEASE AND CUTTING SLIP					
					Department:.....
					No:.....
Customer Job No:.....					
Description of Job:.....					
Quantity:..... Size:.....					
No of Pages:..... M/c Overseer.....					
Method of working:.....					
PAPER WAREHOUSE TO ISSUE					
No of Sheet	Description	Stuck No	Issued by	Date of issue	Stock records
CUTTING INSTRUCTION					
No cut per-					
sheet:.....					
Cut to size:.....					
Special					
Instruction:.....					
.....					

Figure 7. An example of a typical material release and cutting slip, paper warehouse to issue and cutting instruction, Adapted from *an approach to printing management* by G.A.Adeniyan, 2006. Copyright 2006 by G.A.S.Adeniyan

Figures 4 - 7 are examples of conventional information communication media that managers in the traditional printing enterprises use for print media production. These analogue and manual data communication tools are labour intensive and sometimes cause

unnecessary mistakes thereby resulting into production flaws (Ruggles, 1991). Also the high demand for print media which resulted from the increasing rate of literacy, print product advertising, high religious and political activities as well as aggressive competition by the electronic media made these manual data handling tools to become highly ineffective. This affects print productivity and quality delivery and led to application of computers in the printing industry that started around 1950. According to Ruggles (1991) there were limited use of computers in the printing, publishing and allied industries, but with the development of phototypesetting machines followed by technological advances in electronics industry, the computer systems are now common production tools in the printing industry especially in this 21st Century.

The concept of Print MIS was not introduced until in the 70s when information technology, computer programming and business fields merged together, resulting into a field called Management Information System [MIS] (Mauro, 2007). The idea was to create a workforce that could bridge the communication and technical gaps between management and computer programmers. This led to the first Print-focused MIS system with the introduction of multi-users computer network in the late 1970s (Efi, 2005). Efi pointed out that the Steward and Logic Systems were among the first that concentrated on print estimating, invoicing and accounting and these tasks in the printing industry became computerized. Computer then became a common tool in the printing industry with virtually every phase of production and the production management by providing needed information to workers to help them in the production of print media.

The utilization of computer and Print MIS always involves the application of people, technologies and procedures within a manufacturing workshop. Print MIS system was particularly designed to analyze the operational activities of a print production house by incorporating data from all departments and product life cycles. It helps the management with information required to successfully run the business on a day-to-day basis, as well as it provides strategic support for long term growth decisions in the industry.

A good Print MIS solution therefore lets you develop an electronic specification form that considerably reduces quoting response time in contrast to unreadable handwritten orders and offers flexibility needed to modify standards with changing business needs. It is a multi-functional system all interacting to some degree especially in creating estimates and generating quotations for the customer and contributes to the development of the overall print business. A typical example of an interactive Print MIS is as seen in figure 8.

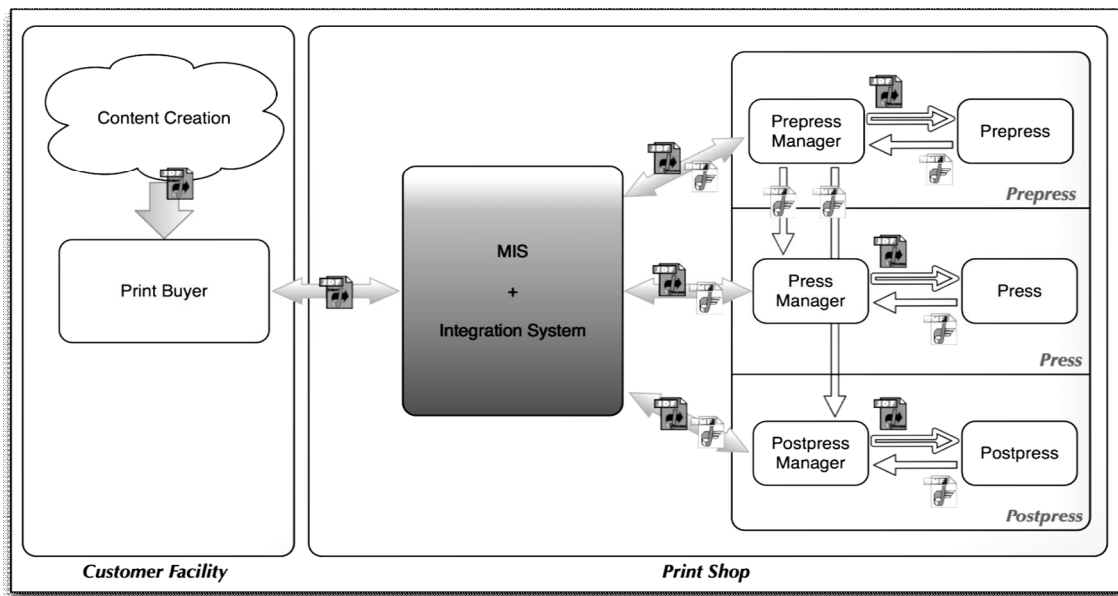


Figure 8. An Interactive Print MIS with the Various Workstations and the Print Clients. Adapted from "Montreal MIS Tutorial" by CIP4 Organization, 2005. Copyright, 2005 by JDF Optimus

2.3.2 Components of a Good Print MIS

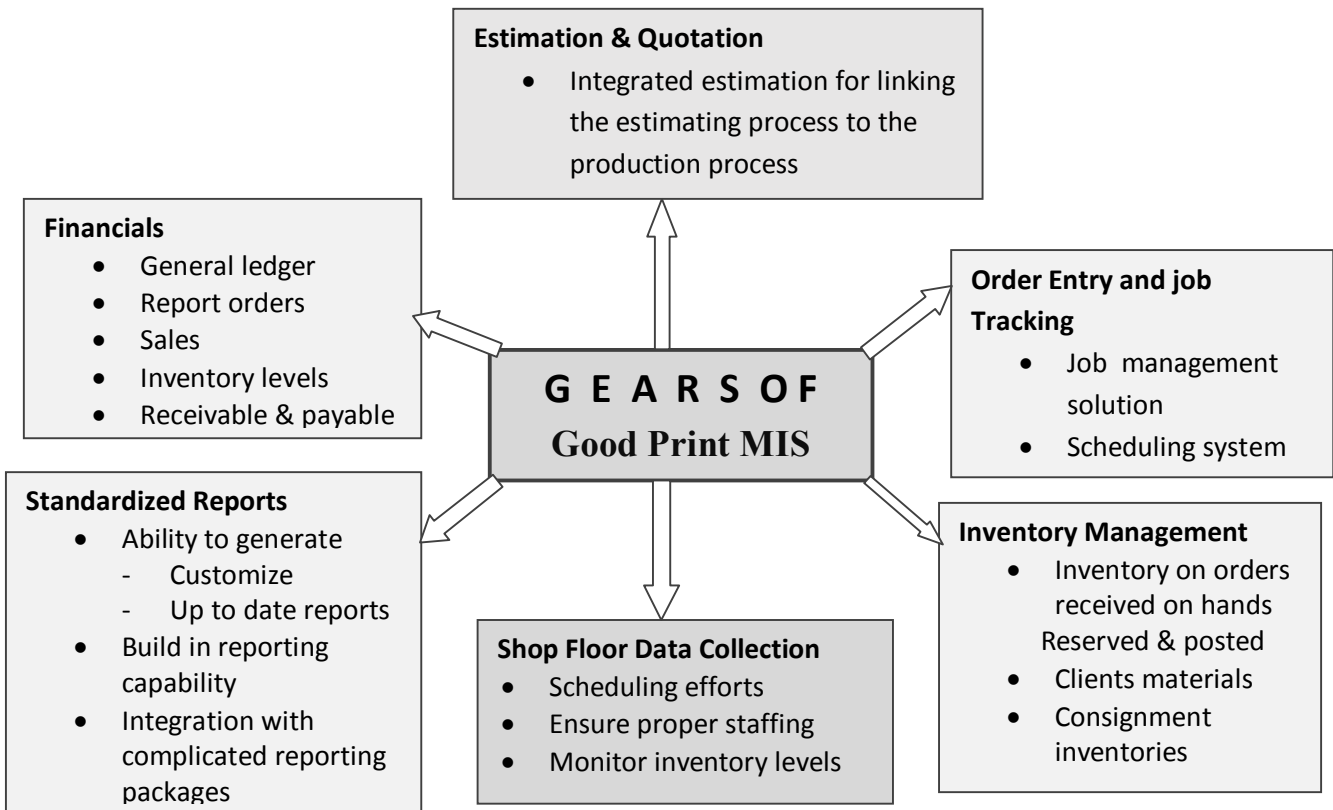


Figure 9. A good example of a typical Print MIS Suite, Adapted from óprint management information system - ã must for printersötodayö by Mariam, 2012. Copyright 2012 by Print industry trends

Figure 9 shows the components of good Print MIS solutions that provides different services to print industry. These Print MIS solutions provide services which include:

- (a) **Estimating:** This defines the individual elements of a job, the process and materials to be used to produce them and the associated costs. It produces an estimate which in turn is used to generate a quote, define many of the details of an order, inform production scheduling and relay materials requirements to purchasing. The estimate module is the core of Print MIS system in the printing industry
- (b) **Order Entry:** A module used by customersö service to maintain customer information, generate quotes, enter orders and track in-process and complete jobs.

Other details are not defined in the estimating module are typically maintained in Order Entry, including production instructions and shipping information.

- (c) **Scheduling:** This module helps to plan production by determining when and where a job will be produced. Specific equipment, production center and production steps are identified and the job is assigned a time to begin activities in one or all of the production centers.
- (d) **Shop Floor Data Collection:** A module use for capturing actual production information on a job. It acts as a record of time and materials. It enables managers to control those key aspects of costs and productivity. It can be integrated with production equipment using a Direct Machine interface (DMI) to enable the MIS system tracks, in real time, the number of units of product produced.
- (e) **Shipping:** This module manages the shipment of a job. It generates shipping documents and labels, it also stores tracking number, package weight and freight costs.
- (f) **Inventory:** Use for tracking materials and other production consumables. It usually takes physical characteristics (size, paper caliper, ink mileage, etc.) to support the estimating process.
- (g) **Purchasing:** This works in conjunction with the order entry and inventory modules to generate purchase orders for materials and outside services.
- (h) **Accounting:** Accounts Payable (AP), Accounts Receivable (AR) and General Ledger functions are located in this module. Connection to the other modules provides an integrated view of accounting information by customer, supplier and internal cost centers.

- (i) **Job Costing:** This module is used to analyze the actual costs of specific jobs and the productivity of various resources. Productivity can often be tracked by employee, shift, plant, machine, department, etc. Data from the shop floor data collection module is used to support the costing analysis.
- (j) **Reporting:** This is actually not a module as such but a system of providing some standard reports within each of the modules. Nearly all the modules enable users to customise the built-in reports and create new reports. Customization is required to ensure that management reports reflect the priorities and constraints of the business.

The reports come in three different ways, thus:

1. *Performance Analysis:* Compares one entity to a standard of performance or to other entities ñ thus, actual performance versus production standards, quality measure, identifying top customers, etc.
2. *Tactical Planning:* This describes what should happen in the short term future such as the jobs scheduled for the next shift or a list of late orders
3. *Strategic planning:* Identifies potential changes in strategy to address under-performing markets and products or to analyze historical lead time, run sizes and margins.

The study by McWilliam (2007) on Print MIS did not cover all types of Print MIS systems, however, the study reported that depending on the type of MIS, there are between 50 and 200 software packages on the market. Table 1 shows different types of modules that are produced by SolPrint Company alone.

Table 1

SolPrint ModulesPrint MIS

SolPrint and SolPrint XN Modules that are Available

MIS Console	Prospecting & CRM	Sheet/Web Estimating
Digital Estimating	Continuous Estimating/Label Estimating	
Contract Pricing	Fastrack Estimating	Broking Estimating
Order Processing	Production Control	Purchasing
Paper Stock	Pallet/Reel Tracking	Paper Supplier Interface
Raw Material Stock	Scheduling	Shop Floor Data Collection
Direct Machine Interface	Job Costing	Dispatch
Invoicing	Complaints Monitoring	Quality Assurance
Finished Good Stock	Sales Ledger	Purchase Ledger
Nominal Ledger	Time & Attendance	KPI Dashboard Reporting
Report Writer	Report Scheduler	Application Interface (API)
JDF/JMF/MIS	JDF/JMF Studio	JDF/JMF Shop Floor
Sales Rep. XN	Customer XN	Supplier XN
Production XN	Shop Floor XN	Agency XN
Web2Print		

Note: The different types of Print MIS Modules that are made available for printers. Source: SolPrint Modules: www.cip4.org/cybermall. Retrieved October 12, 2011

Modules generally are not designed for the same print environment. All Print

MIS solutions are designed to function in specific ways and for specific jobs.

McWilliam, (2007); and DPS Staff, (2010) differentiate these Print MIS packages

based on the following:

2.3.3 *Production Methods*

The production method determines whether a particular Print MIS application package supports certain production methods and product categories or not. For instance, a typical commercial printer with offset presses and standard print finishing

equipment will definitely have quite a good number of software choices to make. Here, the estimating module in most packages is designed to support a workflow that begins with an estimate, which becomes a quote and eventually becomes an order for finished sheets produced on an offset press. Many of the applications support calculation for book printing and binding and other in-line finishing operations. Some packages provide better support for web presses. Differences in functionality can include support for roll changes, in-line finishing operations, turn bars etc. Also the support for buying and managing paper rolls can vary greatly between the packages.

For Enterprises that run flexographic presses, their choices for packages are narrowed. These may include estimating features to automatically calculate the number up and around, tooth counts and the ability to add a large number of in-line processes to a press. Also requires are features to manage cylinder and die inventories; including tracking impression counts and last retooling dates and the ability to associate dies with a specific customer. Digital printing is supported but in a small growing number of Print MIS packages. For examples, order entry enhancements commonly support rapid entry of simple jobs, inline finishing and tracking the click counts on equipment. Few packages specifically support variable data printing (VDP).

2.3.4 *Multiples*

The “Multiples” that can actually differentiate Print MIS packages include:

- i. Multiple Plants

ii. Operations in Multiple Countries

iii. Multiple Currencies

iv. Multiple Languages

It is seen that a few packages can run different financial reporting periods for multiple companies, tax codes, etc. Many packages support multiples plants with limited integration. And not all multi-plant applications support warehouse to warehouse inventory transfers, cross plant scheduling (the production of job components in different plants), and sharing employees between plants:

(a). *Size and Complexity*

As a general rule, larger and more expensive Print MIS Packages provide more features and capabilities than smaller less expensive packages. Therefore, most vendors have a realistic view of the size of company they serve best, and are interested in avoiding companies outside their target markets. If the printing company is too large for the package, the software vendor will struggle to keep up with enhancement requests and customer expectations. If the printing company is too small for the package, the maintenance burden and software complexity may be overwhelming. It is important to note that size mismatches can literally eliminates the value of the Print MIS, creating a situation where the organization would have been better off on the old system or running without one. The best Print MIS vendor and best package for any given printing company are really based on the needs of that company. When evaluating potential candidates, pay attention to the relative size of the companies and market that the Print MIS vendor is trying to serve.

(b). *Technology and Connectivity*

Some Print MIS applications offer limited connectivity to external applications. This may not matter in small shops as everyone will use the Print MIS for most of their job functions with third party application, limited to prepress and the office productivity suite. In these cases, it does not matter if the Print MIS package has strong integration capabilities. However, in larger print environments, multiple applications may exist, and these required flexible and connectible solution. Thus, does the Print MIS need to send something, receive something, or both? Ask not only if something can be done, but how it can be done; nearly anything is possible with technology given enough resources. Figure 10 shows the holistic picture of what Print MIS can handle in the printing enterprise.

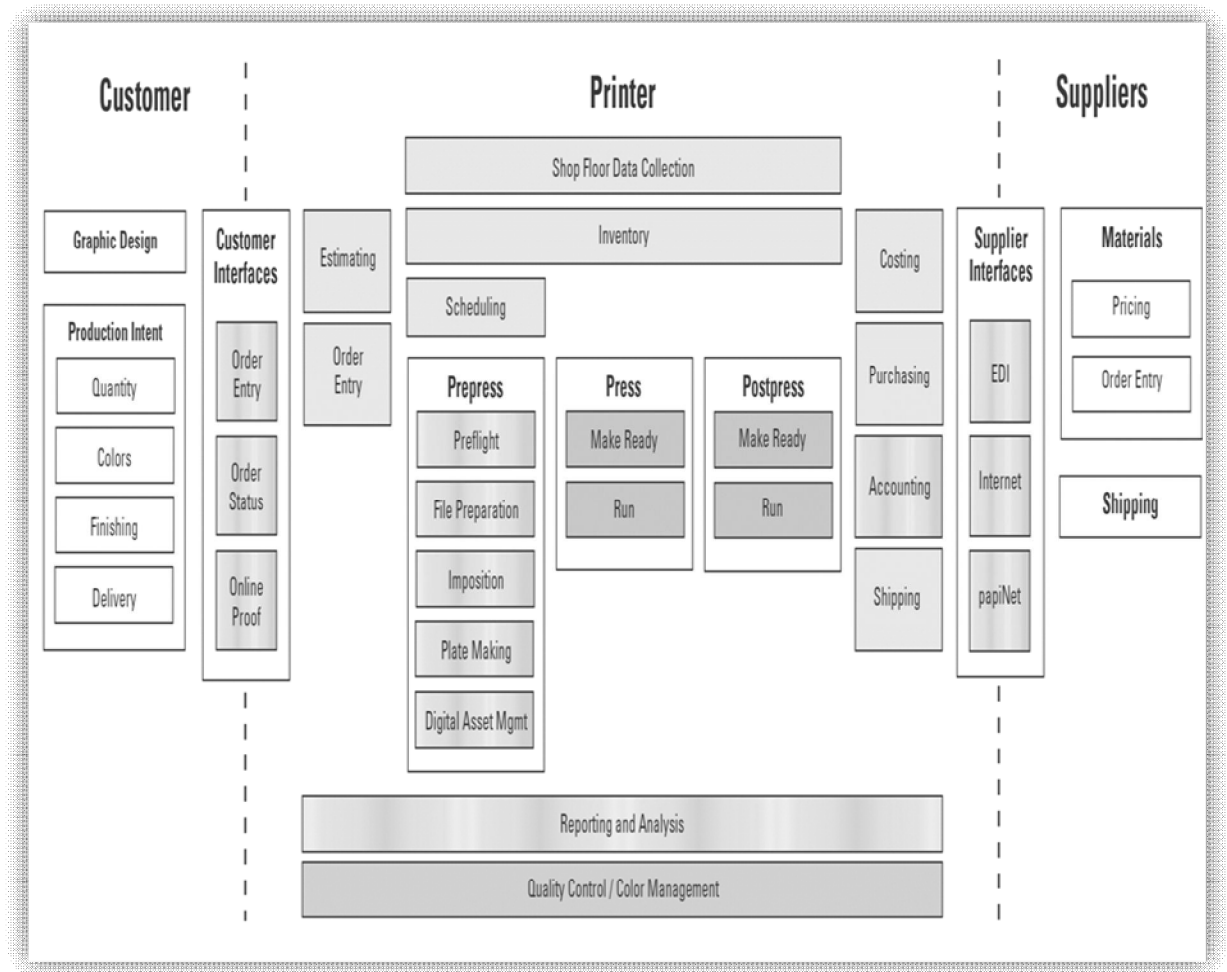


Figure 10: The holistic Function of an MIS Solution in a Digital Printing Enterprise. Adapted from *omis: a guide for managers* by McWilliam, S. 2007. Copyright 2007 by a production of network pdf, www.networkpdf.com

2.4. The Print MIS Selection Process

On the selection process, Efi (2012) says there are seven key elements that must be considered when selecting the Print MIS. The list includes:

1. *Flexibility of the Print MIS:* Ensure that the solution offers flexibility you require to run your print business.
2. *Depth of the Print MIS.* The ability of the software to handle your print business situations

3. *Stability*: Look for a Print MIS with a proven track record and a company with a well-documented software development and quality assurance process.
4. *Focus*: Look for a Print MIS Provider that is focused on print business industry and has significant industry experience on the management, development and support staff.
5. *Growth Potential*: Print MIS provider should be able to meet current print organizational needs while demonstrating the resources and insight in the innovative qualities in to deliver the product needed tomorrow.
6. *Implementation and Training*: The implementation and training plan should be built to meet the organizational needs and expectations. It is important to keep in mind the fact that staff needs to run the business well while they are being trained.
7. *Help, service & support*: It is necessary to have it in mind that whether it is a simple question or a serious problem, one needs to know that Print MIS provider will be there to attend to organizational needs. Have the on-line help offer by the Print MIS and ask about support options. These Print MIS selection Processes are important for any potential digital printing enterprise. And for Print MIS to be installed or implemented, the print environment must be digitally friendly.

2.5 Need for Implementing Print MIS

Gupta and Ramakrishna (2003) categorically declared that there is need to implement fully, integrated computer-aided print production control system for managing digital press routine through MIS. This according to the authors does not

only increase print production capacity and efficiency but also help to survive the current print business crises. This condition absolutely makes it necessary for printing enterprises to update to digital Print Technologies for system integration and implementation of Print MIS for digital workflow. This can obviously make the print business survive the current competition in the mass media communication.

It is expected that DPEs should live up to customers' expectation by updating their old technologies to new ones. Lack of this technological update made Gupta and Ramakrishna (2003) lamented over the print business situation in India. The authors pointed out that, it is ironical, considering the international pace of development in printing, the printing presses in India, having in-house pre-press, press and post press sections backed by four to five 4-colour printing machines, have been using such Print MIS in a haphazard manner. And it was also observed that even this usage is even to a limited extent only. This condition by comparison to Nigeria is even worst considering the fact that Nigerian Print business customers still prefer taking print jobs to places as China, India and even South Africa for production because such countries still print better, cheaper and quicker than Nigerian printers (Adebayo, 2010).

The implementation of Print MIS requires that the printing machines are digital with a control console. This enables technical workflow system to be much suitable for the Print MIS implementation. The digital workflow system in Nigeria is not fully and widely developed, but there are few CtF, CtP and DI technologies in some major cities like Lagos, Abuja, Kaduna and Port-Harcourt. It is always

expected that once the technical workflow systems (pre-press, press & post press) are in place, networking for free flow of information for administrative and production functions can be achieved using the Print MIS. With the Print MIS, all data and information come together in the central database for accessing by the different production units to enhance productivity and efficiency. This is another paradigm shift (technological change) in the industry, changing how the industry is being managed to produce print.

2.6 Print MIS and the Digital Printing Technologies

Printing Industry is continuously changing at a rapid pace. The Gutenberg's, Schenck's and the Jacques (Luttrop & Greenwald, 2009) analog printing techniques have evolved into digital printing technologies for the production of print media. The last two decades has witnessed tremendous changes in the industry as identified and explained here.

2.6.1 Digital Printing Technology

Digital Printing evolves from the Gutenberg's analog system of printing that was practiced by many centuries ago. Advances in technology have made it possible to change from analog reproduction to digital reproduction system called "digital printing technology. Digital printing technology is an electronically controlled method of producing black and white or multi-coloured (or both) images without image carrier on myriad print surfaces (or substrates). Digital printing is also known with the name Non-impact printing (NIP). The NIP is a Master-less (no printing plates or master image carrier) printing technique which differentiates it from the

conventional printing process having master image carrier for production of many copies.

Digital printing is a relatively new technology introduced into the industry in the 90s (Kipphan, 2001). The technology was developed from a photocopier by Xerox Company. The first digital printing machine was called Docutech (Peter, 2010). The Xerox DocuTech was a high-speed duty-cycle black and white laser printer that redefines corporate printing. This technology led to, for the first time manuals to be stored digitally and printed on demand in volume, Peter added. The printing industry globally is gradually adopting digital printing technology to complement and in some cases to replace the conventional printing systems (Cahill, 2000). Digital Printing is much suitable for short-run length and printing on demand (PoD).

2.6.2. What constitutes Digital Printing?

Many authors have given different definitions on what constitutes digital printing technology. The definitions of digital printing when examined closely revealed that some authors' definition placed emphasis on the process of production while others on the machinery used for the print production. For instance, Nomikos, Darzentas, Politis, Spyrou and Darzentas (2004) assert that digital printing is a method by which electrically made up black and white or multicolored images, which may differ by sample or page are produced directly from an information system with a digitally controlled printing engine. However, Romano (2000) describes digital printing as any reproduction technology that receives electronic

files and uses spots (or dots) for replication. Ink, toner, inkjet or any other dye or pigment-based transfer system may be used. This definition covers almost every present digital print system for outputting graphic information to film, plate or paper. On the other hand, Luttrup and Greenwald (2009) considered digital printing as machines that utilize digital data files for printing text and graphics on a variety of media, including paper, cardboard, vinyl and so on. Other authors further, maintained that digital printing is the process whereby the content and original for printing are directly transferred as digital data from pre-press to printing process directly, and that digital printing, whatever the technology employed, is considered to span the gap between desktop computer printing and traditional printing (Pre-press, 1999).

However, when describing digital printing in terms of machines or hardware, Holland (2001) comes up with the following descriptions of the different types of digital printing machines:

Non-Variable On-Press Direct Imaging (No film or plate)

True digital which can handle variable content (Image carrier is re-imaged after each print).

Politis (2004) widens this description list to include whole system and suggests the following set-ups could be considered as digital printing:

- i. stand-alone machines, either for one-or-four-colour printing in terms of capacity to offset print (not copiers), producing sheets or rolls of paper, with further processing in a binding and finishing departments

- ii. digital printing systems where printing units or machines are combined with on-line binding and finishing systems, leading to a ready-to-deliver printed document (trimming can either be included or be a separate unit to these systems).
- iii. direct imaging printing machines which are termed hybrid printing machines where direct imaging is combined with traditional offset printing systems (74 Karat and Heidelberg Quickmaster are examples). Romano, however (2006) classified digital machines into two:

The ones he describes as Totally Electronic Printing (TEP) and those he called ñ Direct Imaging (DI) Presses. Totally Electronic Printing (TEP) refers to the use of a re-imageable carrier or no image carrier for the transfer of toner or inkjet ink to paper. TEP is a direct-to-paper technology with no intermediate image carrier. Direct Imaging (DI) replaces the term *hybrid press*, which refers to the imaging of fixed image carriers (plates) on the press, rather than off-line. *On-press plate making*, refers to the use of a one-time use plate; on-press image carrier creation may allow the re-use of the image carrier after cleaning. Developmental systems may image the plate cylinder directly and then clean it for another imaging. In comparison with traditional printing processes, the two processes can be seen as presented in figure 11.

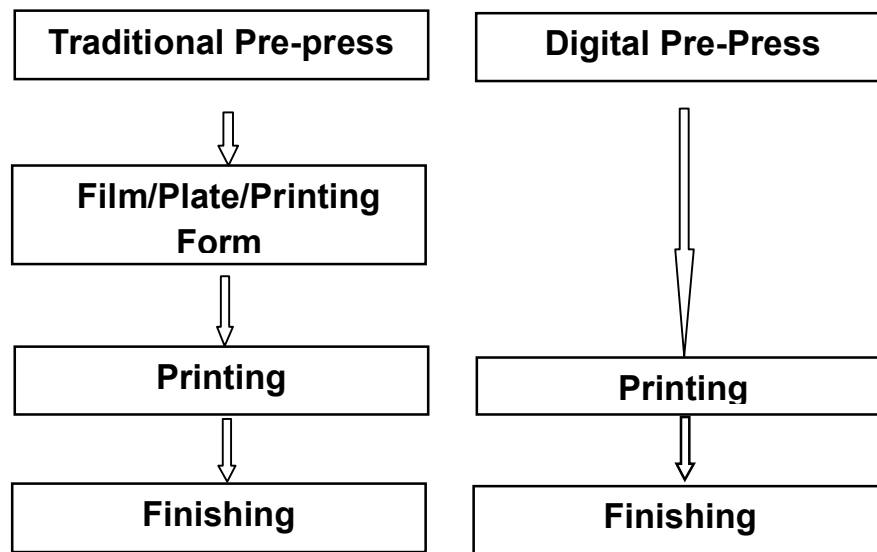


Figure 11: Traditional versus digital printing process. Adapted from “To print or not to print (Digitally)? Innovative digital printing characteristics and their degree of penetration in print media markets” by S. Nomikos, J.S. Darzentas, A. E. Politis, T. Spyrou and J. Darzentas, 2004. Dept. of media tech. and graphic arts, Royal Institute of Tech. Stockholm, Sweden

The study carried out by Interquest (1999) categorized digital printing into:

- viii. Direct to image carrier (Electro-photography)
- ix. Direct to paper (inkjet, thermal direct, dye sublimation and electrostatic)

The classification of these technologies is as presented in figure 12.

Digital Printing Processes

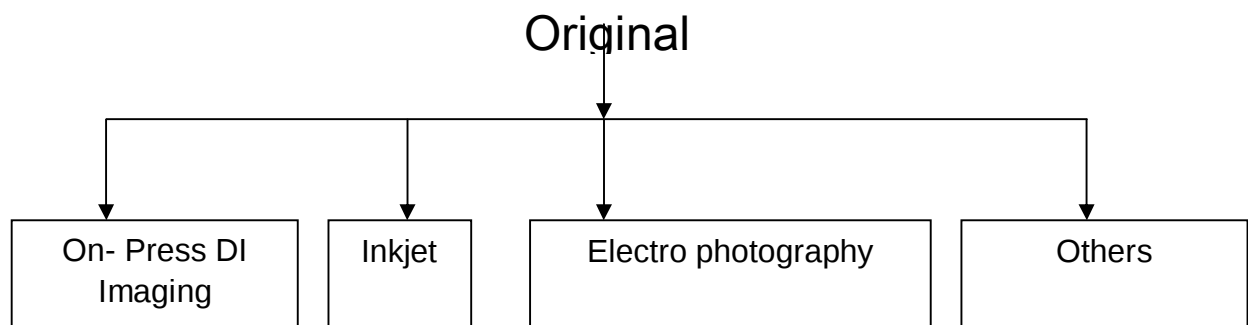


Figure 12: Technology Map of Available Digital Printing Systems. Adapted from “To print or not to print (Digitally)?” by S. Nomikos, J.S. Darzentas, A. E. Politis, T. Spyrou and J. Darzentas, 2004. Dept. of media tech. and graphic arts, Royal Institute of Tech. Stockholm, Sweden.

Generally, the digital printing process consists of the following three major steps:

- i. Capturing an image
- ii. Producing the image
- iii. Finishing the image

2.6.3 *Digital Printing Enterprise in Nigeria*

Digital printing enterprise started in Nigeria in 2001 when the Planet Press Limited installed an SM74+5+L DI Press. The machine was equipped with an on-line coating device and its installation was to raise printing in Nigeria to what is obtained globally. (Iheukwumere, 2001). In 2002, the Paragon Digital Vision Limited also acquired a large format digital printer for the production of billboards and posters. This development led to the coming on board other digital printing enterprises such as Digiprint International, Lagos, with Quickmaster QM46DI; Kquality Printing and Packaging Ltd, Abuja; Mamlaka Digital Prints Limited, Lagos; and many others (see Table 2).

Table 2

Some Digital Printing Enterprises in Nigeria

Name	Print Business	Location
1. Academy Press	Printing/Digital Printing	28/32 Industrial Avenue Ilupeju, Lagos
2. Adex Publicity Com. Ltd	Printing/Digital Printing	316 Ipaja RD, Agege, Lgs
3. African Newspapers Nig	Printing/Digital Printing	Imalefalafia St. Ibadan
4. Cheston Limited	Printing/Digital Printing	10 Eze St. Uwani, Enugu
5. Clear Impressions Ltd	Printing/Digital Printing	Sharadan Ind. Est. Kano
6. Colorfeathers Ltd	Printing/Digital Printing	19 Afam St. P/Harcourt
7. Delta Color Prod.Nig Ltd	Printing/Digital Printing	Agege, Lagos
8. DigiPrints International	Printing/Digital Printing	Lagos
9. Ekido CtP Centre	Printing/Digital Printing	Lagos
10. Huangjian Myet Nig.Ltd	Printing/Digital Printing	Lagos
11. Karrington Nig. Ltd	Printing/Digital Printing	Lagos
12. Mamlaka Digital Prints	Printing/Digital Printing	Lagos
13. Paragon Digital Vision Ltd	Printing/Digital Printing	Lagos
14. Planet Press	Printing/Digital Printing	Lgs/Badgry Exp
15. Yaliams Press	Printing/Digital Printing	Abuja

Note. The few selected digital printing enterprises in some cities in Nigeria by the researcher, 2012

This development seems to place Nigeria in the limelight with the rest of the world in terms of digital and direct imaging printing (Ayovunefe, 2003). Oshai (2010) also observed that, Nigerian printers are about to start smiling that the era of saying computer-to-plate is very expensive has gone for good because is available

now in Nigeria market that an average printer can afford it. According to the author, the era of color separation is also gone because you can get a used Plate Setter machine between N3m to N4m while the CtP machines are being introduced in Nigeria costing only between N6m and N7m.

This development has ushered in many entrepreneurs into the sector most especially into large format digital printing machines for the production of billboards and posters. (see figures 13 and 17). These prints are very conspicuous along major roads in Nigeria with adverts of different products and political campaign posters. The adoption of digital printing technologies into Nigeria Printing Industry though has been slow, but quite encouraging. The growth has been steady and many factors could have been responsible for slow pace of development of in this sector.

Therefore, Jimoh (2012) lamented that, as far as printing is in Nigeria, there is still much to be done. That if Nigeria wants to be among the countries to be taken serious in the business of print production in the world, it has to make policies that will improve the development of this sector, because the type of machines and equipment exhibited in IPEX 2010 revealed that Nigerian Printing Industry is far behind. From different field observations, printing in Nigeria cannot score more than 25% in terms of development. Print business in Nigeria was at its lowest ebb and suffered from neglect and lack of government patronage which promoted cut-throat competition amongst practitioners in the sector (Okodugha, 2011).



Figure 13. HP Designjet PostScript Inkjet Large Format Printer - 44" - Color - L3S82A#B1K of OceöArizona 660 UV Flatbed Series Printer; Technical Specifications; 6-channel ink system configurable as CMYK +CM, CMYK +WW or CMYK +WV; 6 - 42 picoliter ink drop sizes; 2" maximum media thickness. <http://www.pcnation.com/web/details.asp>



Figure 14. OceöArizona 440 UV Flatbed Series Printer: Product Highlights: A faster, mid-volume; UV curable flatbed inkjet printer; Up to 696 sq. feet/hour; Support for 8'x10' or dual-zone 4'x8' production; Roll Media Option: **Technical Specifications**; 4-channel CMYK ink system upgradeable to 6-channels; 6 - 42 picoliter ink drop sizes; 2" maximum media thickness. <http://www.pcnation.com/web/details.asp>



Figure 15. Canon imagePROGRAF iPF770 Colour: Technical Specifications: Print Resolution (Up To) 2,400 x 1,200 dpi (Max); Media Width - Cut Sheet: 8" - 36", Roll Feed: 10" - 36"; Physical Dimensions - 30" (H) x 56" (W) x 43" (D): Large Format Printer ñ has one-inch print head with 15.360 nozzles, an L ñ COA print processor, as well as workflow software; Sizes range from 60 inches to 17 inches:
<https://csa.canon.com/online/portal/csa/csa/products/largeformat/>:



Figure 16. One of the Campaign Posters of Nigerian Politician originally Designed for Size A1 but has been reduced to A4 for the purpose of this Research work by the Researcher. Adopted from Trice D Graphic Design Enterprise, Kaduna, 2015

**You are invited to
LIBERTY**

Praise Fest 2015

A Celebration of God's Faithfulness to Nigeria

Theme:
Empowerment for CHANGE

Date: 1st October, 2015

Time: 4:00 pm

Venue: CHARISMATIC RENEWAL MINISTRIES
OVERCOMERS' CENTRE
1, Ibiya Street, (Behind Space 2000), Barnawa, Kaduna

Powered by **EAGLES PRAISE TEAM**

Speakers:
HELEN AKOR
Prinz Talker
PST DAVID APODIE IBI AMEH
PST CHUK EMOSS
PST JOEL MADARI

Logos:
GOD BLESS NIGERIA
MWAP TV

Figure 17. A Billboard ad Created by Trice D Graphic Design Enterprise, Kaduna for Charismatic Renewal Ministries for Praises Festival, 2015, in Kaduna. Adapted from Eagles Praise Teams of Charismatic Renewal Ministries, Kaduna, 2015

Digital printing enterprise in Nigeria calls for drastic change. This is due to the inability of many printers to respond to new trends in print business and as such, their immediate environment have become the remote cause of stagnation in the industry (Adebanjo, 2012). The author also reiterated that there is need for all printers to update themselves and to respond to changes in printing environment by moving from old to new technologies for print production.

Lack of technological update in the industry coupled with factors such as instability in political, social and economic policies of the government have affected the printing enterprise in Nigeria. Some of these enterprises have even folded up completely. For instance, Pacific Printers Ltd Lagos, Smift Print & Packaging, Daily Times of Nigeria Ltd, Sketch Publishing Company Ltd, Timi Press Limited, Super Colour Production Limited, Board Pack Limited, Jeromeliaho & Associate Limited, Abiodun Printing Press just to mention but a few which all have total employees between 300 and 500 with the exception of Daily Times that have 2000 while Sketch Publishing Company had 1500 (Olukilede, 2012).

This situation applied also to the Federal and States owned government printing presses where most have become archives and the personnel redundant. This has resulted to outsourcing government printing jobs abroad for production. Akinsoyinu (2009) reported that in 2007, more than 60% of Independent National Electoral Commission (INEC) voting materials were printed in South Africa. Print job outsourcing is a way to permanently destroy the local printing industry. And it is most likely that the use of obsolete and outdated print machineries and management

work tools and refusal to continually update knowledge on modern trends in the industry accounted for poor and inadequate provision of print media in Nigeria.

2.7 Changing Pattern of Work Organization in the Industry

Historically, from the 15th to 19th Century, the print industry has been relatively stable in operational and developmental structure in comparison with the other manufacturing industries. Telford (2007) pointed out that from the Mid-15th century to the Mid-20th century; innovation in this sector was slow to make an impact on the working practices and the technology used in production of printed information. During this period, there were clear distinct production units in the prints manufacturing process. These lines of distinction have been based on crafts and skills drawn between the departments and within them as well.

Child (1967) in Telford (2007) noted that from the introduction of the printing process, each craftsman concentrated his energies on a narrowed field of work. He claimed that from the outset, printing consisted of two basic processes that remained practically unchanged for four centuries. According to him these processes are compositing and presswork which he went on to identify as semi unskilled work involved in assembling the printed work into books. However, Gennard (1990) structured print production process into five: 1. Compositing; 2. process and foundry; 3. machine room; 4. finishing, wire house and dispatch; 5. office and general management. These sections have divisions of tasks where compositors were to set correct type, machine operators to put inks on paper (production of printed sheets) and book binders to finish the printed work.

Following these divisions in the print production industry, the time gap in pre-press unit of the printing industry was put into context by Gennard (1986) in Telford (2007) that, where hand and mechanical composition dominated for 400 years and 50 years respectively, photocomposing only dominated for 15 years. The 15 years short-lived innovation was superseded by computer technology, which was introduced in the mid 1980s while integration of communications technologies in the industry was in the 1990s. Significantly, the driver of this change was in the developing small computer industry (Ponniah, 2003). It was the emergence of desktop publishing (DTP) technology. This technology completely changed the entire pattern of print work in the prepress. The single most important factor in the development of desktop publishing (DTP) was the development of low-cost laser printer engines by CANON in 1985. Specifically the Adobe Systems developed the PostScript (PS) language that enables different computer systems to exploit laser printers.

Another significant breakthrough was the emergence of Microsoft that created a common software standard where authors and external contract writers who owned machines that are compatible with the one in the magazine houses, DTP systems would allow a near-seamless integration of actors who can be geographically dispersed. These technologies made possible remote printing as information could be passed in digital form from the publishers' firms to the printers or authors to printers. In the same way, organizations could communicate and control remote teams via telecommunication systems. Thus, ICT enables the possibility of international competition in print media industry. This development led to the

transformation of the printing and publishing sectors from a highly regulated production-based industry from 15th ã 20th C to a networked-driven service-based industry in the 21st C. The networked-driven print service-based industry is a digitized work environment and this has created a problem for the conventional skilled workers employed in a reproduction houses because, computer-based technology has converted most of the manual tasks to digital screen system. Birkenshaw, et al (1999) pointed out that:

Digital technology is the major driver for change across the industry. It is forcing change from a traditional craft-based approach toward a controlled, manufacturing-based one. Digitization has revolutionized prepress. DTP allow publishers to handle many elements of graphic design and preparation themselves on relatively low-cost equipment without the craft skills previously needed. Boundaries between design and production have disappeared, typesetting has declined and reproduction houses are changing (pp. 34-35).

This development reveals that, the clearly defined areas of demarcation of print production that had existed for years, - where copy was set in prepress, printed in the machine room and finished in the bindery are beginning to become somewhat blurred. Gennard (1986) argues that, “computer technology application to the printing industry is removing boundaries between previously separated tasks.” The printing is now mainly controlled through computer setting of ink coverage and registration. In PIRA projection on the technical developments in print over the next

five years, Birkenshaw et al. (1999), said that the most significant development in conventional printing processes was the application of the automation and control. All press control systems are now computer systems of some sort. In post press, computer logic has been introduced to automate folding, stitching and trimming equipment, but in neither of these areas to the extent of that experienced in the prepress.

2.7.1 Challenges for New Skill Sets and Competencies

Traditional Print Media Industry in Nigeria are facing critical human resource challenges. The evolving industry is continually witnessing the emergence of new technologies which are altering the manner in which print production is performed (Hoban, 2010). These emerging technologies are IT-based that they also require soft-knowledge to operate effectively and this knowledge is becoming important in the information society (Bresnahan, 1999; Bradley, 2000 & ComPrint, 2002).

Frey; Sorce; Armendariz; Gargiulo, and Searles (2009) observed that, the print industry is becoming more involved in digital services and therefore requires new skill sets and competencies. This is obvious since new technologies always demand new skill sets. This specifically requires that workers must need access to learning programs that promote the computer-based skills that lie at the heart of all manufacturing and services occupations (Canadian Printing Industries Sector Council, [CPISC] (2009). In Nigeria printing industry, this is a critical stage of transition as the enterprises are diversifying in missions and processes to address the competing print communication media (Adams, 2008). This has resulted into a good

number of challenges for the human resource and the industry manifesting itself in the following forms: system integration, greater demand for database management services, widespread use of customer interface software, developments in prepress technologies, increased automation and integration of post press tasks.

This trend poses a number of obvious systematic human resource challenges. For example, with the technologically advanced print media industry, fewer workers may be required for the industry, however very highly skilled workers are required with broad knowledge of printing processes and specific skills in particular areas. The CPISC (2009) declared that, in no distance future, digital printing enterprise will require adaptable, multi-skills workers who can operate computerized high-technology equipment, analyze problems, make decisions, work cooperatively, interact with customers and enjoy a clear understanding of the entire printing production process.

It is certain that the evolving technologies in the print media industry are redefining job competencies for the sector as revealed by several studies that were conducted on the industry's skills requirements for the digital printing; among them were:

- i. printing industry skills formation strategy
- ii. an examination of Canada's modern print and graphic communications industry and its human resource challenges
- iii. training for the future, skills for the future
- iv. new skills for digital asset management (DAM) and variable data printing services
- v. identification of skills needs for the graphic communications industry (Xerox, 2011; CPISC 2009; Frey & Christensen 2006; Petfield, 2010; Politis, 2004; CPISC 2008).

This study sorted out the skill sets recommended by these studies and reorganized them as follows:

- (a) General Digital skills for the modern printing industry
- (b) Professional broad-base skill sets which are divided into:
 - 1.General
 - 2.Production
 - 3.Management (detail of skill sets is as contained in the appendix)

Skill basically, is seen as ability to do something well, usually gained through training or experience (Encarta Dictionary, 2009). According to Dictionary.com (2012), skill is an ability and capacity acquired through deliberate, systematic, and sustained effort to smoothly and adaptively carry out complex activities or job functions involving ideas (cognitive skills) things (technical skills), and/or people (interpersonal skills). Politis (2004) defines skill as the relevant knowledge and experience needed to perform a specific task or job and/or the product of education, training and experience, which together with relevant know-how is characteristic of technical knowledge. Generally, skills can be categorized into:

- i. Domain ñ general skills
- ii. Domain - specific skills

For domain-specific skills ñ they are skills that are required only for a specific or certain job, for example, a technical skill is required for the accomplishment of a specific task. However, domainñgeneral skills, an example can be seen in the domain of work, where some general skills would include time-management, teamwork and leadership, self-motivation and many others. In general, one usually requires the skills that support

life long learning which must include not only literacy and numeric (i.e.basic skills), but also, communication skills, problem-solving kills, team working skills, creative thinking, computer/decision making skills, learning skills (Politis, 2004).

However, in discussing new skill sets for the digital print media industry, Levenson (2007) identified two groups for the industry in the twenty-first century print industry namely:

Mental or cognitive skills (*Analytical Thinking and Understanding: skill sets required for managers*).

Physical skills: Physical skills as identified by Levenson (2007) are:

1. ability to minimize waste -*e.g., paper gets waste faster with faster presses*
control of electronic devices, computer management and workflow systems, be able to network computers to enable easy movement of folders, knowing how to “repurpose” for multimedia;
2. ability to improve and maintain quality through; negotiate supply purchasing arrangements, understanding workflow management, and monitor production systems;
3. be able to control mechanical devices with focus on manual dexterity and manipulations and maintenance.

2.7.2 IT and Competencies in the Digital Printing Enterprise

Information and communication technology (ICT) industry is quite an important factor for driving growth in all countries of the world (Politis, 2004). According to survey conducted by Organization for Economic Cooperation and

Development (OECD, 2001), reveals that lack of trained specialists has been steadily growing since the mid-1990s in the US. However, in Europe it is mainly small and medium-size companies that were affected by the shortage. Politis (2004) testified that whenever graphic arts companies offering innovation in cross-media services looking for employees with information and communication technology skills, they often confront enormous problems. The further stated that owing to the difficulties involved in recruiting new staff in the future it will be crucial for graphic arts (Print Media Industry), and therefore the industry needs to address the subject of personnel development in a way that allow them to deploy the human resources available to them effectively and continue developing them in anticipation of future needs. Skills development should involve all generation of employees and it is indispensable to involve all employees in this aspect including older ones ñ because in the long term neither society nor companies can afford to let employees retire at an earlier age. Also it is a fact that older employees possess considerable ability a combination of experience and skills, both of which are important prerequisite for initiating change process (Politis, 2004).

2.7.3 Skills, Competencies and Job Profiles in the Digital Printing Enterprise

The digital printing environment has introduced new skill sets for the industry. According to Porter (1993), five essential skills are needed for production employees in this new print environment namely: creativity, knowledge of science, technology, electronics, and mechanics. The author further states that creativity consists of innovation, development of new ideas and ability with design skills. While science consists of knowledge of science as applied to production processes, and materials.

Technology is acquaintance with technology as it is used in various production operations. Electronics consist of knowledge and ability as applied to the control of quality and production. Mechanics include design of technology, configurations, ergonomics and so forth. Porter asserts that essential skills are those required by the job, and not those gained while doing the job if training is offered [see Table 3].

Table 3
Production –Worker Practical (Skills Requirements) Essential Skills

		Creative	Science	Technology	Electronics	Mechanical
DTP		xx		xx	xx	
	Scan	x	xx	xx	xxx	
Original	Plan/Surface Preparation		x	x	xxx	x
	Artwork	xx				
	Sheet		xx	xxx	xxx	x
Printing	Web		xx	xxx	xxx	xx
	Digital		xx	xx	xxx	x
	Auto/Mechanical		x	xx	xx	xx
Finishing	Hand/Bench	xx	x			
Packaging	General	xx	x	xxx	xx	xx
	Hand	xxx	x			
Binding	Mechanical		xx	xx	x	x
	Design	xxx	x	xx	xxx	x

Note. Production–worker Practical Skills Requirement (essential skills). X = basic knowledge and ability; xx=working knowledge; xxx = in-depth knowledge, Porter (1993). Adopted from “Human Capital Development and Competence Structures in Changing Media Production Environments” by A. E. Politis, 2004, p.83

Pinto (2002) in Politis (2004), says changes in the printing industry have significantly influenced the structure of competencies in the sector. The author pointed that, there is a move from complex equipment in simple workflows to simple equipment in complex workflows. This has created a stressful working environment and caused the development of more generic job descriptions. And again there is an increasing trend for transferring some tasks to the customer side. This has inevitably shifted the qualifications and specializations of people in the print media industry from being task-oriented to being market oriented, (Pinto, 2002; Politis, 2004). Pinto further argues that:

New business and organization changes in the digital printing enterprise sector require management, competencies and teamwork capability. Further, a wide knowledge of tackling multi-variable situation as well as a different attitude to work in a market-oriented environment and concluding that the proposed wide knowledge base should consist of mathematics, physics, IT, some chemistry, and communication skills all of them are oriented towards problem-solving situations (p. 7).

Similarly, Stevens (2002) argues that changing markets in the printing and publishing industry affected competencies of management, commercial staff and production personnel. According to the author, manager's job profile should consist of general management skills, external orientation, logistics, market, sales and ICT knowledge. In the same vein, the commercial staff should possess competencies in analysis and problem solving, in specific client approach management, communication and teamwork. The production personnel should be able to handle the technical

intelligence of machines and efficiently operate production as well as possess problem solving abilities, communication skills, show a team work spirit and participates in life long learning programs. The level of expertise requires of a digital printing industry is suggested by a general trend, that includes the following three wider areas of skills (Politis, 2004): graphic art skills, management, administration and social non-technical skills and information technology (IT) skills.

These skills have been widely acknowledged as the most appropriate ones, regarding the formation of a new structure of competencies that are required for the successful employment of people in the digital printing industry. The first group of skills consists of skills oriented towards design, creativity, printing and finishing techniques, publishing, page layout, scanning as well as other similar skills (Politis, 2004).

2.7.4 Knowledge and the Digital Print Work Environment

Today, many high-tech print jobs are not dependent on location, because they are being supported globally by integrated communication networks. The current wave of technological changes has made it impossible to predict with any degree of precision the type and range of tasks and demands that people will be expected to undertake over the next few years. Yet it is vital that as new tasks and technologies emerge, people can be found who have the capability to rapidly acquire the associated skills, knowledge and competencies to function and be relevant in the digital print media industry. The emphasis is on developing

knowledge workers capable of making rapid skills transitions and attitude adjustments in response to unforeseeable contingencies. In addition to demonstrating high-level job-specific skills, individuals are increasingly being expected to possess, as a minimum set of capabilities such as: general readiness and capacity to engage in personal developmental growth, contributing to life long learning, flexibility in what they undertake, and responsiveness in the face of often conflicting demands.

2.8 Technological Changes in the Production of Print Media

The Print Media Industry is among many industries that have been forced to deal with impact of technological change. Being an old industry of many centuries, with a venerable craft tradition, it has been badly affected by the changing wave of technology development. Consequently, several of the craft aspects are in retreat while many have been embedded in software (Lewis, 1997). The study conducted between 1931 and 1978 on the industry by Wallace and Kalleberg (1982) discovered that there was a clear erosion of craft skills in the composing workshop ñ the core organ of the print media industry. Based on this study, the authors at that time predicted the total elimination of many printing skills in the future. Subsequently, Kalleberg, Wallace, Loscocco, Leicht and Ehm (1987) documented a deskilling trend in the composing, plate making and press room operating in the newspaper segment of the print media industry. The authors asserted that, 'many workshop workers are now relegated to paste-up and that the new technologies had led to drastic reduction in number of composing room workers' (p. 57). This technological change is a constant and that made Finch and Crunkilton (1993) to

say that, 'unlike times past, work is no longer static' (p.16). Similarly, Hovels and Berg (1994) on their study on vocational curriculum points out that 'it is important for vocationalists to understand that there is interplay of skill, power and control in the print media workplace which are being transformed by technology'

In the same vein, Lewis and Konare (1993) added that the type of information deemed to be the highest priority was that which relates to the changing workplace which occupations were becoming obsolete, how the educational requirements of jobs were changing and how technology was affecting jobs. This points out to the fact that change in technology affects workplace and therefore this section of the study examines the impact of the Print MIS on print media industry. In specific terms, the study assesses the impact of Print MIS on digital printing enterprise in Nigeria.

2.8.1 Impact of Print MIS on Human Workforce

In the study titled 'Printing 2000' Birkenshaw (1999), predicted that the new technologies in the industry will dramatically affect the nature of the workshop workforce and its relationships with management. This prediction had come to pass as the Print MIS had made so much impact that even workers in the industry were either made redundant, lose their jobs or were asked to go for re-training to update their skills and knowledge on the new technologies to make them relevant in the new print media environment. Lewis (1997) observed that, new skills are being demanded in the front office and on the shop floor, resulting to new job specifications, continued technical training, adjustments in salary,

wages and changes in work rules and relationships with management. The industry is shifting from analogue technologies to digital technologies that are integrated for easier print media workflow manufacturing. These changes have resulted into the following:

Change in Skill Demanded

One of the impacts of Print MIS on human workforce is the new skills demanded for the use of new technologies. The implementation of Print MIS in the digital printing enterprise demanded new skills in the industry. For example the skills such as: hand composition, page lock-up, type casting, type distribution, operating monotype keyboard, drawing layouts, plate exposure, melting of alloy, phototypesetting, process camera operator, film retouching, stripping, and plate processing.

Manual estimating and costing have become obsolete and irrelevant. This means that, manual layout artists, keyboard operators, camera operators, retouching artists, lithographers ñ all became irrelevant and redundant. The entire prepress activities (tasks) have been computerized and the new technologies integrated. This flushed out any worker whose skills and experiences were associated with analogue technologies. Birkenshaw et al. (1991) pointed out that:

Digital technology is the major driver for change across the print industry. It is forcing change from traditional, craft-based approach toward a controlled manufacturingñbased one. Digitization had revolutionized prepress. Desktop publishing allowed publishers to handle many elements of graphic design and preparation themselves on relatively low-cost

equipment without the craft skills previously needed. Boundaries between design and production have disappeared, typesetters have declined and repro houses are changing (pp. 34 ñ 35).

This explains the fact that computer technology application in the print media industry is removing the boundaries between previously separated print production tasks and therefore changing the skills previously needed. Print Week (2000) affirms that what is required now is digital skill and knowledge since the digital technologies have undermined the craft-based traditional skills that were prevalent to a deskilling exercise.

In an interview conducted with one of the traditional prepress workers in Kaduna, the traditional print worker declared that, 'I see my job disappearing because the computer will eventually take up more of the work. The customer is no longer creating the art board; he's creating the computer file. That is why I am currently taking some classes in InDesign.' Another however confessed that, when one was a stripping artist, one has control over the process because you had your hands on a piece of physical object, a flat, a film, a brush, a knife, in fact you were in hand-on control. But now, one goes in there and you punch on what you feel (are) the right digits, and the computer is doing the work. And when it doesn't come out as expected, you do not know, what to do, you are helpless.'

This scenario above described the situation that the traditional printers have now found themselves in with the evolving Print MIS in the Industry. This made skills acquisition in the areas of computer system necessary if one is to be relevant in the digital printing enterprise in Nigeria.

ii. ***Change in Work Tasks***

The tasks that printers perform in the traditional print workshops have been drastically affected by the increasing mechanization and application of Print MIS as part of production process. With the implementation of Print MIS in (any) printshop, tasks which were previously performed directly by human operators are being automated, changing the human's tasks to one of supervisory control. Print workers no longer perform their usual repetitive tasks, but rather were made to be able to recognize and react to problems situation within and without the organization. In pre-press section of the digital printing, for instance, work tasks have been automated and physical effort substituted (Vieitez et al., 2001) by the application of Print MIS.

This development also affected the structure of the traditional printing organization, shaping it to fit the new information technology systems. Also the hierarchy as the principal structure of communication is dramatically affected by the capabilities of the system. The implementation of the IT ñ based programs reduced drastically layers of middle management between the front line supervisors and the chief executives, thus simplifying organizational structure of the traditional printing. This brings about improved coordination and increased supervision. It had been noted that printing enterprises with well-developed Print MIS solutions lend themselves more towards flat structures but this must be done with caution. This has equipped workers with higher skills for higher levels of autonomy and decision responsibility.

iii. Changes in Number of Workforce

The study by Gennard and Bain (1995) pointed out that with the advancement in printing technologies and the introduction of Print MIS in the industry, the manual tasks such as estimating the cost of the print job to ordering raw materials required, overseeing work in progress and to matters of payroll, raising invoice which were separate tasks performed by individuals within the department are no longer obtainable in the digital printing organization. The Print MIS system now controls both the production and administration of the print business and provides software framework for online trading. The integrated system workflow therefore replaces these individual work tasks to maintaining one that operates the computer to effect access to information and to different work units and to managers for print production.

The Efi (2007) depicts a typical management technology of a printing organization having three major areas ñ administration, planning and production see figure (18). In this system, virtually every operation and every person in the business of the organization provides information to or pulls information from ñ thus having a fully integrated Print MIS solution.

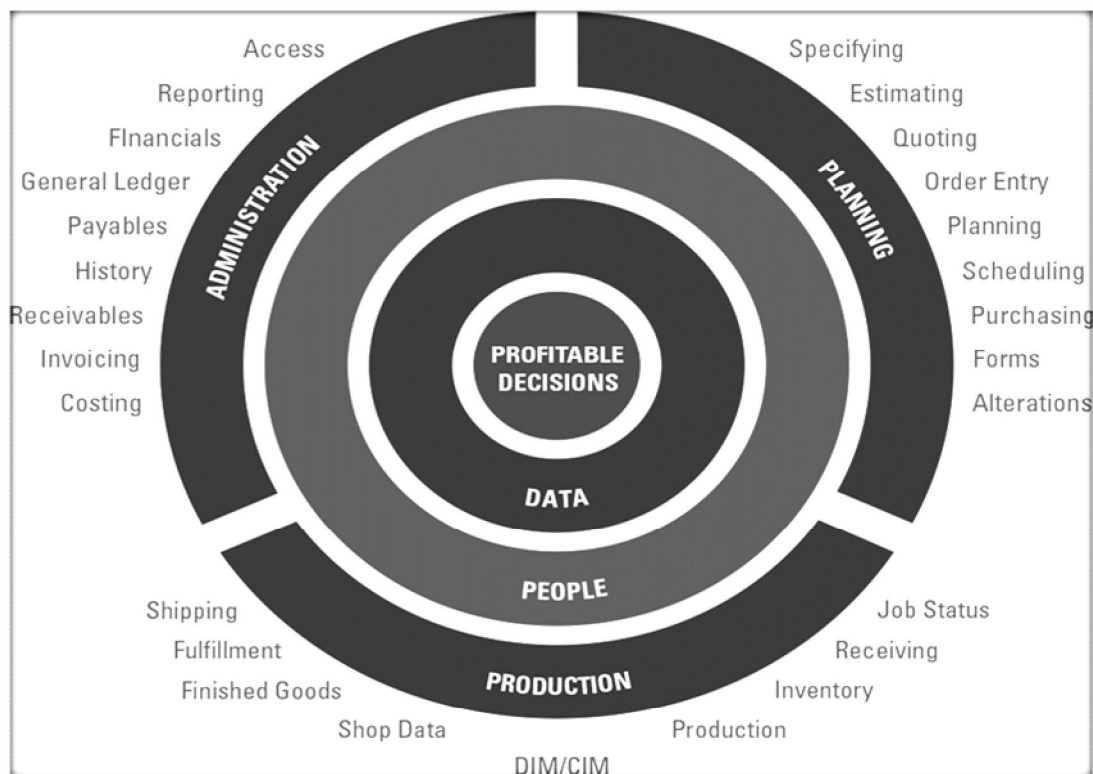


Figure 18: A Typical Structure of Management Technology of Printing Organization, Adapted from "ABCs of print mis, profit focused print management" by Efi, 2005. Copyright 2005, by Efi Essential to print, ABCs of Print MIS, Foster City, CA

Print MIS system according to Bill Jacot in Efi (2005), - ABCs of Print MIS says "growth has been phenomenon even with very few additional employees. Without the integrated data that we received from Print MIS Solution, it would not have been possible" (p. 11). This explains the true value of putting the Print MIS in print business. A Print MIS solution is the linch-pin to a successful re-thinking of the business and production process associated with the business of print. The tool allows the printing operation to be more accurately analyzed and forecast the business, operate more efficiently, and identify process change that can improve productivity and profitability even more with less number of employees. For instance, computers are now used for creating drawings, charts, graphs, full colour

artwork layouts and creation of full visuals for reproductions. This had eliminated many prepress and production job workers who usually perform such operations manually. Computers are now performing functions previously performed by humans, ñ Print MIS greatly accelerates this process and allows computers to perform variety of complex functions, which in the past, were performed by humans. Tasks such as information transaction and processing, and intelligent scheduling have been computerized hence replacing administrative and clerical works in the industry. This resulted into fewer number of workforce in the work production units.

iv. Change in Work Relationships and Working Conditions

The traditional printing workplace ñ whether the prepress, press or post press workshop, usually consists of good number of workers operating and controlling the machines as well as coordinating their activities. For instance, in a typically sheet fed offset press or web, you have skilled operators who run press and take charge of its subsystem such as ink/water, paper feeding, drying systems, plate alignment, color balance and quality output. Similarly in the binding section, there are numerous pieces of bindery equipment that require skilled operators. These operators work within the same environment, interact with one another and having a cordial working relationships. These traditional print workshops have well defined tasks carried out by the skilled individuals whose experience and knowledge have been acquired through years of apprenticeship and/or college schooling. Under such conditions, there is a close relationship of mutual understanding, respect and dignity of labour. Another great

feature is the supervision or ongoing work where the supervisor or manager is always in close contact with the production staff creating work atmosphere of hierarchy, autonomy and loyalty. With this, employees' social needs in the workplace were met and management did address their problems in group and were being valued by their employers.

However, with the computerization of the traditional printing tasks, it raises the possibility of constant monitoring of the work process by management through the use of computer system, hence decreasing the element of autonomy and control formerly held by the elite print workers. The digital printing workshop has different feature ñ there is no conventional ink and water, no printing plates and no drying systems. There is relatively little the operator must do in terms of physical machine adjustments or maintenance hence the machine operator is left to only communicate with the machine and no longer fellow employees as in traditional printing workplace. The digital printing workshop is an integration of the entire production process under the control of the DTP operator (ILO, 2000). The common feature of communication in the digital print environment is man to machine and machine to man.

This system of integration and digital workflow though it is designed to reduce human error and compensate for human limitations in the pursuit of efficiency, it however reduces discretion and control, craftsmanship and training, power of workers in workplace relationships and the interest and satisfaction gained from the job (Parnell, 2006). Workers now communicate through the networked computers or other digital systems, thereby losing the cultural work relationships formerly being enjoyed. Thus,

the previous human social relationships between workers involving cooperation, a sense of cohesiveness and solidarity have turned into competition and isolation in the new digital print environment (Hugentobler, 1987). This is as a result of the implementation of Print MIS which has replaced crafts workers previous sense of pride and masters (Vieitez et al, 2001). Thus many workers feel a loss of identity, dehumanization and because of computerization, they feel like 'just another number' because computer reduces or eliminates the human element that was present in the non-computerized system (Parnell, 2006).

Print MIS also creates more lack of social contacts which could be damaging to the social, moral and cognitive development of workers who spend long period of time working alone on the computer machine. This system also affects individual's health and safety ñ it leads to job stress since an increase and/or responsibilities can trigger job stress. This is always possible with workers who is not proficient with computers but must work with them. However, on the other hand, working conditions or digital workplaces are becoming less hazardous with the computerization and implementation of Print MIS, since the digital printing enterprises are becoming more automated. Thus digital printing enterprises are now using fewer chemicals and solutions than in the past and experience fewer equipment related accidents.

2.8.2 Impact of Print MIS on Production

Through Print MIS, basic production information is made available to the production staff, most especially the operators who now produce the right print quality without wasting of materials. All the production steps and instructions are made available and this helps to avoid unnecessary production mistakes that do let

to wastages. The use of **work order** has been improved greatly through the Print MIS which provides basic graphic information regarding what to do on the print such as location of holes, the pattern of folds, sequence and location of cuts. It also provides the image of an expected result that helps the operators providing reference point and this assists the operators to reduce downtime. It also improves quality and can reduce wastes by preventing mistakes.

Another tool is the application of shop floor data collection (SFDC). This tool is quite an important device for production. Production workers provide basic information such as time spent, materials used, start and stop times, make-ready, running and wash up time. With this information, the workers can be assessed to know the training needs for such workers. The integration of SFDC with the Print MIS use direct machine interface (DMI). This simplifies SFDC by providing operation counts directly into the data collection system. With this system, the operator selects the activity to perform, turns on the counter and the technology records both the time and materials automatically. Many manufacturers of printing machines have computerized their machines that enabled the operator/supervisor to track time and material. Some advanced systems can automate make-ready activities as well as track quality and manage color.

The manufacturer-driven technologies can be provided with a print of integration by the Print MIS so that when job information is entered into the Print MIS, it can be automatically passed to multiple devices. Usually the operator selects the list on

his/her computer terminal, and the equipment will configure itself while the operator performs other tasks.

Job scheduling in many organizations is still an activity that occurs on a large board with coloured paper, markers and with the help of some talented people. However, with the Print MIS, the scheduling tool has made this function automatic. Automatic scheduling can be done graphically by week, day, and hour. Schedules can be driven by start time, due data and midpoint. The midpoint scheduling is typically used to determine the best time for a job to arrive at a specific piece of equipment (e.g press) while jobs are scheduled in other production units are on a first-in/first-out basis. Some advanced job schedulers support "what if" analysis that compares different scenarios before committing to one schedule. Some systems even support dynamics task scheduling. If a job is moved ahead in the schedule for a press, the application can automatically moves the job ahead also in the prepress department. This ensures that the jobs will be ready for the press at the scheduled time.

These production impacts can be viewed in real-time by the Print MIS. A change in a job schedule can be viewed by an operator immediately, ensuring that the proper job is processed next. With the SFDC the location and status of a job can be identified by anyone with access to the system. When the system access is combined with DMI, managers even have the ability to see the job percentage of completion at any time. If the job is running long, schedule changes can be made right away, enabling the production team to quickly respond to the unexpected events.

2.8.3. Impact of Print MIS on Human Resources Management

The capacity development of print workers in the digital print enterprise became necessary because Print MIS is one of the core communication tools in the print workshop. This demands for new skills and competencies by every worker in the new digital print environment. Walton (1999) emphasized that learning skills and knowledge in such new print environment are matters of utmost interest. The author pointed out that the majority of SMEs in the sector have not specialized functions or departments to handle the growing concern for the acquisition of new skills for the running of these enterprises. Accordingly, the following have therefore been observed to be the impacts of Print MIS on HRM as a whole in the digital printing enterprise:

- i. The establishment of part time resources development support as a consultant to provide training needs for skill acquisition as demanded by the new digital printing enterprise
 - ii. DPEs now are forced to seek for high level of external professional assistance for advice and support on team development and networking, and guidance on approaches to organizational development.
- a. DPEs are now forcing business links through sector-specific networks where they can participate and develop mutual support systems. Such networks are closely associated with particular external training providers which can meet the training needs and updating for latest knowledge for print production workers

- b. DPEs are creating the need for support through external mentoring schemes, where trainees could identify their development needs in terms of: career management, general support, learning and development, self-reliance and specific skills. This has been found to be a means of motivating and equipping workers in the DPEs. One of the workers in the DPEs confessed by saying that, "this is a brilliant idea, for the first time in my life, there is someone's whose time is just for me" (Langridge, 1998).

2.8.4 Impact of Print MIS on Digital Workflow

Primarily, the essence of digital workflow in printing is the integration of many technologies consisting of functional processes. These processes in conventional workflow include scanning, film assembly, film output, stripping, contacting, exposure, duping, proofing and plating. However, with digital workflow, some of the common processes include: pre-flighting, trapping, open prepress interface (OPI), serving, imposition and RIPing (Romano, 2001). Each of these steps has evolved from manual techniques which today had become totally automated with the implementation of Print MIS.

Print MIS was primarily designed to increase system efficiency in an organization that had been transformed from analogue to digital technology. The traditional printing organizational workflow is characterized by different independent work units that are not connected hence do cause work delay as production staff have to walk from one unit of production to another. This mechanical workflow system has been replaced by digital workflow system, where

many of the tasks that were once done manually have been computerized and the processes automated.

Ray (2000) pointed out those mechanical workflows were labour and craft skill intensive. With the introduction of Print MIS, there has been a transformation of system where digital workflows have replaced traditional mechanical workflows throughout the printing industry. The entire system provides accurate and useful dataflows back and forth between the Print MIS and other systems equipment and personnel to streamline the entire facility (Fig 20).

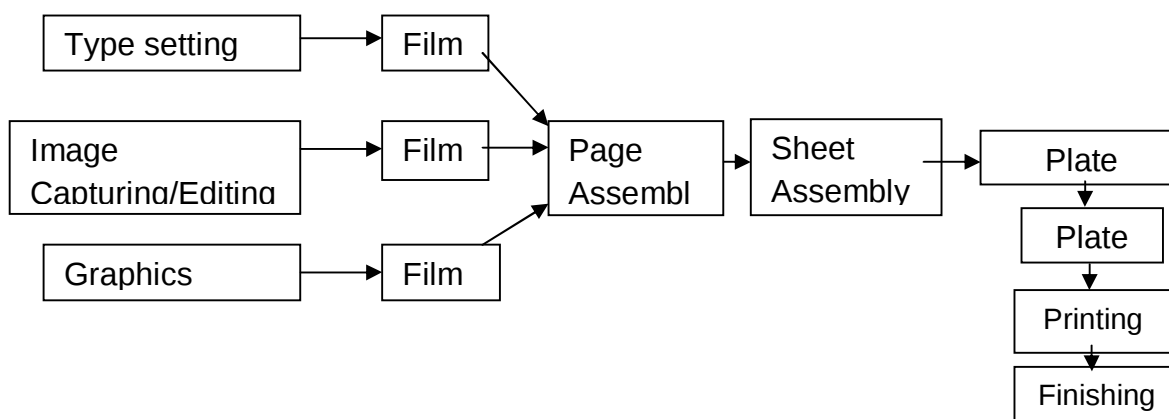


Figure 19: Conventional (Analog) Workflow for the production of Print Media. Handbook of Print Media ñ Kipphan, 2001P. 926

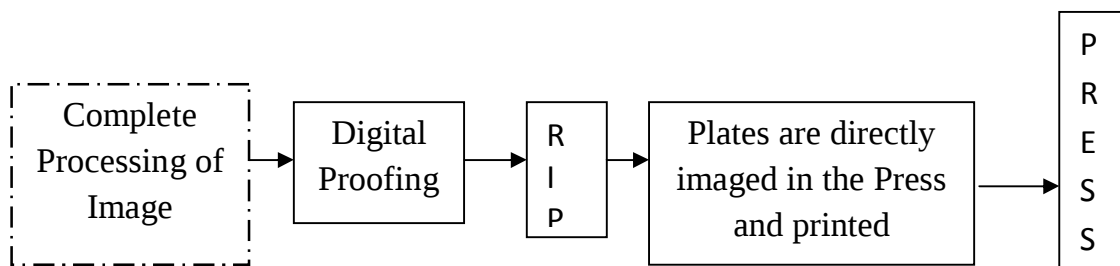


Figure 20. Digital workflow with computer to Press technology (NIP) or DI technology Heidelberg. Adapted from offset Printing Technology, Principles of Prepress. Print Media Academy

Generally, workflow automation is about the flow under consistent and monitored control by automating functionality. The result is elimination of double handling and the improvement of productivity and communication with integration between the stakeholders involved in the process, both time and money is saved improving output and creating overall value. The impact of Print MIS on digital workflow cannot be assessed in isolation because it operates in conjunction with processes like PDF, JMF and PPF. These tools of production also affect the structural process of the print production in the industry and consequently the employment number, the quality of work, skill requirements and labour relation.

It is quite clear that employment in the print media industry is declining as recorded in the sector in the 12 EU member states which revealed that employment went down from 882,654 in 1991 to 817,318 in 1995 (European Commission, 1997). Similarly, in Nigeria employment in the prepress area has been badly affected. For instance, DTP caused composition and litho shops to be closed. Employment therefore shifted partly to new DTP shops and in-house DTP departments. The organization of work in the press has been affected though less fundamentally than in the prepress in Nigeria printing industry. Empirical studies revealed that printers' job in Nigeria has split into different typologies:

- i. there is a tendency towards modern process management of orders, including prepress engineering, planning and workflow management
- ii. there are press operators running printing presses, including such traditional activities as cleaning (press maintenance), ink and papers supply and tackling minor disruptions in the workplace.

- iii. the polarization entails distinct differences in qualification requirements ñ where the process manager requires high technical and IT skills, management and teamwork abilities; the press operators require lower level of technical skills

2.8.5 Impact of Print MIS on Customer Service Relationships

Customer services in the Print Media and Pre-media Industry are an integral part of sales offer to the customers by printers. It is a fundamental norm that print media enterprises usually do not take for granted. It is a highly regarded service that printers maintain at all cost.

This is primarily done to ensure that:

- i. Customers are really satisfied at all times
- ii. Customers are retained for the future, (Vision in Print, 2006).

To the best practicing printers, customer service relationships involve producing and delivering work on time. However, superior customer service might include:

- i. providing management reporting to customers
- ii. pro-actively supplying job status information to customers
- iii. undertaking regular reviews with customers for their current and future needs
- iv. the ability to respond to requests very quickly
- v. making it as easy as possible to buy print from the company (Vision in Print, 2006).

Given the above stated services in the print media industry, how does Print MIS impact customer relationship? Relevant literature reveals that with the implementation of Print MIS in the DPEs, the following have been identified as impacts, on customer relationships:

- i. Customers service reps can now easily provide more information in less time using
- ii. Print MIS. This means that it improves the CSRs access to data and provides more information to customer and this leads to:
 - a). improved speed in print business transaction
 - b). accuracy in information processing
 - c). extended customers service
 - d). Customer-specific products and pricing information became so easy to access with the Print MIS
 - e). Print Enterprises can tailor programs to each customer, reducing the burden on staff which they are no longer required to memorize the list of rules of each customer. They only learn how to access information in the system which provides the rules, products and prices for each customer
- iii. As the repository of all information about a job, the Print MIS can share data with internal and external users through the services provided by the internet. This has made it so easy and faster for customers to share information. With this provision, some costs are shared with the customers in each for better and faster implementation of print business agreements.
- iv. With the introduction of JDF, customers can now imbed production requirements directly into artwork files which through Print MIS database are made available.

Production information such as design information, quantity of inks, quantity of jobs, folding specifications, etc. can be predefined by the customers, directly and then automatically integrated into incoming orders. This reduces chances for mistakes and ensures that the printer and the customers have the understanding about the desired outcome of the job.

2.9. Strategies for Implementing Print MIS

The strategies for implementing Print MIS in the digital printing enterprises are as listed below:

- i. Developing human capital
- ii. Restructure the administration and production of the organization
- iii. Print business specialization
- iv. Implementing Print MIS in stages and evaluation

2.9.1. Developing Human Capital

Human capital development (HCD) is the most important element for success in business today. Developing human capital requires creating and cultivating environments in which human beings can rapidly learn and apply new ideas, competencies, skills, behaviours and attitudes toward higher performance. Specifically, printing firms must invest necessary resources in developing human capital which tends to have a great impact on performance.

2.9.1.1 Some Strategies toward Developing Human Capital in the Digital Printing Enterprises

Human Capital Development focuses on two main components which are "individuals" and "organizations". According to Garavan et al (2001), human capital has four different attributes – thus:

- i. flexibility and adoptability
- ii. enhancement of Individual competence
- iii. the development of organizational competence
- iv. individual employability

Human capital development is any activity which improves the quality (productivity) of the worker. Therefore, training is an important component of human capital development. This refers to the knowledge and training required and undergone by a person that increases his/her capabilities in performing activities of economic values.

a). Training in the Context of Human Capital Development

Training is considered as one of the most significant elements for the development of the people working in the print media sector. Kenny and Reid (1988) use the term "training intervention" to refer to any event which is deliberately planned by those responsible for training in order for learning to take place. These events are referred to as strategies, encompassing a wide range of activities, and can be grouped under five headings (Kenney & Reid, 1988):

- i. training on the job
- ii. planned organization experience
- iii. in-house courses

- iv. planned experiences outside the organization
- v. external courses

On the general consideration, training is a sub-set of HRD, which contributes to overall learning and development effort of a human being. As Walton (1999) pointed out on the whole, training strategies tend to concentrate on performance-in-task skills and capability enhancement. Training and development strategies are broader in focus, incorporating a range of approaches for preparing individuals for roles they might be called on to play in future in the organization or other similar organization.

b). Up-skilling in the Digital Printing Sector

- i. Schools and training institutes:** Training Institutes are always willing to offer any facility when there is demand and they also have the responsibilities to develop relevant training schemes for up-skilling in close cooperation with the industry.
- ii. Companies:** the responsibility for up-skilling lies with those who benefit most - the companies and employees. Management plays an important coordinating role in initiating training activities by a top-down approach. These training activities demand strategy as well as organization of the learning process and not the usual ad-hoc approach. Company success is primarily based on willingness to continue with education, job motivation and team player attitude.
- iii. Employees:** Employees should be in position to anticipate change through the development of an individual strategy, setting such questions to themselves as:
 - 1. what is going on in my unit?
 - 2. where do I stand in terms of my worth ?

3. what are my competencies?
4. what do I want to do next?
5. how do I get there? (Deboer, 2002).

2.9.2. Restructuring the Administration and Production

It looks so obvious that the advancement in technology is making the traditional printing organizations incapable of meeting print needs of customers who sometimes make request on demand. These traditional printing organizations therefore need to undergo restructuring to keep pace with the current technology. Generally the structure of an organization defines its tasks and responsibilities, work roles and relationships, and channels of communication (Mullins, 2002). Restructuring has been considered to be the key to develop the power of an organization and strengthen its structure (Bin Ageel, Shakeel & Awan, 2011). It is necessary that restructuring an organization must be in such a way that it enables the ease of workflow to accomplish internal tasks, to coordinate various print activities and to interpret the external print environment. One basic fact about digital printing enterprise is sharing of information in the workplace therefore the structure of such an organization must be the one that will facilitate these objectives.

Basically, the structuring requires here is that of changing from the analogue traditional print organization to digital printing enterprise. This is to enable the implementation of Print MIS for enhancing print productivity. Print MIS as a repository of information requires that its position in the organization should be very strategic if efficiency and effectiveness of the entire system is to be achieved. Thus,

the Print MIS must be strategically located to serve its clients. Therefore, for a digital printing enterprise to perform well, each unit of production must perform its tasks and the tasks must be coordinated with one another to enable Print MIS works effectively.

Organizational structure in digital printing enterprises refers to the allocation of tasks and responsibilities to individuals and groups within the organization and the installation of technologies to ensure effective communication and integration of effort for the production of print media (Bresnahan, et al. 1998; Kiernan, 1995). This involves the design of organizational structure and internal systems facilities, interactions and communication for the coordination and control of print activities.

Re-structuring here refers to changing the systems of communication, systems of authority (and/or roles) and systems of workflow of the traditional printing organization to conform to the digital printing environment. It is a change toward digitization to enable the implementation of Print MIS technologies. Since Print MIS is a (complete) change in technology, it requires that organizational restructuring should include majorly:

1. Technology (machines, computers, tools)
2. People (their number, skills, competencies, knowledge, attitudes etc.)
3. Task performance or even task definition
4. Building (space re-organization)

In organizational restructuring in the print media industry, the following actions are important:

1. Clarify the purpose of the HCD effort,
2. Assess the present strength and weaknesses of the organization's skill base.
3. Scan the external environment for the threats and opportunities that are likely to influence human performance in the new print environment
4. Compare strengths and weakness with future threats and opportunities
5. Select a long time organizational strategy of HCD which is likely to prepare both individuals and organizations for the future
6. Implement the chosen strategy, paying attention to:
 - i. *None-employee Development*: what should be done to meet learning needs of people external to the print media enterprise
 - ii. *Employee Development*: What should be done to create long term talent
 - iii. *Employee education*: What should be done to help people realize their career objectives
 - iv. *Employee Training*: what should be done to help people master job requirements and improve job performance (Rothwell & Kazanas, 1989).

2.9.3. Print Business Specialization

Printing industry generally is a bespoke industry producing myriad of products ñ annual reports, brochures, labels, cartons, posters, banners, forms, books, corporate, stationery etc. (Speirs, 1993). This makes it necessary for printing entrepreneurs to be specialized in one or two areas of the print business. The type of print business to specialize in must be known and the mission statement clearly stated. This is always done to avoid potential pitfalls and to determine exactly what to do now and what to achieve in the future. Knowing exactly the type of print

business to specialize in it will enable you to prepare a flow chart of the administrative steps and the production department involvement for each job ñ for instance, from enquiry to invoice. It also makes possible for Print MIS supplier to demonstrate how the system would cope with the flow of work (Bisset, 2002) and to make recommendations for change of procedures where necessary. It is necessary to be certain of the type of print business to enable appropriate selection of technologies for the production of the print media.

Printing entrepreneurs/investors tend to exploit one or more areas of print products production for comparative advantage because printing industry is quite a big and wide industry that engages in the production of myriad products (Akinsoyinu, 2004). This is to enable better management since printing serves all sectors of the economy including government, financial services, and distributive services and manufacturing industry (Speirs, 1993). And to enable better production services, Speirs classifies printing services into two:

Major categories, thus:

1. General printers (jobbing printers), whose products include:
 Leaflets, Booklets, Folders, General Printed Stationary, Timetables,
 Posters, Envelopes, Cards etc.
2. Specialist Printers whose products include:
 Books, Periodicals, Cartons, Packaging, Labels, Business forms, Direct
 Marketing

However, Luttrop & Greenwald, (2009); Rodman (2006), and Kipphan, (2001) provided a general list as print business areas which includes:

posters, periodical, catalog, cartons, labels, packaging, business/forms, bill boards, logos, direct/mail/marketing, books, newspapers, magazines, banners, corporate stationary and identify sets (logo, letterhead, envelopes, business card), annual reports, advertising/commercial print.

These areas of print businesses demand that information should be easily provided and well managed to enable production. The flow of information here is absolutely important for ease of accessibility, correctness and timely provision of the information. This requires a good management information system that will make every worker to provide information to or pull information from the system (Print MIS). This ensures that staff have access to information they require to enable them perform credibly well in the business of print production. The implementation of Print MIS therefore does not necessarily depend on the type of print business but the volume of work involves in the organization. This in turn determines the type and selection of appropriate printing machines to be installed.

2.9.4 Implementing Appropriate Print MIS System in Stages

Appropriate Print MIS is the supposed software for running print business at its maximum capacity. It is supposed to be the most suitable for the print organization. Appropriate software is the one that provides all the necessary feature requirements for the print business and in the near future. The appropriate Print MIS technology is that which meets all the print business needs of the organization. Bisset (2002) warns that probably the greatest danger is buying a system that is not suitable

for the type of print business the organization is running, or installing a system and then not using it correctly, or to its full potential. Once this happens, it is considered not an appropriate technology for the print business. This requires making sure that you really understand what it is you want to achieve by the setting up such a print business enterprise.

Most print business organizations achieve this through conducting fact finding mission and in-depth analysis of the print business before requesting the supplier to supply the software. Included in this analysis is the plan for now and the future - what is driving the print business requirements and how one believes the MIS could benefit the business.

Based on this analysis, the appropriate Print MIS system for the print business can be ordered for installation and implementation. Most leading MIS Systems are hugely sophisticated but that does not mean they should not be easy to operate because Print MIS systems are all designed to be easy to operate.

Some features to look for in the Print MIS

It is expected that most good Print MIS should have all the necessary components, nevertheless those components need to be enhanced with some certain features to improve the collection and utilization of information. These features may include:

- i. Intelligent Specification
- ii. Client access for order management
- iii. Computer-generated production forms
- iv. Dynamic scheduling

- v. DMI (Direct Machine Interface) for data collection directly from presses and other equipment
- vi. Client access for finished goods inventory management
- vii. Flexible financial reporting
- viii. Employer, equipment and sales analysis
- ix. Database extraction and custom reporting tools.
- x. Integration layers for JDF and 3rd party data

Bisset (2002) outlines the following strategies which should be considered when trying to implement Print MIS:

- i. make sure that the Print MIS system can be upgraded easily and generally at no cost or at minimal cost. Most at times, print business starts with one product but as the business grows, it is required that more products are added to the production chain and therefore requires system upgrading to a full version.
- ii. ensure that all the modules are sold to the organization as may be required for the print business and ensure that extra modules can be added with the minimum of effort and disruption to the production chain.
- iii. Ensure that the Print MIS supplier has flexible and open approach to the supply of the modules. And do not be tied to buying óstandardô functionality that may not be relevant to your print business requirements.
- iv. The service and maintenance contracts should be the one that satisfies you. There is no point in buying low cost Print MIS system only to be tied into an expensive service contract.

- v. the Print MIS must be flexible enough. Every company has its own requirements and you need to ensure that your chosen Print MIS makes information simple and easy to access
- vi. ensure that the software will run on your hardware and also check whether the full MIS software runs on a PC as well as a MC if this is what you require
- vii. how open is the system ñ can the system link to other software you are running, e.g e-commerce or accounts system. Make extra effort to find out if the Print MIS supplier has written links to other software solutions and who they are ñ this is a good indication of how open and flexible the MIS supplier is (Bisset, 2002).
- viii. how much training will be required - most good Print MIS suppliers do supply a training matrix to calculate the number of training days required.
- ix. ensure that the Print MIS is CIP4 enabled to a broad range of prepress, press and postpress devices.
- x. can the Print MIS adapt to suit the print business requirements? How many major releases are issued each year?

2.10. Related Empirical Studies on Print MIS

Many research works have been conducted in management information System (MIS) however; available literature revealed that only few contained information that are directly related to the problems of print management information system in the digital printing enterprise. Nevertheless, the studies which were not directly related to this study were found quite helpful for the study.

Rodriguez, Gogula, Kharakar and Kumar (2006) carried out study on the Current and Future use of Print MIS Systems in Production Printing in the U.S and

the Non-users of the Print MIS Systems in their operations. The study used a survey methodology and research questionnaire items were generated and sent to Print MIS vendors for review and comment before the instrument was then administered to printing establishments.

The study found out that Print MIS system has been in use in the majority of the printing establishments for more than a decade and even deployed the system in the print production area. It found out that the Print MIS users drive business growth while non-users were either unaware of Print MIS Solutions and/or did not understand the return on investment delivered by this technology. This inhibited their willingness to implement these print production solutions. Rodriguez, et al. (2006) pointed out that access to real time data and better business decision making are the primary benefits of Print MIS system though, the main problem of implementation revolves around staff training and consistent utilization. This study provided an insight into the use of Print MIS System in the Print production area of the U.S print industry. It revealed that Print MIS systems has a great potential for driving business growth and for those that have not implemented these solutions need to understand the benefits and adopt them for implementation. The study then recommended that a more detailed study about reasons for not using these information system need to be conducted and analyzed for future research. Also, a follow-up study should be done in order to evaluate the implementation plans and changing needs of the non-users which this study addressed.

Another study was carried out in India by Gupta and Ramakrishna (2003) on Computer-aided Print Management Information System (Print MIS) for Printing

Presses aimed at discussing the role of Print MIS and its benefits to the printing enterprises. It was an explorative study and revealed that, for digital printing enterprises, there is need for implementing fully integrated computer-aided print production control system for managing information system that will not only increase their print production capacity and efficiency but help them to survive the current economic and print business crisis. The study also found out that this concept is still yet to catch up fully in India, whereas most of the top printing enterprises abroad have already been using computer-aided Print MIS software to compare and assess business and technical data for decision making. One of the major benefits identified by the study was the full integration of operations and improvement in allocation of physical (materials and machinery), financial and human resources particularly under constrained conditions; increases the efficiency of output in terms of print quality and reliability, and achieved major improvement in productivity. Though the study concluded that Print MIS technology was all about providing management control over the day-to-day operations of printing business, however, it is important to understand that coordinating and controlling printing business is more than just performing the production tasks of running a printing press or operating a printing machine. Planning of the whole print production requires not only a thorough understanding of the production but it also demands functionaries having multiple skills beyond the reproduction of text and images on paper and ink (Gupta & Ramakrishna, 2003).

The Influence of New Technologies on the Technical and Technological Elaboration of the Printing Production Process was the study conducted in Croatia by

Milkovic, Mrvac and Milkovic (2007). The study sought to see how new technologies (Print MIS, PDF JMF) impact the realization of speed and quality. Milkovic, et al found out that the new information and communication technology has brought some major changes in the production concerning greater productivity and efficiency since access to information and flow of information has been enhanced. This has led to constant improvement and supplements the existing printing technologies with new procedures and methods that situate modern production at the print of great dynamic and very demanding development consideration. These new technologies have impacted so much on productivity that McWilliam (2001) concurred by saying that, running of the printshop has changed dramatically over the years. Ten years ago, a shop would have 10 jobs that had to get out in the next 10 days. Now, they have 10 jobs that need to get out in the next hour! The only way to do this without throwing people at the problem is through automation which Print MIS plays a key role

A report conducted by Efi (2005) titled ABCs of Print MIS Profit Focused Print Management, quoted Bill Jacot, Vice President of Manufacturing Lagraphico that, growth has been phenomenal and that's with very few additional employees. Without the integrated data that we receive from our Print MIS solutions; it would not have been possible. Also in the same report, Chuck Kinzer, CFO, Omaha Print said, as a direct result of having better estimating standard with Print MIS solutions we've increased our profit margins by about 5 percent which is big when you're talking about an average industry profit of 3 percent. The Efi report observed that, today's Print MIS solution provides the foundation for addressing the current

competitive print market challenges. In fact, with business moving at the speed of the internet, a good Print MIS isn't an option – it is an absolute necessity. Print MIS provides the tools for managing financial, administrative and production operations. And it delivers the process integration a printer needs to achieve the level of speed, cost, leadership, quality, services, and flexibility required to remain viable and competitive.

D'Amico (2006) carried out another study on Barriers to the Successful Implementation of Print Management Information System in midsize commercial printing companies. It was a qualitative study that specifically wanted to find out how do previously identified factors critical to the successful implementation of Enterprise Resource Planning (ERP) systems in large print corporations relate to the successful implementation of Print MIS in midsize commercial printing companies. The methodological approach was through an in-depth interview using a semi-structural format of open-ended questionnaire with in-depth follow-up discussion with print industry experts. The results of the study identified three categories of impediments – thus *major, moderate and minor* impediments as tabulated in Table 4.

Table 4

Interviewees' Ranking of Critical Factor: their Degree of Importance as Impediments to the Successful Implementation of Print MIS in Graphic Communications Companies

	Critical factors in implementation of Print MIS	Degree of Importance as an Impediments		
		Major	Moderate	Minor
1	ERP teamwork & composition	X	X	
2.	Change management Programme & Culture		X	
3	Top Management Support	X		
4	Business Plan & Vision	X		
5	Business Process re-engineering (BPR) and Minimum customization	X		
6	Effective Communication	X		
7	Project Management	X		
9	Monitoring & Evaluation of performance		X	
10	Project Champion			X
11	Appropriate Business & its legacy system	X		

Note. Adopted from "Barriers to the successful implantation of print management information System (Print MIS) in Midsize commercial printing companies: Qualitative Study by G. S. D'Amico, 2006, Visual Communication Journal Fall 2006 P. 26 Copyright 2006 by International Graphic Arts Education Association, Inc

The study concluded that tight profit margins of the midsize commercial printing companies can make it very difficult to free up the capital and staff resources needed to properly incorporate Print MIS technologies. And that some impediments seem to be more of people rather than resource base; - from the unwillingness of top management to make a total commitment to the new technology at the strategic level, to the

unwillingness of line workers to adopt to new ways of doing work and letting go of their traditional work practices.

On technological change and skill development, Lenvesan (2007) carried out a study on Philosophical Premises Underlying Successful Education and Training in the Graphic Arts. The study came out with two major categories of training needed to develop skill sets for employees of the graphic arts in the twenty-first century. These are mental or cognitive skills and physical skills. Under the cognitive or mental skills, the following set of skills were identified for the new technological digital print environment:

- i. developing skill for accepting changes as a rule: resisting change is a natural tendency. But doing so inhibits professional growth in technologically dynamic field such as the graphic arts (printing industry).
- ii. analytical thinking and understanding systems: systems concepts, field management and workflow analysis have become the skill set required for aspiring managers in the graphic arts.
- iii. understanding the relationship between people and technology
- iv. understanding contingency management
- v. creative cognitive skills as opposed to physical craft skills
- vi. organizational communication skills
- vii. marketing sales and customer service skills
- viii. skills in practicing professional ethics
- ix. understanding laws and policies concerning intellectual property and
- x. overall communication skills

However, the physical skill sets as required in the technological dynamic print industry include:

- i. the ability to minimize waste
- ii. the ability to improve and maintain quality
- iii. the ability to control electronic devices
- iv. knowledge of computer management and workflow systems
- v. knowledge of how to repurpose for multimedia
- vi. the ability to improve job handling practices and productivity.

It was strongly viewed that the new print environment needs a vision of the future and this calls for effective education and training in the digital environment. Workers of the twenty first century in the digital printing industry should be developed to have intellect, openmindedness, business sense, understanding of technology and vision to translate the print media profession into one that addresses the fundamental information and communication needs of the society on the personal individual level and for commerce (Levenson, 2007).

These related studies did not covered much on the area of creating awareness on the benefit of implementing Print MIS in the DPEs and the fact that the evolving technologies will soon render the analog print production an unviable print business in Nigeria hence the need for this study.

2.11. Summary of Related Literature Review

The review of related literature revealed that Print MIS is a major factor in the production of print media in the digital printing enterprise by providing timely

information to users to enhance productivity and system efficiency. It also revealed that there are many types of Print MIS Systems available for implementation. They come in modules and are designed to function in specific ways for specific jobs which they differ in sizes and complexity.

Literature review on the evolving Print MIS revealed that the analogue traditional printing industry is gradually changing into a digital printing manufacturing industry where printing machines are integrated, bridging all production islands into single production chain. The integrating systems connecting these machines includes: JDF, PPF, JMF, PJTF, the Print MIS and the internet connecting printing organizations that are thousands of kilometers apart.

The review of related literature revealed that the kind of print business set in place must determine the appropriate Print MIS for implementation to meet up the print organizational needs. It also noted that there are certain features in the Print MIS that the print investors must look for and to identify strategies for their implementation. It revealed that Print MIS is an integrated workflow tool that its implementation has rendered conventional printing skills obsolete. Therefore the industry is undergoing restructuring and re-investment in new technologies and in human capital development for effective management of the new print organization.

The literature review however, discovered that most of the literatures were conducted in foreign countries; therefore they did not fit into developing world like Nigeria, consequently, the need to assess the impact of Print MIS on the digital printing enterprises in Nigeria.

CHAPTER III

METHODOLOGY

3.1. Introduction

The study on Impact of Print MIS on the Digital Printing Enterprise in Nigeria presented in this chapter, the procedure carried out under the following sub-headings:

- i. Research Design
- ii. Area of the Study
- iii. Population
- iv. Sample and Sampling Technique
- v. Instrument for Data Collection
- vi. Validation
- vii. Reliability
- viii. Method for Data Administration and Collection
- ix Method for Data Analysis

3.2 . Research Design

The study adopted a descriptive survey research design. The survey research deals with information gathering, describing, summarizing and analyzing it for the purpose of clarification (Creswell, 2003). Ujo (2000) describes survey research as a methodology for collecting data and describing (the characteristics and features of facts about a given population) it in a systematic manner. Similarly, Osuola (2005) pointed out that survey research design deals both with large and small population by selecting and studying the chosen sample from the larger population to identify the relative incidence, distributions and inter-relations of certain associative variables. Therefore survey research design is the most appropriate for this study. It is flexible enough to provide opportunity for dealing with different aspects of a problem under study (Kothari,

2012). This research design is therefore adopted in this study to assess the impact of Print MIS on the digital printing enterprise in Nigeria.

3.3. Area of the Study

The areas covered for this study were Kaduna, Jos, Enugu, Port Harcourt, and Lagos cities as well as Abuja, the Federal Capital Territory (FCT) in Nigeria. These areas were chosen as the representatives of the six geopolitical zones of the country. The choice of these cities was informed by the high concentration of printing firms especially those licensed by Chartered Institute of Professional Printers of Nigeria, (CIPPON, 2001; Bugi, 2007; Akinyisanu, 2008). These areas have high printing activities and consequently high rate of employment of printing professionals (Olubunmi, 2008).

3.4 Population

The target population for this study was 1315 registered printing managers in the five selected cities and the Federal Capital Territory (FCT). The population comprised of 270 top level managers, 420 middle-level managers and 625 low-level managers as presented in Table 5.

Table 5

The Statistics of the Distribution of Printing Managers in Strata as Covered in the Study Area

States		Top level Manager	Middle Level manager	Low-level Manager
1	Abuja	26	45	80
2	Enugu	54	55	65
3	Kaduna	21	70	90
4	Lagos	120	180	270
5	Jos	19	25	70
6	Port Harcourt	30	45	50
Total		270	420	625
Grand Total				1315

Note. The table showing the different number of managers and grand total population as statistics obtained from CIPPON and NUPPPROW, registered printing professional bodies in Nigeria, 2011

Top level managers in the printing industry were holders of at least a degree with a minimum of 10 years work experience or Higher National Diploma (HND) with working experience of not less than 15 years. Middle-level managers are holders of HND or first degree with not less than five years of working experience while low-level managers are holders of National Diploma or Advance Certificate with not less than 10 years of working experience. The selection of these categories of managers was informed by the fact that any DPE manager whose qualification and experience is below this standard cannot provide required response to the questionnaire specifically designed for the management level. The selected

categories were considered knowledgeable enough to provide required response to the questionnaire for this study.

3.5. Sample and Sampling Technique

The study drew up a sample of 306 from the population of 1315. This number was considered appropriate for the study. It was obtained statistically using Taro Yamane's formula for a finite population (Uzoagulu, 1998).

$$\text{Thus: } n = \frac{N}{1 + N(e)^2}$$

Where n = the sample size

N = the finite population

e = Level of significance (0.05)

Proportionate Stratified Random Sampling Technique was adopted for the study due to characteristics of the level of managers which provided degree of heterogeneous features between each stratum but homogeneous within each stratum (Cooper & Schindler, 2003). The selection from each stratum is as shown in Table 6.

Table 6

The Selection of Managers from each Stratum

Level of Printing managers	No of managers	Proportionate Sample
Top level managers	270	63
Middle-level managers	420	98
Low-level Managers	625	145
Total	1315	306

Note. The number of managers chosen is based on each stratum and the proportionate number drawn from each stratum as a sample, by the Researcher, 2012

3.6 Instrument for Data Administration and Collection

The instrument adopted for data collection was a 60-item questionnaire structured on a 5- point scale of Strongly Agree, Agree, Undecided, Disagree, Strongly Disagree. The instrument has 4 sections; section (i) was used to draw responses on the strategies used for implementing Print MIS in the DPEs in Nigeria. Section (ii) sought responses on the effects of Print MIS utilization on workers with no computer skills in the digital printing enterprise in Nigeria. Section (iii) sought responses on the effects of Print MIS utilization on the print business operations for print production in the DPEs in Nigeria (iv) elicited responses on the effects of Print MIS implementation on DPEs in Nigeria. These sections of the instrument adequately covered the content for the study. In using the Likert Scale, the types of response alternatives (Likert items) were generated based on the nature of each research question that guided the study.

3.7. Validation of the Instrument

The instrument for this study was subjected to face and content validation. Accordingly, three experts were involved, one from the Department of Fine and Applied Arts, University of Nigeria Nsukka, another one from the Department of Art Education, University of Nigeria Nsukka, the last one from the Department of Printing Technology Kaduna Polytechnic. The purpose of this exercise was to ensure relevance and adequacy of the content and to make sure that all the items in the instrument were appropriately arranged and every item checked against ambiguity (Uzoagulu, 1998). The inputs of all the experts were found useful and were used for improving the quality of the instrument used for this study.

3.8 Reliability of the Instrument

The reliability of the instrument was determined by administering 15 copies of the questionnaire to randomly selected digital printing managers in Kaduna. Cronbach's alpha coefficient was adopted to measure the internal consistency of the items that made up the instrument. The internal consistency of each of the sections was as follows: Section I (7 items) $\alpha = 0.79$; Section II (27 items) $\alpha = 0.81$; Section III (16 items) $\alpha = 0.75$; and Section IV (10 items) $\alpha = 0.78$. The overall internal consistency for the instrument of 60 items was therefore 0.78

3.9 Method for Data Administration and Collection

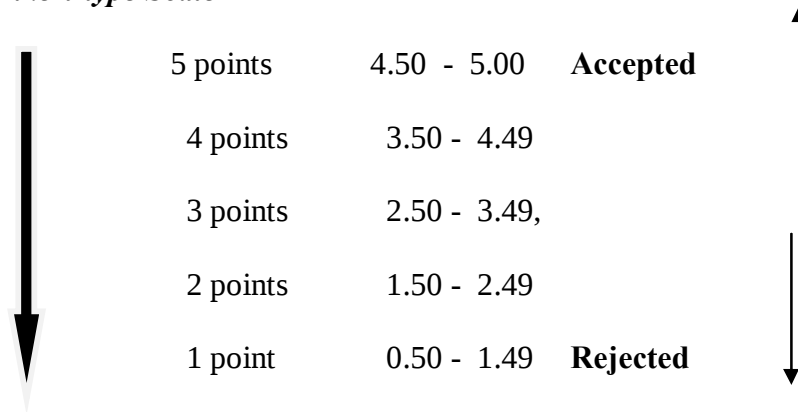
The administration of questionnaire was performed by the researcher and three other trained researcher assistants on questionnaire administration and collection. The trained research assistants were picked one each from Enugu, Port Harcourt and Lagos who were familiar with the environment hence they were able to visit the digital printing enterprises and administered the questionnaire. The researcher administered the questionnaire to the respondents in Abuja, Kaduna and Jos, since these were within his geographical zone and also very familiar with the terrain of these areas. The respondents were given five working days to enable them read and fill out the questionnaire which were then retrieved from the printing enterprises by the researcher and the research assistants.

3.10. Method for Data Analysis

The method for data analysis for this study was carried out using mean statistics and standard deviation for all the research questions. However, on the

Likert Scale, the decision rule point which serves as a guide to the researcher was based on the calculated mean score value of 3.00. This created a dichotomy of opinion on whether to accept or reject an issue. Consequently, any rated opinion whose mean score value is 3.00 and above was accepted while any rated mean score value of less than 3.00 was rejected as stated below:

Likert-type Scale



5 points	4.50 - 5.00	Accepted
4 points	3.50 - 4.49	
3 points	2.50 - 3.49,	
2 points	1.50 - 2.49	
1 point	0.50 - 1.49	Rejected

CHAPTER IV

4.1 PRESENTATION AND ANALYSIS OF RESULTS

4.2 Introduction

The study on Impact of Print MIS on Digital Printing Enterprise in Nigeria in this chapter was carried out by analyzing the data collected using, mean score and standard deviation. Data analyzed were presented here in table format. Each table contained information on responses to the research question that guided the study.

4.3 Research Question 1

What are the strategies used for the implementation of Print MIS in the Digital Printing Enterprise (DPE)?

Table 7

The Strategies for the Implementation of Print MIS in the DPE in Nigeria

	Rated Strategies for Implementing Print MIS	X	SD	Remarks
1	Human capital development should be an ongoing activity when Print MIS is implemented	4.1	1.2	Accepted
2	Ensure that all staff are aware, prepared and trained for the type of Print MIS to be implemented	4.1	1.1	„
3	Print MIS should be implemented in stages based on the organizations' work capacity	3.8	1.0	„
4	Ensure that print MIS is CIP 4 enabled for prepress, press and post press operation/machines	4.0	1.2	„
5	Restructuring conventional printing organization to conform to digital print environment	4.1	1.0	„
6	Implement appropriate Print MIS for the appropriate print business operations	4.2	1.0	„
7	Imbibe the organizations' culture/training prior to implementation of Print MIS	4.2	1.0	

Grand Mean (x) = 4.1, The mean score for the strategies for the implementation of Print MIS in the DPE in Nigeria

4.4. Research Question 2

What are the effects of Print MIS utilization on workers with no computer skills?

Table 8

Rating Result of Workers who Have no Computer Skills

	Computer skills for Digital Printing operations	X	SD	Remarks
8	General computer knowledge	4.3	1.0	High
9	Word processing skills/spreadsheet	4.1	1.0	„
10	Power Point Presentation Skills	4.1	1.2	„
11	Page Layout Programs	4.2	1.0	„
12	Digital Asset Management (DAM) Skills	3.7	1.1	„
Grand mean (x)=4.1Revealing the mean score of workers who have no basic computer skills for digital printing operations				

Table 9:

Rating Results of Prepress Operators with no Computer Skills

	Computer skills for Digital Printing operations	X	SD	Remarks
13	Computer appreciation	3.7	1.2	High
14	Word processing/spreadsheet skills	3.8	1.0	„
15	Power point presentation	3.7	1.1	„
16	Page layout programs	3.4	1.2	„
Grand mean (x) = 3.7 Mean rating score of prepress operators who have no computer skills for digital printing operations.				

Table 10:
Rating Results of Press Operators with no Computer Skills (Machine Operators)

	Computer skills for Digital Printing operations	X	SD	Remarks
17	Computer appreciation	3.8	1.2	High
18	Word processing/spreadsheet skills	3.8	1.2	„
19	Page layout programs	3.9	1.2	„
20	Powerpoint presentation	3.9	1.2	„
Grand mean (x) 3.8 The mean rating score of press operators with no computer skills for digital printing operations				

Table 11:
Rating Result of Print Finishing Operators with no Computer Skills

	Computer skills for Digital Printing operations	X	SD	Remarks
21	Computer appreciation	3.7	1.2	High
22	Word processing/spreadsheet skills	3.7	1.1	„
23	Powerpoint presentation	3.9	1.2	„
24	Page layout programs	4.1	1.0	„
Grand mean (X) 3.9 Mean rating score of print finishing operators who have no computer skills for digital printing operations				

Table 12:
Rating Result of Print Production Managers with no Computer skills

	Computer skills for Digital Printing operations	X	SD	Remarks
25	Computer appreciation	4.1	1.0	High
26	Word Processing/spreadsheet skills	4.0	1.1	„
27	Powerpoint presentation	4.0	1.2	„
28	Page layout programs	4.1	1.1	„
29	Digital asset management (DAM) skills	4.3	0.7	„
Grand mean (x) 4.1 Mean rating score for print production managers with no computer skills for digital printing operations				

Table 13:
Rating Result of Print Chief Executive who have no Computer Skills

	Computer skills for Digital Printing operations	X	SD	Decision
30	Computer appreciation	4.2	0.9	High
31	Word Processing/spreadsheet skills	4.3	0.9	„
32	Powerpoint presentation	4.1	1.0	„
33	Page layout programs	4.2	1.0	„
34	Digital asset management (DAM) skills	4.2	1.0	„
Grand mean (x) 4.2 Mean rating score of print chief executives with no computer Skills for digital printing operations				

Research Question 3

What are the effects of Print MIS utilization on the print business operations for the production of print media Enterprise (DPE) in Nigeria?

Table 14

Effects of Print MIS Utilization on the Print Business Operations in the Print Planning Section

S/No	Rated Items on Utilization of Print MIS	X	SD	Remark
35	Job Estimation/Quotation	2.9	1.7	Not Accepted
36	Job Production Planning /Scheduling	2.9	1.7	„
37	Paper stock controlling (inventory Management)	2.7	1.6	„
38	Shop floor Data Collection	2.4	1.5	„
39	Order Entry /Production Monitoring	2.7	1.6	„
40	Sales and Financial Management/Standard report	2.6	1.5	„

Grand mean ($\bar{x}$) = 2.7 demonstrated that the effect of utilizing Print MIS is low and therefore not acceptable

Table 15

Factors that Created Lack of Utilization of Print MIS in the Digital Enterprise

	Rated factors creating lack of Utilization of Print MIS	X	SD	Remarks
41	Lack of organizing workshops/Seminars	3.9	1.0	Accepted
42	Lack of basic knowledge to search for relevant information	3.7	1.1	„
43	Lack of ICT skills to utilize internet services	3.7	1.3	„
44	The industry's professional bodies are not performing their basic functions of educating and training members	3.7	1.0	„
45	Printed media containing information on Print MIS are not readily available	3.7	1.3	„

Grand mean ($\bar{x}$) 3.7 show that all the factors are responsible for creating lack of utilization of Print MIS for Print media production

Table 16

Print MIS Utilization for Print Business Operations in the Press Section

	Rated items on utilization of Print MIS for Print Business Operations in Nigeria	X	SD	Remarks
46	Job Estimating/Generating quotations	2.3	1.6	Not Accepted
47	Job production Planning/scheduling	2.3	1.6	„
48	Order entry	2.0	1.4	„
49	Shop floor Data Collection	1.9	1.2	„
50	Invoicing/job costing	2.0	1.6	„

Grand mean ($\bar{x}$) 2.1 Grand mean revealed that Print MIS utilization is below acceptable level of mean score of 3.0

4.6 Research Question 4

What are the effects of Print MIS implementation on the Digital Printing Enterprise in Nigeria?

Table 17:

Effects of Print MIS Implementation on the DPE

	Rated Items on Impacts of Implementation of Print MIS on Workers	X	SD	Remarks
51	Print MIS drives print business growth	4.4	1.2	Acceptable
52	Print MIS improves accuracy in the delivery of data/information in the workplace	4.0	1.1	Acceptable
53	Makes possible the timely and easy access to information in the workplace	3.9	1.1	Acceptable
54	Print MIS improves the accuracy of exchange sharing of information between customer and the printing enterprises	4.2	1.1	Acceptable
55	Print MIS increases productivity and efficiency	3.9	1.1	Acceptable
56	Print MIS has changed analog Print operations to digital print operations	4.2	1.1	Acceptable
57	Print MIS has controlled both the administration and production of print business operations	4.3	1.0	Acceptable
58	Print MIS has computerized all the prepress operation and work stations integrated into single production workflow	4.1	1.0	Acceptable
59	Print MIS integration of work station has led to reducing and downsizing in the workforce	4.3	1.0	Acceptable
60	Print MIS has made workers without digital skills lost their jobs	4.0	1.2	Acceptable

Grand Mean ($\bar{x}$) = 4.10 showing the impact of Print MIS on the DPE

4.7 Findings

The findings of this study were presented here based on the research questions that guided the study.

- A1.** Print managers accepted the strategy that the HCD should be an ongoing activity when Print MIS is implemented
- 2. Print managers accepted the strategy that the management should ensure that all staff are aware, prepared and trained for the type of Print MIS to be implemented
- 3. Print Managers agreed that Print MIS should be implemented in stages based on the organizations work capacity
- 4. Print Managers were of the opinion that management should ensure that Print MIS is CIP4 enabled for prepress, press and post press operations
- 5. Print Managers accepted the strategy that the management should re-structure the conventional print organizations to conform to digital print environment which is the key to successful implementation of Print MIS
- 6. Print Managers agreed with the strategy that management should implement the appropriate Print MIS in the organization for the appropriate print business operations
- 7. Print Managers agreed with the strategy that management should ensure that appropriate organizations culture/training is done prior to implementation of Print MIS.
- B1.** Print Managers agreed that the workers did not have the following computer skills for effective digital printing operations:
 - i. General computer appreciation

- ii. Word Processing/Spread Sheet
 - iii. Powerpoint Presentation
 - iv. Page Layout programs
 - v. Digital Asset Management (DAM)
2. Print Managers agreed that prepress operators did not have the following computer skills for digital printing operations:
- i. General computer appreciation
 - ii. Word Processing/spread sheet
 - iii. Powerpoint Presentation
 - iv. Page Layout programs
 - v. Digital asset management (DAM)
3. Print Managers agreed that press operators (Machine Operators) did not have the following computer skills:
- i. General computer appreciation
 - ii. Word Processing/spread sheet
 - iii. Powerpoint Presentation
 - iv. Page Layout programs
 - v. Digital asset management (DAM)
4. Print Managers agreed that the print finishing operators did not have the following computer skills for digital print finishing operations:
- i. General computer appreciation
 - ii. Word Processing/spread sheet
 - iii. Powerpoint Presentation

- iv. Page Layout programs
 - v. Digital asset management (DAM)
5. Print Managers agreed that print production managers did not have the following computer skills for digital printing operations:
- i. General computer appreciation
 - ii. Word Processing/spread sheet
 - iii. Powerpoint Presentation
 - iv. Page Layout programs
 - v. Digital asset management (DAM)
6. Print Managers agreed that Print Chief Executive did not have the following computer skills for the digital printing operations:
- i. General computer appreciation
 - ii. Word Processing/spread sheet
 - iii. Powerpoint Presentation
 - iv. Page Layout programs
 - v. Digital asset management (DAM)
- C.1.** Print Managers rated the effects of Print MIS utilization on job estimating/quoting below the acceptable mean score rating level of 3.0
2. Print Managers rated the effects Print MIS utilization on job production planning/scheduling below the acceptable mean score rating value of 3.0
3. Print Managers rated the effects of Print MIS utilization on paper stock control in the below the acceptable mean score rating value of 3.0

4. Print Managers rated the effects of Print MIS utilization on shop floor data collection below the acceptable mean score value of 3.0
5. Print Managers rated the effects of Print MIS utilization on order entry/production monitoring below the acceptable mean score rating value of 3.0
6. Print Managers rated the effects of Print MIS utilization on sales and financial management/standardized report below the acceptable mean score rating value of 3.0
7. Print Managers generally indicated high level of agreement that the effects of Print MIS utilization in the print business operations in the DPE all fell below the expected level of acceptance of mean score value of 3.0
8. Print Managers agreed that lack of organizing workshops/seminars is a factor creating lack of utilizing Print MIS in the DPE
9. Print Managers agreed that lack of basic knowledge to search for relevant information is a factor creating lack of utilizing Print MIS in the DPE
10. Print Managers agreed that lack of ICT skills to utilize internet services is a factor creating lack of utilizing Print MIS in the DPE
11. Print Managers were of the opinion that the industry's professional bodies were not performing the basic functions of educating and training members which is responsible for lack of utilizing Print MIS in the DPE
12. Print Managers were of the opinion that non availability of printed media containing information on Print MIS is responsible for creating lack of utilizing Print MIS in the DPE.

- D.13.** Print Managers agreed that majority of DPEs in Nigeria did not utilize Print MIS for job estimating/generating quotation for print operations.
14. Print managers agreed that majority of DPEs in Nigeria did not utilize Print MIS for job production planning/scheduling for print operations.
15. Print Managers agreed that majority of DPEs in Nigeria did not utilize Print MIS for Job order entry for print operations
16. Print Manager agreed that majority of DPEs in Nigeria did not utilize Print MIS for Shop floor data collection for print operations
17. Print Mangers agreed that majority of DPEs in Nigeria did not utilize Print MIS for invoicing/job costing for print operations.
- E1.** Print Managers agreed that Print MIS helped in improving the accuracy of data/information delivery in the workplace that led to reduction of problems for workers in the information processing and disseminating in print media production
2. Print Managers agreed that Print MIS drives print growth that can impact positively on the DPE
3. Print Managers agreed that Print MIS makes possible the timely and easy access to information in the workplace
4. Print Managers were of the opinion that Print MIS improves the accuracy of exchange /sharing of information between customers and the print organizations
5. Print Managers agreed that Print MIS utilization increases print productivity and efficiency in print management

6. Print Managers agreed that Print MIS utilization changed analog print operations to digital print operations
7. Print Managers agreed that Print MIS utilization had controlled both administrative and production aspects of print business operations
8. Print Managers accepted that Print MIS enhances the computerization of all the prepress operations and workstations and had integrated them into single production workflow
9. Print Managers agreed that Print MIS integration of workstations have led to redundancy and causing downsizing in the workforce
10. Print Manager agreed that Print MIS had made some workers with no digital knowledge and skills lost their jobs.

4.8 Discussion of the Findings for this Study

Discussion of the findings for this study was organized based on the research questions that guided this study as follows:

4.8.1 Research Question 1

What are the strategies used for the implementation of Print MIS in the Digital Printing Enterprise (DPE) in Nigeria?

4.8.1.2 Findings

Seven (7) strategies were identified for the implementation of Print MIS in the digital printing enterprise in Nigeria, these strategies are:

- i. Human capital development (HCD) should be an ongoing activity when Print MIS is implemented

- ii. Ensure that all staff of the organization are aware, prepared and trained for the purpose of change
- iii. Print MIS should be implemented in stages based on the organization's work capacity.
- iv. Ensure that Print MIS is CIP4 enabled for prepress, press and postpress operations/machines
- v. Re-structure the conventional printing organization to conform to digital print environment, is key to successful implementation of Print MIS.
- vi. Implement the appropriate Print MIS in the organization for the appropriate Print business operations.
- vii. Ensure that the appropriate culture/training is done prior to implementation of the Print MIS in the organization

4.8.1.3. Discussion

These findings revealed the collective ideas, goals, and experiences that provided general guidance for successful implementation of Print MIS in any digital print organization. The purpose of this guidance is to ensure the efficiency in print management and productivity in print organization's workplace.

These guidelines are the strategic plans set towards achieving effective print production as end result. They are simply the strategies required for implementing Print MIS. They can equally be seen as the procedures or ways in which Print enterprise employ for a change from the conventional print organization to a digital print organization.

Implementing a system is a change and change is constant, that organizations have to always prepared for it and to also work for it. Literature revealed that there is no single right way to developing strategies for the implementation of a system in an organization. Therefore organizations, whether they are implementing a system for the first time or replacing a component/machine with another, some basic guidelines or plans for implementation should be adopted as stated here in this study.

Strategies as discussed in this study means ideas, thoughts, insights, experiences, goals, expertise, memories, perceptions and expectations that provided general guidance for specifications in pursuit of particular ends (Nickols, 2012). It is in pursuit of print productivity, print quality and production efficiency that these strategies have been identified. These strategies were highly rated by managers of digital print enterprise in Nigeria (see table 17). The high rating of the strategies was consistent with the work of Wheelen and Hunger (2008) which the authors pointed out that:

selecting the best strategies depend on the most important criterion in which the proposed strategies have the capability to deal with the specific factors developed to take advantage of environmental opportunities and corporate strengths/competencies, and lead away from environmental threats and corporate weakness (p. 201).

Another important factor for the high mean ($\bar{x}$) score ratings by the digital print enterprise managers for this question is the ability of each alternative (Strategy) to satisfy agreed-on objectives with the least resources and fewest negative side effects

on the industry. Such level of acceptability demonstrated that the collective strategies form a comprehensive master plan that states how the print enterprise will achieve its mission and objectives. For instance, considering the strategy on HCD, which states that HCD should be an ongoing activity when Print MIS is implemented. This is consistent with the work of Bray, Painter and Rosin (2011) that was conducted on *Developing Human Capital: Meeting the Growing Global Need for a Skilled and Educated Workforce*, where the authors stated that advances in technology and management processes occur so often and quickly that continuous learning is an immutable fact of life for employees who want to stay marketable in a high-tech and rapid changing global job market ñ and this is true for everyone, from the factory floor to top management.

The print media industry is changing fast and therefore require employees who are knowledgeable, skillful and very competent in their jobs. The employees therefore need to be updating their knowledge and skills continuously to remain relevant in the industry. Discussing on HCD, Politis (2004), pointed out that, education, training and various forms of learning have been the most prominent activities for professional development ñ and form strategies for human capital development. Consequently when Print MIS has been implemented to form the core information gathering and dissemination tool, it becomes the responsibility of the management to ensure that the employees remain competent and relevant by continuous training to update their knowledge in all relevant areas.

HCD is necessary because it remains the most important function in organization which according to Marimuthu, Arokiosamy and Ismail (2009), it improves the

quality (productivity) of the worker. In addition to this, was the finding that prior to Print MIS implementation, all staff should be aware and trained for the purpose of the change in the organization. This finding is consistent with the writing of McWilliam (2007) titled *MIS - a guide for managers*, where the author pointed out that the change manager should monitor employee morale to ensure that they are properly trained and even to act as cheer leader to motivate themselves. Also the study conducted on Strategic Approach for Successful Implementation of MIS for Manufacturing Industry by Kuppilli and Aryasri (2012), agreed that some of the most important things to consider while implementing MIS include computerized infrastructure, technically trained staff, accurate data collection and a database management system. This study conducted by Kuppilli et al tally with these findings:

- i. Re-structure the conventional printing organization to conform to digital print environment
- ii. Ensure that Print MIS is CIP4 enabled for prepress, press and post-press operators/machines for successful implementation. Consequently, the authors stressed that, management in addressing the issues of successful implementation of Print MIS, existing organization structure should be modified to align relevant functions as well as modifying the existing documentation to suit MIS requirements ñ dictating and monitoring the execution of all of the diverse aspects of production and administrative workflow. For example, figure 16 showed the Print MIS for quoting functions as part of the production workflow.

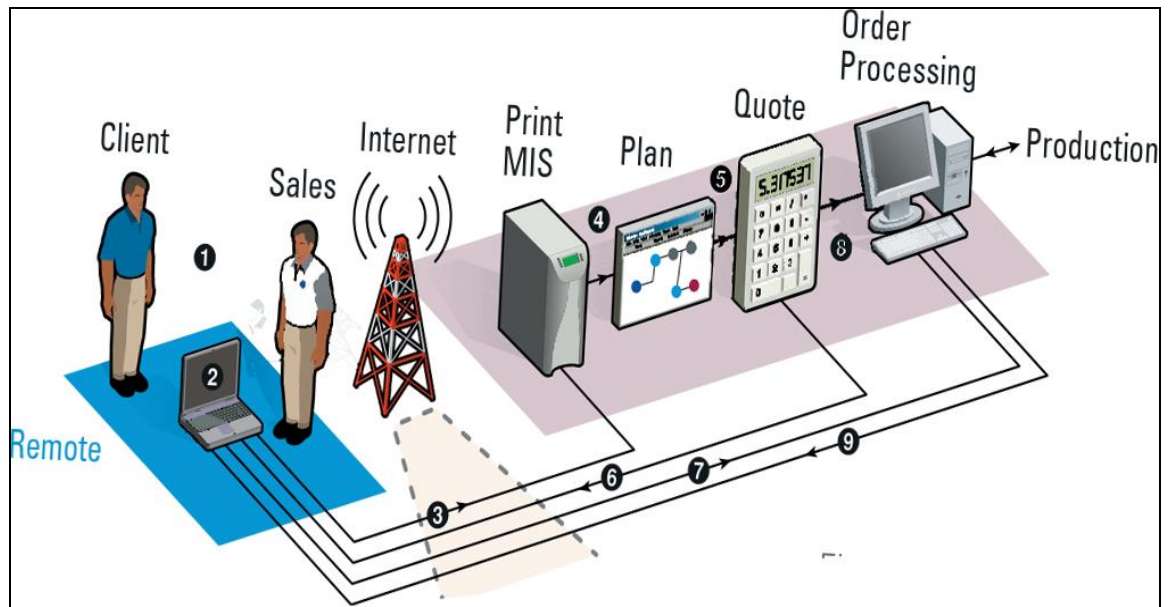


Figure 21. Advanced quoting function with Efi PrinterSite Internal of an Print MIS in a printing firm. Adapted from "ABC's of print mis, profit focused print management by Efi, 2005. Copyright Efi Essential to print, by ABC's of Print MIS, Velocity Way, Foster City CA

Note:

1. Customer communicates spaces to sale
2. Sales inputs specs into printer customer site
3. Specs transmitted by MIS
4. Specs mapped to estimating system
5. Estimator reviews and dispatches quote
6. Sales present Quote
7. Job accepted
8. Estimating plan used as a function of a job plan
9. Real-Time status available through Print site

4.8.2. Research Question 2

What are the effects of Print MIS utilization on workers with no computer skills in the digital printing enterprise in Nigeria?

4.8.2.1 Findings

Based on the study conducted, managers who were found not to have possessed computer skills needed for digital printing operations in the DPE with a grand mean ($\bar{x}$) score rating of 4.0 on the Likert Scale

4.8.2.2 Discussion

This finding revealed that management and the operational tasks of day-to-day running of digital printing enterprise required workers who generally should have basic digital skills and professional broad based skill sets and not craft-based skill sets. Such general digital skills sets include general computer knowledge, digital asset management (DAM), word-processing and page layout programs (Tables, 8-13).

These tables showed that there is no significant difference in the opinion of the managing directors, general managers and the floor managers on the skills needs of workers in the digital printing enterprise. Also, the low value of standard deviation (SD) simply indicates that the majority of the scores are clustered around the means ($\bar{x}$) indicating the homogeneity in agreement in opinions of the managers in rating skills needs of workers in the digital printing enterprise. It is therefore a common opinion among the managers that workers in the digital printing enterprise must possess these computer skill sets and the professional broad-based skills to be able to work and manage any digital printing enterprise.

This finding derived support from the work of European Network Education Councils (EUNEC) of 2011 on New Skills for New Jobs: Challenges for Vocational Education and Training in the 21st Century. The report submitted that you can't do today's

job (digital print production) with yesterday's methods and expect success in business tomorrow (EUNEC, 2011). Basically, the adoption of new digital printing technologies is radically changing the print industry's workforce skills. The industry as at today need fewer workers who must be digitally competent and skillful because many of the printing processes are now handled via the new technologies that are networked. Going by this revelation, workers in the new print workshops are expected to have high level of digital skills and knowledge in the professional broad based management tasks to be able to work in the increasingly integrated technology rich print environment.

The finding also agreed with the study on Impact of Technology on Work and Jobs in the Printing Industry: Implication for Vocational Curriculum where Lewis (1997) reported that, the printing industry is among many industries that have been forced to deal with the impact of technological changes such as emergence of digital skills and methods of print production. In this study, analog skills, repetitive jobs and physically strenuous jobs, including routine works have disappeared and a total upgrading of qualifications or skills in the appropriate technologies such as desktop publishing systems, colour electronic prepress systems and many other digital technologies in the print media industry are required. This outcome makes the new skills sets for the digital printing enterprise a must acquire skills by print workers.

Supporting this discussion is the submission made by Lewis (2008) testifying that, 'skill' had now taken on a new meaning on the shop floor or print workshop as it is characterized by the rationality of digitization that brings with it. That much of what was

formerly considered to be a skill now seemed to reside in computer and software. This submission also tallied with the writing of Xerox (2011) on the Evolving Printing Industry and its Impact on Career and Technical Education. The study pointed out that, printing industry is undergoing dramatic changes with the advent of software design tools and high speed digital printing such as digital printing, direct imaging, and Print MIS are transforming the workforce skills required to support the evolving printing industry.

The change in skills need in the industry posed a greater challenge to many printing firms in Nigeria most especially those that are drag-footing in adopting new technologies. According to Afolabi (2014), to survive the new print media environment, print companies should toe the path of evolution continuously. Failure to do this can be disastrous because this finding revealed that print organizations need to be sensitive to current changes so that they can operate more efficiently and to manage the management of change taking place in the industry. But quite unfortunately, what is been seen mostly is quite obsolete because of the inability of the print organizations to embrace the technological change in printing in Nigeria. According to Obokhai (2013), many printing organizations in Nigeria have gone into extinction because of their inability to improve their services due to lack of relevant technologies and update in skills and knowledge for print production. Obokhai went on to point out that seminars/workshops help to update one's knowledge which today's printing industry needs. It is an obvious fact that seminar and workshop are necessary components of human capacity development because they help in the acquisition of new skills and new approaches to handling task thereby providing quality work and services.

Therefore, in order to help print workers achieve these fundamental tasks in the industry, it requires consistent and vigorous staff training and development in the appropriate development centers and institutions of learning. As rightly puts by Obokhai (2013), "these programmes deepen ones understanding on the job and print business priorities" (P. 3). It is imperative for print industry practitioners to embrace basic human capital development at various levels for sustainability and productivity of print media in Nigeria.

4.8.3. Research Question 3

What are the effects of Print MIS utilization on the print business operations for the production of print media in the digital printing enterprise (DPE)?

4.8.3.1 Findings

Print MIS utilization has minimal effects on the six major print operations for print media production. The rating of Print MIS utilization fell below the cut-off point of mean score rated value of 3.0 on the Likert Scale.

4.8.3.2. Discussion

The finding revealed that the level of utilizing Print MIS for all the six major print operations in the industry fell below the rated cut-off point of mean score of 3.0 on the Likert Scale. That is, the level of utilizing Print MIS in the digital printing enterprise in Nigeria is below acceptable level for any economic value of consideration for industry's profitable practice. Also the high value of standard deviation (SD) of 1.7 indicated high variability of the scores above and below the

mean (x) score. What this mean is that the managers' agreement on the low level of utilization (x=2.7) is loose. That is, managers in the digital printing enterprise had no homogeneous opinion on the large scale practice of utilization of Print MIS in Nigerian printing industry. Print MIS for job estimation/quotation, job production planning, scheduling, paper stock controlling, shop floor data collection, order entry and production monitoring are still using paper based-information systems.

This finding agreed with the study conducted on Guide to Effective MIS use for Printers which pointed out that, widespread opinion is that printing companies generally do not use their MIS system as maximally as required and hence are missing out on much of the benefits potentially available from their MIS investment (Vision in Print, 2006, p.1)

Consequently, the effectiveness of Print MIS to help employees perform business functions quickly and consistently is lacking. According to Neubauer (2001), 'Job boards and spread sheets don't cut it these days. Only by using a Print MIS can you effectively managed your in-plant'. This lack of utilizing Print MIS is responsible for the low productivity in the print industry in Nigeria. This has resulted into massive importation of printed products into the country while huge volumes of print jobs are being taken abroad for production (Ojalumo, 2013). According to Orija (2008), the imported volume of printed products was 700,540 tons worth \$5.7 million in 2002 and \$8.5 million in 2006. This is indicative of the fact that the industry in Nigeria is not meeting the print needs of the citizenry. Adesanoye and Ojeniyi (2005) in their writing asserted that in 1995 alone, books needed by the primary schools in Nigeria was about 96 million while secondary schools required

about 165 million. And as at today, the figure might have likely double. And again adding this requirement did not include books needed by the tertiary institutions, given the fact that we have now 123 universities comprising of private, state and the federal. We also have 78 Polytechnics according to NBTE and about 36 Colleges of Education. This is only one sector!. What about others? This explained why print needs of the country is grossly inadequate because the present print technologies in the industry need to be upgraded. However, the industry seems mostly likely not to be so keen in embracing these new technologies for higher productivity. This means that printers in Nigeria are either unaware of the Print MIS solutions and/or do not understand the return on investment (ROI) delivered by the new technologies such as the Print MIS solutions in question.

On factors creating lack of utilization of Print MIS in Nigeria, the finding revealed that of all the (5) factors identified, none was rated below 3.0 mean (x) score value. That is, the factors identified were all rated as responsible for creating lack of utilization of Print MIS in the digital Printing enterprise in Nigeria. For instance, lack of organizing workshops/seminars ($x=3.9$); lack of basic knowledge to search for relevant information ($x=3.7$); lack of ICT skills to utilize internet services ($x= 3.7$); the industry's professional bodies are not performing their basic functions of educating and training members ($x=3.7$).

These findings were contrary to the writing of Orija (2008) who stated that, training, training, training is the mantra often repeated by press manufacturers and printers alike. It summed up to the failure of print organizations in Nigeria to embark on some basic human

capital development programme to upgrade staff knowledge and skills for print production. This may be attributed to several factors, some of which were inherent in the industry in Nigeria such as very weak regulating professional body like (CIPPON), low level of education by the practicing printers; high level of incompetency among the practitioners in the industry, lack of proper exchange of technological knowñhow among the local printers and unwillingness of the practitioners to adjust to digital print production because of cost and other factors. These factors coupled with other economic and government policies that are not favourable to the industry are largely responsible for the country's inadequate print productivity nightmare. The Nigerian Print Industry need to change because the industry has evolved into digital technology and consequently, production workflow has been automated with the help of production tools such as JDF, JMF, JPTF and communication tools such as Print MIS. According to Milkovic et al. (2007), digitization has become key to successful print business practicing in every organization. Therefore for digitization to be successful in Nigeria, it requires that the printing industry has to embrace technological changes such as the JDF, JMF and Print MIS and to come out with ways on how to invest on new equipment and on human capital development which are basic to today's print industrial growth and development. The study conducted on human capital development and competence structure on changing media production environments, Politis (2004) in Ades (2001) pointed out that, ópractitioners need to develop new skills that require continuous updating and should possess competence, in areas such as digital workflow, cross media publishing and digital printing (p. 8)ô.

Another factor that is eminent in the cause of creating backwardness in Nigerian printing industry is the seemingly separation between the industry and education professionals. There is a disconnect between the print business people who create jobs and the print educationists who provide students and other practitioners with knowledge and skills needed to be successful as employees in the printing industry (Bay, et al, 2011). Until when the practitioners in the sector are well trained and knowledgeable, Nigeria printing industry will continue to lag.

This finding is not surprising as Abiodun (2008) stated that, "the successful employee must re-style or retool his/her skills in an ever-changing environment". Nigeria should borrow a lead from countries like Canada which developed what is called "Charting our Course: the skills and technology roadmap for the printing and graphic communications industry (CPISC, 2008)" and India which according to Harikrishman (2008), attributed the rapid development of the print industry to a rising level of education in the country. This is a striking factor in Nigeria because the high rate of schools enrollment from nursery to tertiary level is alarming given the population of learners in schools in Nigeria. The stakeholders in the industry need to exploit this area by investing in the industry for more productivity since there is a large market for the print products due to the growing population in the education sector and in other social and religious activities in Nigeria.

4.8.4 Research Question 4

What are the effects of Print MIS implementations on the Digital Printing Enterprise in Nigeria?

4.8.4.1. Findings

The findings on the effects of implementation of Print MIS on the digital printing enterprise were:

1. Workers agreed that Print MIS helps to increase print business growth where it has been implemented
2. Improvement on accuracy in the delivery of data/information
3. It brought about easy access to information in the workshop
4. Print MIS users agreed that it increases productivity and print quality
5. Print MIS implementation brought about digitization of prepress activities
6. Print MIS allows workers/clients to extract information about the progress of the job on ground regardless of distance of place of production which had previously not been possible
7. Reduces several layers of reporting relationships between workers and managers ñ i.e. eliminates layers of unnecessary middle level management and improves customer services and efficiency.
8. The traditional print organization's structure having divisions and production units each with its own hierarchy has been replaced by cross-functional teams.
9. Print MIS has rendered obsolete the analog printing skills especially in the prepress ñ i.e. the new technology has led to deskilling of the conventional print workers
10. Print MIS has brought about loss of jobs in the industry especially for workers who had no computer skills as well as reduction in number of workers in the workplace compared to when it was an analogue organization .

4.8.4.2 Discussion

These findings revealed that DPEs that have implemented the Print MIS, had some impacts. For instance, the mean (x) score rating of opinions of the print managers on print business growth was 4.4; improvement on accuracy in the delivery of data/information was 4.0; increase in productivity, efficiency and print quality was 3.9 and change of analogue to digital print operations was 4.2. These statistical mean opinion ratings showed a gradual growth in the industry for only the users of Print MIS in Nigeria

These findings agreed with the writing of Orija (2008) who submitted that, the total printing volume in 2005 was 1,520,000 tons while in 2006, it was 1,700,102 tons, thus the total printing volume had a slight increase. In agreement with this, Ogunlolu (2002) pointed out that, there had been a gradual replacement of old printing machines with new ones which ultimately had imparted positively on graphic communications industry but on a small scale. Prominent among these technologies are direct imaging (D1) and computer-to-plate. This has brought about slight improvement in the integration of information systems within and outside the print organization, streamlined organizational structure leading to improvement in communication and work production efficiency in the work place. However, this slight improvement does not measure up with the global print development especially in countries like UK, Sweden, Germany, China and New York. For instance in 2008, China installed a total of 1431 digital printing machines and had an annual output of 636.913 billion Yuan (N17,196.651 Billion Naira) on print products while in USA, printing industry is the second largest manufacturing industry with a population of over 1million

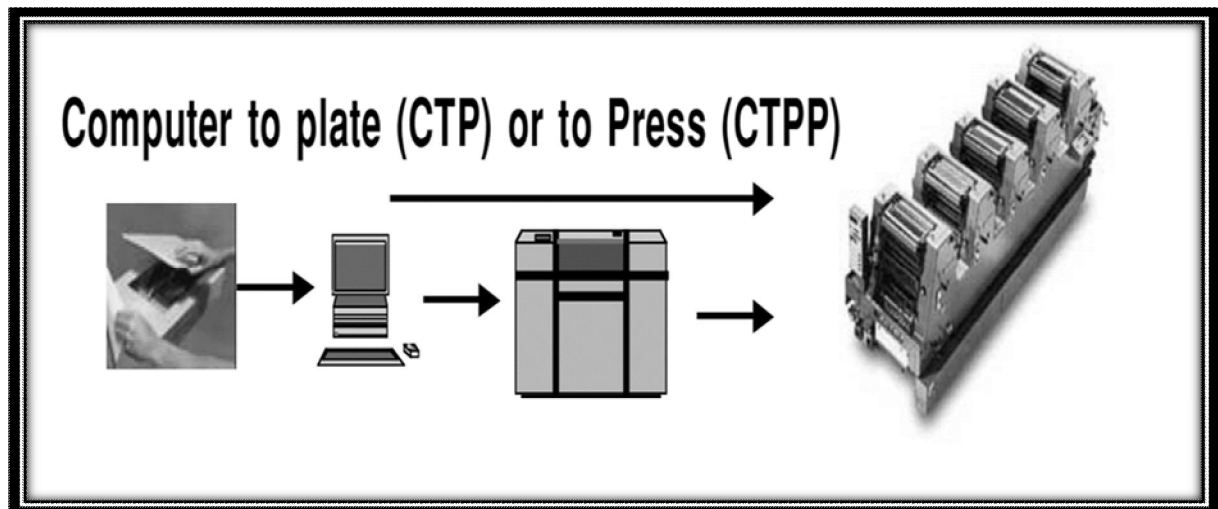


Figure 23. Showing Computer-to-press workflow adapted from "Building practical workflows" by H. Fenton, 2005, Copyright 2005, by NAPL/HowieAtPre@aol.com

With the CTP System, (Figure 23) the workstations such as film exposure, and platemaking have been cut off and therefore data from the computer is sent direct to press or to plate mounted on the press

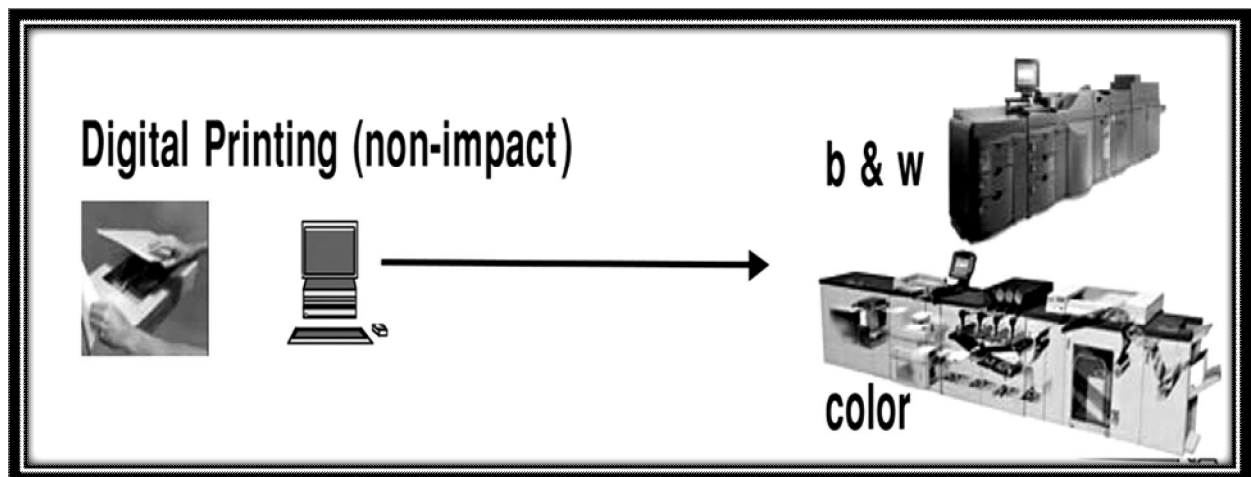


Figure 24. Showing digital printing workflow for both black & white and colour, adapted from "Building practical workflows" by H. Fenton, 2005, Copyright 2005, by NAPL/HowieAtPre@aol.com

Figure 24 showed an example of non-impact printing which does not make use of image carrier but information from the computer is sent direct to the substrate to print. These technologies coupled with the Print MIS implementation led to integration of work

processes, it rendered most prepress workers idle thereby removing them from their duty posts in the prepress especially those without the digital skills. According to Jimoh (2010), there have been rampant cases of down-sizing of analogue skill personnel from the industry. This made Abo (1999) in his writing to recommend that, personnel in the print industry need to update skills to meet up with the changing trend in the industry. Effect implementation of Print MIS on skills was significant that it led to deskilling and eventually loss of jobs of some workers, while to some, loss of satisfaction at workplace as the workers became less responsible for the creation of the finished print products. That is, most of the routine print job processes today have been digitized and automated (Figure 24).

The Print MIS system also affected the close contact relationship used to be enjoyed between workers in their workshops. This technology does not necessarily bring workers into physical contact to share or to exchange information as in the traditional print workshops (Parnell, 20006). Figure 25 showed a typical example of digital printing workshop where each workstation is managed by an individual.

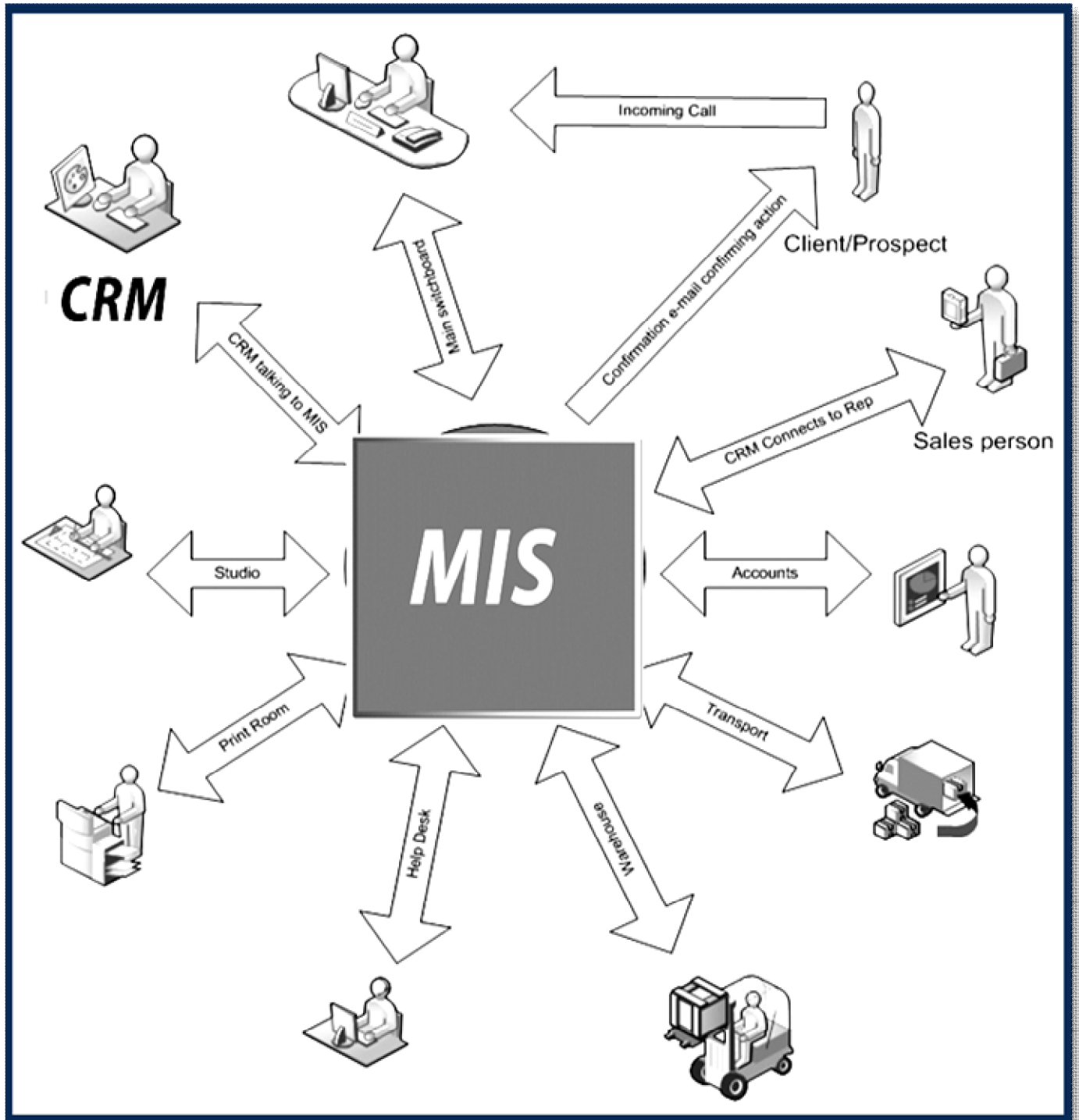


Figure 25: Showing all the Departments Within an Organization Log their Activities through One Common Data Base ñ the MIS with Individual Workers in their Workplaces , Adopted from óThe importance of crm in the current business climate by DDS Accura, nd. Copyright Accura/USA www.accuramis.com

This lack of physical contact in the workplace as a result of implementation of Print MIS restricted workers' social relationships/contacts in the workshops. This resulted to some unfortunate psychological effects such as depression and loneliness. According to Telford (2002), use of computerized Print MIS can also create stress, backaches and muscle tension in the wrists and fingers due to repetitive strain while on computer system (Figure 26). Figures 26 and 27 showed the different types of effects usually accompanied with long time operating the computer system without a proper ergonomic systems while figure 28 showed good posture of working on computer system.

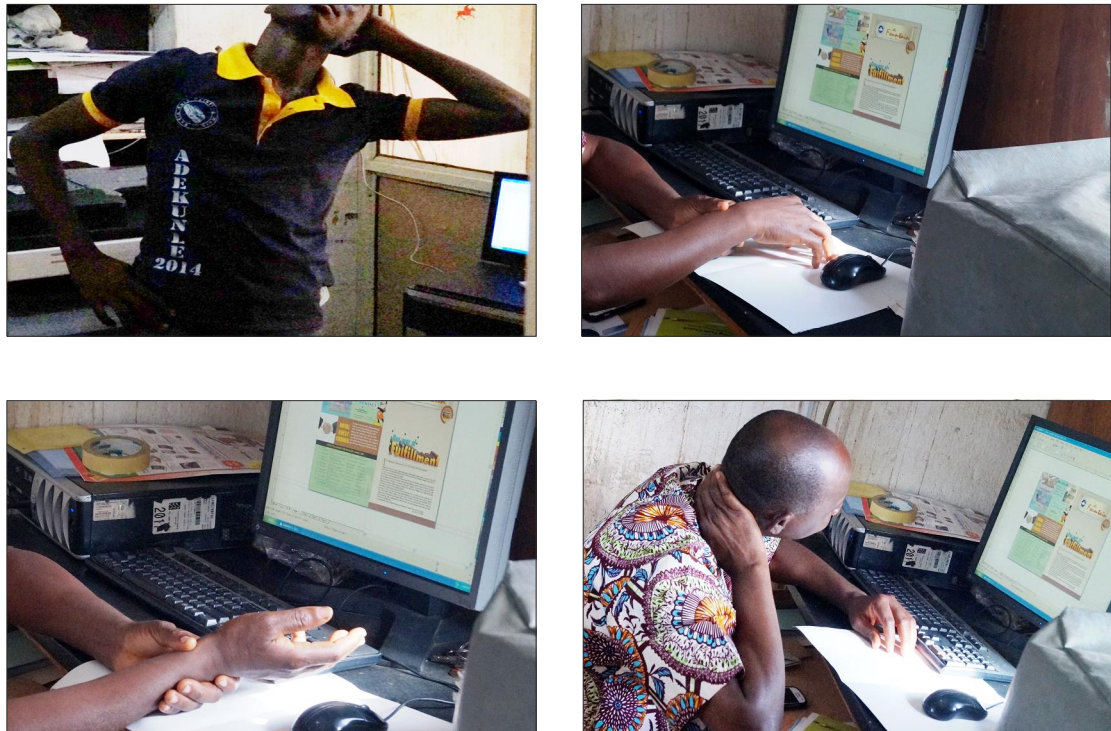


Figure 26. Showing the Effects of Long Time Sitting and Operating a Computer with Poor Ergonomics Facilities. Photographed by the Researcher, 2015

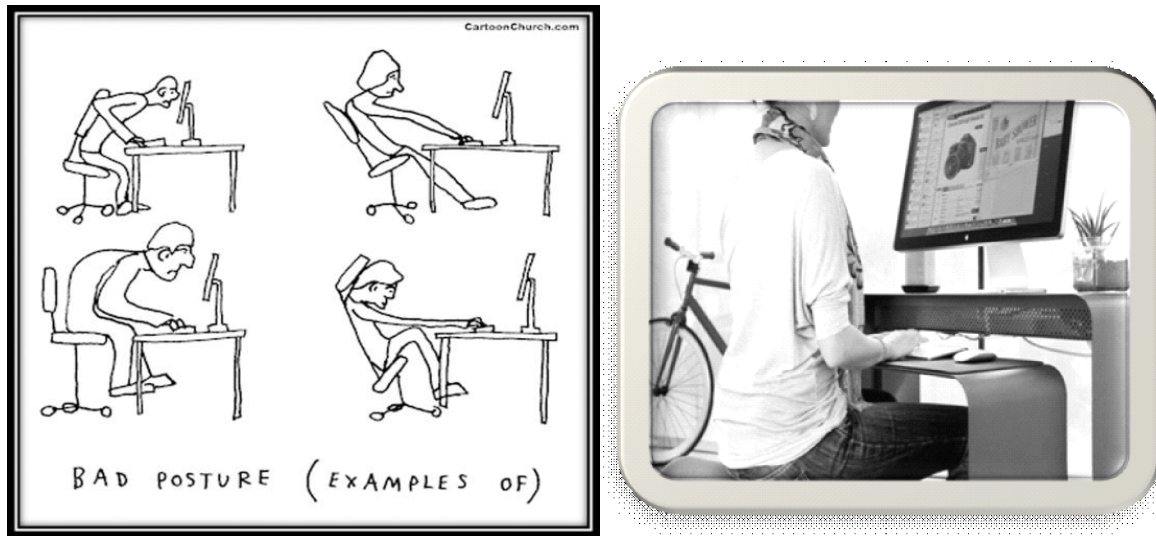


Figure 27. Showing Bad Posture When Working on a Computer System Adapted From UCLA Ergonomics on Good Working Positions by Ergonomics Stock Photos, Illustrations, and Vector Art www.shutterstock.com

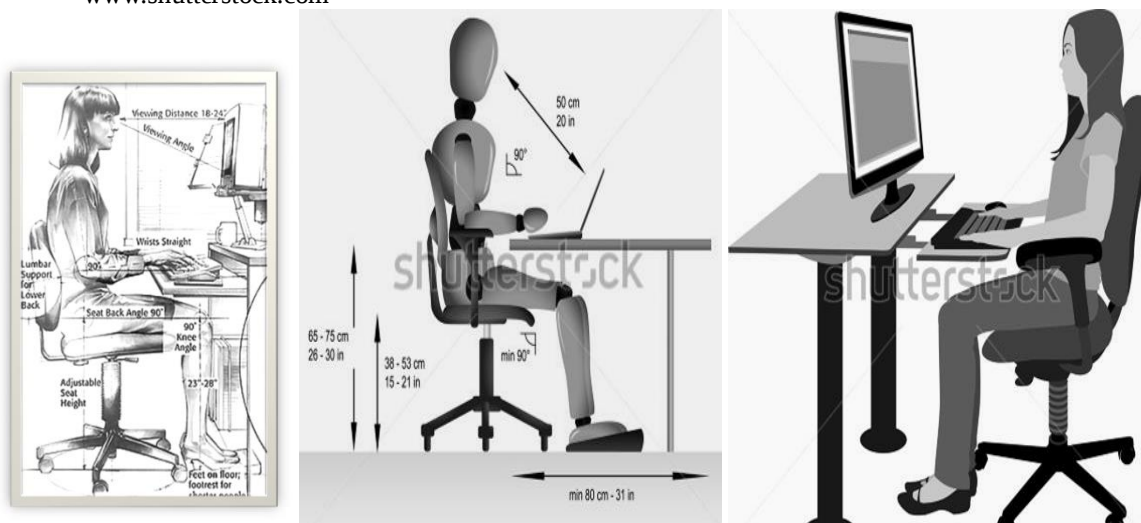


Figure 28. Showing how to sit correctly when working on a Computer System in order to avoid diverse health problems. Adopted From UCLA Ergonomics on Good Working Positions by Ergonomics Stock Photos, Illustrations, and Vector Art. www.shutterstock.com

This development made some workers especially the analog printers felt a loss of identity, dehumanization and feel like just “another number” because computer reduces or eliminates the human element that was present in the non-computerized print workshops. Print MIS transformation, according to Telford (2007) affected the craft tradition that was prevalent in the analog print workshop. This led to a deskilling and later brought about

fewer people who possessed different skills and abilities in digitization for working in the print media organizations.

The trend had created other areas of work in the industry and had made many printers to move into services which are beyond the traditional ink on paper work. These areas include:

- iii. Data asset management (DAM)
- iv. Inventory management
- v. Design services
- vi. New e-commerce services.

These services made printers who have these skills today to become full service communication providers for their clients.

Consequently, as the industry is improving globally, Nigerian printers must endeavour to train and retrain their personnel to acquire the appropriate digital skills for the emerging print technologies. For instance, the introduction of internet is helping in fast access to transfer of data/information (files) from one point to another which is done in matter of seconds. Also the introduction of cell phones has bridged the communication gap between the customer and the printer thereby enhancing print business transactions and production.

Printers have to re-skill in the appropriate areas of digital technologies to be able to work effectively and efficiently in the production and management of print media in Nigeria. Today's print technologies are digitally based and computer-friendly hence digital

skills and knowledge are basic requirements in the digital print industry. According to Xerox Corporation (2011), printing industry is undergoing dramatic changes with the advent of software design tools and high speed digital printing. Most importantly, this new technology is transforming the workforce skills required to support the evolving printing industry.

Shoneye (2008) also agreed with this transformation in the printing industry by saying that "printing technology is moving at jet speed," (p.23). With this rate of development in technologies development for print production, it is equally necessary to develop human capital to manage and use these technologies at a profitable level. It also demands for constant updating of skills and knowledge in the industry. Failure to do this, means planning to be thrown out of the print production business within shortest possible time because of lack of competence and skills in the print production technologies.

CHAPTER V

5.1 SUMMARY, CONCLUSION AND RECOMMENDATION

5.2. Restatement of the Problem

Impact of Print Management Information System (Print MIS) on the Digital Printing Enterprise was a research conducted in six cities in Nigeria, namely: Kaduna, Jos, Enugu, Port Harcourt, and Lagos as well as Abuja, the Federal Capital Territory (FCT). It was observed that the traditional print industry in Nigeria is characterized by mechanical and analogue print management information systems such as works instruction ticket (WIT), loading cards, estimate forms, order entry forms, shop floor data collection, and many other forms of Paper-based Information Systems (Adeniyani, 2006; Speirs, 1994). This form of management information system has been found to be error-prone, causes waste of materials, time consuming especially for re-entering of information when a job is moved between systems of production (Buckwalter, 2006), and are not interactive to provide timely information in the organization (Kipphan, 2001; McWilliam, 2007).

Consequently, a dramatic shift emerged in the industry - the computerized information system referred to as Print Management Information System (Print MIS). It is the implementation and utilization of this management tool in the digital printing enterprise that informed the study. Current studies revealed that DPEs that have implemented the Print MIS have witnessed great reduction in the administration and overhead costs in their organizations. This was as a result of ease in accessibility to data by workers and the streamlining of data processing. It has also made exchange of information among workers and managers readily available and even to clients outside the print organizations' workshops. (Bowers et al, 1995; Szentgyorgyvölgy, (2008).

Nevertheless, the implementation of Print MIS raised fundamental issues on digital skills and competence among the analogue print workers who considered this technology alien to their work environment. These phenomena most likely was responsible for the print media low productivity, poor print quality and inefficiency in the print organizations. Also, the gross outsourcing of print jobs to other countries for production was as a result of lack of appropriate technologies, knowledge and the skills to tackle this unfortunate situation in Nigeria. If situations like these exist in Nigerian print industry, then it is explicit that certain factors are yet to be identified on the implementation and utilization of Print MIS in the DPE ñ hence the need for the study.

The study, 'Impact of Print MIS on the DPE in Nigeria' is basically a descriptive survey research carried out to assess the impact of the implementation of Print Management Information System on the Digital Printing Enterprise in Nigeria.

Subsequently, the list of Print MIS software tools were obtained from relevant literature of manufacturing companies, examples are seen in (Table 1) and sorted out based on print business operations in Nigeria. Six cities or commercial towns were identified from the six geopolitical zones of Nigeria (Plateau, Kaduna, Abuja, Enugu, Port Harcourt and Lagos).

The choice of these commercial cities was based on the fact that they have high concentration of printing firms, and therefore, accounted for high print activities and consequently high employment rate in the country (Bugi, 2007; Olubunmi, 2008)

The instrument adopted for data collection was a 60-item questionnaire structured on a 5- point scale of Strongly Agree, Agree, Undecided, Disagree, Strongly Disagree. The sample size of 306 respondents was drawn from the population of 1315. This sample was made up of top, middle and lowñlevel managers in the DPE. The questionnaire was divided into two parts -

Part I was designed to solicit for the demographic data from the managers while Part II consisted of four sections. Section (i) solicited responses from the managers on strategies for the implementation of Print MIS in the DPE in Nigeria, Section (ii) sought for responses from respondents on the effects of Print MIS utilization on workers with no computer skills and section (iii) elicited responses from the managers on the effects of Print MIS utilization on the Print business operations for production of print media while section (IV) solicited responses on the effects of implementation of Print MIS on DPE in Nigeria. The instrument was validated by three experts in which one was from the Department of Fine and Applied Arts, University of Nigeria Nsukka, another one from the Department of Art Education, University of Nigeria, Nsukka, and the last one from the Department of Printing Technology, Kaduna Polytechnic. They checked to ensure the relevance and adequacy of the content and to see that all the questionnaire items were appropriate and very clear and concise for soliciting the expected responses from the respondents. In order to determine the reliability of the research instruments, Cronbach Alpha was used.

The researcher with the help of research assistants distributed the questionnaire to the respondents in the six selected cities of the six geopolitical zones of Nigeria. Only 173 correct questionnaire items were analyzed in which the remaining were either not returned or returned but not correctly filled and therefore were considered not valid. In analyzing the data, descriptive statistic was used and the following major findings were obtained:

5.3 Major Findings

The following were the major findings of the study:

1. Strategies for the Implementation of Print MIS in the DPE

Human capital development, capacity building, organizational restructuring, press equipment are CIP4 enabled, appropriate selection and implementation of Print MIS for the required print business operations, strict adherence to organizational culture and training programs strategies identified were all required for the implementation of the Print MIS, with grand mean (x) rating score value of 4.1

2. General Digital Skills for workers in the DPE

The Print Managers all agreed that the print workers had no minimum computer skills requirements needed for print business operations in the digital printing enterprise. These skills include: General computer knowledge, Word processing/spreadsheet,

Power point presentation, Page layout programs, Digital asset management (DAM)

3. Effects Print MIS Utilization on the Print Business Operations for the Production of Print Media

Print MIS utilization has minimal effects on the six major print operations for print media production. The rating of Print MIS utilization fell below the cut-off point of mean score rated value of 3.0 the Likert Scale

- i. Print Managers rated the effects of Print MIS utilization on job estimating/quoting below the acceptable mean score rating level of 3.0
- ii. Print Managers rated the effects Print MIS utilization on job production planning/scheduling below the acceptable mean score rating value of 3.0

- iii. Print Managers rated the effects of Print MIS utilization on paper stock control below the acceptable mean score rating value of 3.0
 - iv. Print Managers rated the effects of Print MIS utilization on shop floor data collection below the acceptable mean score value of 3.0
 - v. Print Managers rated the effects of Print MIS utilization on order entry/production monitoring below the acceptable mean score rating value of 3.0
 - vi. Print Managers rated the effects of Print MIS utilization on sales and financial management/standardized report below the acceptable mean score rating value of 3.0
 - vii. Print Managers generally indicated high level of agreement that the effects of Print MIS utilization in the print business operations in the DPE all fell below the expected level of acceptance of mean score value of 3.0
- 1. Print managers unanimously agreed that all the factors identified were responsible for lack of utilization of Print MIS tools in the DPE in Nigeria (Grand Mean ($\bar{x}$) = 3.7).*
- i. Print managers agreed that lack of organizing workshops/seminars is a factor creating lack of utilizing Print MIS tool in the DPE in Nigeria.
 - ii. Print Managers agreed that lack of basic knowledge to search for relevant information is a factor creating lack of utilizing Print MIS tool in the DPE
 - iii. Print Managers were of the opinion that the industry's professional bodies were not performing their basic functions of educating and training of members which is responsible for lack of utilizing Print MIS tool in the DPE in Nigeria.

- iv. Print Managers were of the opinion that non-availability of printed media containing information on Print MIS tool is responsible for lack of utilizing Print MIS in the DPE in Nigeria

1. Print Managers accepted that utilization of Print MIS tool for print business operations where they have been implemented in the DPE in Nigeria fell far below acceptable level (Grand mean $(x) = 2.1$)

- i. Print Managers agreed that majority of DPEs in Nigeria were not using Print MIS tool for *job estimating/generating quotation* for print operations.
- ii. Print Managers agreed that majority of DPEs in Nigeria were not using Print MIS tool for *job production planning/scheduling* print operations
- iii. Print Managers agreed that majority of DPEs in Nigeria were not using Print MIS tool for *job order entry* print operations
- iv. Print Managers agreed that majority of DPEs in Nigeria did not utilize Print MIS tool for *shop floor data collection* print operations.
- v. Print managers agreed that majority of DPEs in Nigeria did not utilize Print MIS tool for *invoicing/Job costing* operations.

2. Impact of Implementation of Print MIS on the DPE

Print Managers all agreed that Print MIS has created impacts on the DPEs where have been implemented (Grand mean $(x) = 4.1$)

- i. Print managers agreed that Print MIS tool helped in improving accuracy of data/information delivery in the workplace that led to reduction of problems

of workers in information processing and disseminating for print media production.

- ii. Print managers agreed that where Print MIS has been implemented it drives print growth which impacted positively on the DPE
- iii. Print managers agreed that Print MIS tool makes possible the timely and easy access to information in the workplace where it has been implemented.
- iv. Print managers were of the view that Print MIS tool improves the accuracy of exchange/sharing of information between customers and the print organizations.
- v. Print managers agreed that Print MIS tool increases print productivity and efficiency in print management
- vi. Print managers agreed that Print MIS tool has changed analogue print operations to digital print operations.
- vii. Print Managers agreed that Print MIS tool has controlled both the administrative and productive aspects of print business operations.
- viii. Print Managers accepted that Print MIS tool has enhanced the computerization of all the prepress operations and made workstations to be integrated into single uninterrupted production workflow.
- ix. Print Managers agreed that Print MIS tools integration of workstations have led to redundancy and causing downsizing in the workforce of the industry
- x. Print managers agreed that Print MIS tool has made workers without digital knowledge and skills lost their jobs.

5.4 Implications of the Study

The findings of this study have far-reaching implications for the print industry in Nigeria - particularly the print investors, publishers, print consumers, workers in the industry, researchers and of course the country in terms of revenue contributions to the government (Gross Domestic Products, GDP). Since the utilization of Print MIS in the DPE in Nigeria fell below the acceptable mean score value of 3.0 is indicative of DPEs which are not performing to meet up the print media needs of the country especially as regards productivity, quality and expertise required for efficient print production. This is the cause for the outsourcing of print jobs abroad that have resulted into huge loss to government revenue from the sector (Akinsoyinu, 2009; Okodugha, 2011; Adebayo, 2010). Ojalumo (2013) said that Central Bank of Nigeria (CBN) earmarked N40.3billion for printing of currency and about 70% to 75% of the production of Nigerian currency are being produced abroad. The author according to him also pointed out that N7 billion was spent to print 2007 election materials in South Africa. This money if used in the country could produce a tremendous impact on the economy

Also the poor performance in the DPE is indicative of the fact that the workers lack computer skills, knowledge and competency of utilizing the computer-aided management information system. This is contributive to down-sizing of workforce in the industry since their skills and knowledge have been rendered obsolete by the emerging new technologies - Print MIS and other digital technologies which are the current print technologies globally.

5.5 Conclusion

Based on the findings of this study, the following conclusion have been drawn:

The main conclusion drawn from this study is that the Print MIS system which is generally use as communication tool in the digital printing workplace in developed and some developing countries (Germany UK, Sweden, U.S.A, South Africa etc) for planning and production of print job is yet to be generally implemented in the DPE in Nigeria by majority of the printing practitioners. This conclusion is similar to the conclusion drawn by DöAmico (2006), Rodriquez et al, (2006) and Vision in Print, (2006), which in their research works found out that non-users are either unaware of MIS solutions, refusing to adopt to changes or outright management inability and this is inhibiting their willingness to implement these communication systems in their print workplaces.

Also these factors inhibiting printersö willingness to accept these communication systems in the print workplace have made it difficult for the implementation of Print MIS by the practitioners in the DPE in Nigeria. This made Adebajo (2002) to reiterate that there is need for all printers in Nigeria to update their printing knowledge and to respond to changes in the global printing industry by moving from old to new technologies for higher print productivity.

However, the few DPEs that accepted and have implemented the Print MIS technologies testified that the system have impacted greatly by driving print business growth in their organizations. It is a paradigm shift that every DPE needs, if they are to survive todayö global competitive print business.

Equally, the computer skills and other operational skills needed in DPEs should be impacted on the workers as well as the strategies identified for the Print MIS implementation.

5.6 Recommendations

Based on the findings of this study, the following recommendations were arrived at:

1. Print MIS is the communication tools for the digital printing enterprise in the 21st Century hence stakeholders in the print industry in Nigeria must accept this change and start the implementation as quickly as possible to avoid the industry's complete fold-up due to the global competition in the print production business market.
2. Print Professional organizations/bodies in Nigeria should develop and pursue a vigorous campaign programmes to create awareness on the functions and benefits of Print MIS solutions to members. They should also be organizing workshops for members on the implementation and utilization of Print MIS which should be done in conjunction with vendors of the Print MIS organizations. This is to ensure that members come to reality with the wave of technology change in the industry as well as preparing them for digital print environment towards global competitive print production business market.
3. Print professional bodies (i.e CIPPON, SPPN, NUPPPPOW, ASSPPON, KAMPA and ANP) should come out with professional journals, educative magazines, and other media where industries' updates are discussed and published. This will serve as a forum for good informative and educative media for members and the industry in Nigeria.

4. The management of the DPEs in Nigeria should embark on staff development and training programme on the relevant technological areas of needs to equip their staff with skills and knowledge to make them competent and effective in the management and operations of print production
5. Print MIS implementation strategies are only general organizational principles to guide prospective implementors of the Print MIS solutions. Therefore, each investor /potential investor of the Print MIS systems are to seek professional assistance from the Print MIS vendors for the appropriate Print MIS implementation in their respective printing organizations.
6. Nigerian Government should support the print media industry by way of printing government documents in Nigeria, providing conducive environment for investors in areas of manufacturing of raw materials for industry and establishing institutions for research and training to support the industry in meeting its human and material resources for print production.

5.7 Suggestions for Further Research

The following suggestions for further research emanated based on the findings of the study

1. A Study of the Current Status of Digital Integrated Automation Technologies in the Commercial Printing Industry in Nigeria
2. Implementation of Print MIS Systems in Small and Medium Scale Printing Enterprises in Nigeria
3. Identifying Requirements for Implementation of Print MIS in the Print Media Industry in Nigeria.

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