

**Analysis  
Of Printing Raw  
Materials On  
Quality Image  
Production**

**Dominic Oloo Menya**

*Department Of Business Administration And  
Management, Faculty Of Business Computer Science  
And Communication Studies, St. Paul's University,  
Kenya*

**Charity Muraguri W, Ph.D**

*St. Paul's University, Kenya*

**Muriu Stephen Macharia, Ph.D**

*Department Of Human Resource Development,  
Karatina University, Kenya*

**ABSTRACT**

Printing success will always be based on Total Quality Management (TQM) by continuously looking for ways to improve quality throughout all parts of the printing business and processes. The study examined the background of printing business by analysing the quality issues that lead to quality print production and by analysing factors affecting quality performance in the printing industry in Nairobi Central Business District. A critical inclusion of statement of the problem was identified by the research shadowed by the introductory part. This is harmoniously succeeded with purpose to research on acceptable excellence standard to materials. Theories in quality as fishbone theory developed by Ishakawa, PDCA theory of ratio-quality equal to result of work effort over total cost developed by Deming, and Quality Trilogy theory on excellence arrangement, standard measures plus standard enhancement. Research design, descriptive research was used, specifically survey method. The statistics were obtained via questionnaires from a total of 101 printing companies in Nairobi Central Business District (NCBD). The study sampled from 30 individual printing firms and the sample method used was random process. Data collection tool were questionnaires. Research questionnaires hard copies were distributed one on one to respondents. To analyse data, raw data from the field were revised, and sorted to determine their accuracy. Descriptive analysis and inferential statistics was employed. The study endorsed that all printing firms to adhere and improve on quality of the variables investigated by the research, so as to achieve quality production. In conclusion, print materials have an effect on quality printed products and it's therefore important to note that quality management on printing materials for print production leads to quality printed images. Recommendations is to include proper implementation and regular consistent evaluation on printing materials in print organizations. To ensure high quality printed products are produced efficiently and effectively. Sources of printing raw materials be from reliable, trustworthy supply sources so as to achieve quality production standards.

**Keywords:** Reproduction of originals, On press trouble shooting, Emulsification, Air entrapment, and Substrate

**1. INTRODUCTION**

Printing jobs mostly get turned down, given back or destroyed since they don't meet the set standards, majorly linked for factors relating suppliers or printers use materials that fall short of production standards. Some of the raw materials at times prove to be health hazards when they are used to print packaging for consumable products. Printers have had problems with raw materials (paper, ink, adhesives, and plates).

Print quality requires excellent paper material with correct handling knowledge and control. Quality work is always achieved by the knowledge of employees. An organization may acquire and provide healthy state-of-the art equipment and provide a healthy and safe work environment but if the employee does not understand material specifications, there would be no quality work produced. Most important is material knowledge that a

printing expert should possess. Other requirements include, ability to inspect papers, ink, adhesive and plates on arrival from supply source. Failure may lead to substandard products thus jeopardizing quality at the end to the chain. Ability to coordinate work, for quality results is a printer's major responsibility.

Printers are faced with an economic challenge to verify varieties of materials coming to them for production. Before materials go to press, printers must analyse and know on-press printing characteristics of these materials. On the press, it is too late in the production chain to find out that there is an ink-on-paper incompatibility or the paper will not function well as it should be while in production circles.

Quality of materials for print production leads to quality printed images and sharp details. Whether the substrate is wood, egg, paper, cloth, leather just to mention a few, quality is very vital. In course of assortment and following procurement of these materials and others not included such as fountain solution and others the printer should be aware of their properties, characteristics, compatibility and with the printing processes. Failure to which there would be definite losses to the organization due to rejection, spoilage, time lost and repeating same job due to the mentioned factors.

Materials management entails the planning, selection, purchasing, inventory control, handling, storage and distribution of all materials used in the printing production process. Successful management requires a sound technical knowledge combined with commercial ability as the printer has a dual role. First, he/she must purchase materials to meet the scheduled dates. Second, he/she must purchase and store materials at the lowest cost that is commensurate with quality.

Highly trained staff and the latest technology will have little effect if the correct quality materials are not purchased and are not in the correct place at the right time. If the materials purchased prove to be unsuitable for scheduled use and the product's end purpose, financial loss, client and printer frustrations will be experienced. The method of materials management used to control printing materials can have a great effect either positively or negatively on production.

The major duty of materials organisation is to analyse single substrates, by substrate and enhancing delivery of products through various stages and steps, allocate specifications to the materials required, and decide whether the item(s) are to be retrieved from stock, or purchased individually or collectively.

## **2. PRINTING MATERIAL PROBLEMS**

### **2.1 PROBLEMS ASSOCIATED WITH PRINTING PAPER**

Picking, at production time is lifting the top paper surface onto image carrier, and other ink transmission transfer components, this process makes printing substrates to tear. Pick out all content within paper making ingredients created from pulled stock at paper preparation and processing stages. This is mostly caused by ink being too

tacky and tear the substrate and owing to surface of substrate being weak, the stock cannot hold on to the image transfer carrier. Dusting, ingredient used to make substrate pile on image transfer components which is in the press, other ingredients also block printing later and this blinds the image carrier only after a minor few machine runs. High content and chalk and other substrates making ingredients will always make production to fail. Probable Causes include insufficient holding amongst stock line on surfaces. Image carrier not being dampened before putting press on motion. Solutions include use of chemicals in the trough, by a being metering from a regulated bottle to enhance ink/moisture balance on plate at production time. Linting, fiber get to pile on substrates which have rough surfaces, impression from press blanket cylinder and plate cylinders forces lint out of the stock body. Also probable Causes include paper ingredients and additives not conforming at manufacturing stages, hence ingredients move and are not controlled as the mixture proceeds for substrate production. Carbon shade to print images hence lack flow characteristics on the plate. Too little dampening on press due to fast revolution at production time. Solutions include using surface-sized paper, reduce ink tack, reduce printing speed and increase dampening to reduce on-press troubleshooting.

## **2.2 PROBLEMS ASSOCIATED WITH PRINTING INKS**

Picking, if ink is too sticky, or is drawn for stock to be printed. This material cements itself on the image carrier and leaves smeared ink, at times it leaves ghost of many colors. Causes include poor paper coating, Ink drying too fast. Remedies are clean blankets, soften the content of the color batch by using recommended ingredients, also use anti-set of powder, adjust pressure of the pressing component onto the image or try same job in another machine all together.

Dust, are lints from stock being printed holding on to impressed image carriers, they then accept coloration and image themselves and appear as spaces in print. Dust content are obtained at times when paper is being reduced to size at the slitter or at guillotine machine. Remedies are to pre-dust pressing using a gadget recommended or a cotton cloth, examine all printing stock surfaces prior to cutting, smear ends with recommended liquids or oil. Ghosting, condition impressing and producing unwanted images which replicates on printing substrates or products. These “stencils” or “ghost images” appear from recurrent passes of the ink form roller above image carrier gadgets during press run and decreases or increases color. Causes of ghosting include meagre plan design set at pre-press, a light carbon ingredient of color, show through thin color content in a tuned ink roller. Remedies are to advance job layout. Refer color producers, to analyze pigments, vehicle and additives for superior opacity.

Mottling, image areas are not same in the spread of ink, hence unstandardized shed is witnessed. The error comes from printing stock which has wrinkles on it and accepting absorption of ink. Remedies include consulting stock producer for an alternative, contact pigment/vehicle color producer for contents which will not be absorbed by printing stock, adjust printing machine impression pressure, replace blanket. Also do an analysis

on the remaining stock to be printed. At the same time get new unused image carrier accessories. Delamination, causes include poor stock surface folding of manufacturing ingredients and additives not able to cope with printing ingredients as inks, chemicals and impression stress. Remedies: add recommended reducer and adjust printing pressure to the cylinders or get an alternative printing stock or substrates.

### **2.3 COMMON PROBLEMS ASSOCIATED WITH PRINTING ADHESIVES**

Adhesives must not be contaminated. Any foreign slippery ingredient in an adhesive will make it not fulfill its objective of binding or attaching to surfaces as is expected. The foreign ingredients in an adhesive is expected to yield negative results; since they dilute and weaken the adhesive strength of attaching documents. The foreign matters being mentioned can be slippery ingredients from our hands, possibly from cosmetics or sweat from hand surfaces.

When these foreign elements settle on surfaces to be attached by adhesive, the surfaces become slippery and won't hold adhesives to adhere to the surfaces for attachment. At all costs care and caution must be observed concerning foreign contaminants interfering with adhesives.

The surface to receive adhesive must therefore be well treated prior to applying it. The surface must be roughened should the need arise to do so, but this will also depend with the surface background. Preparation will improve vulnerability of the adhesive, basing argument on the working science of the printing materials.

Mix-ration: mixing ration must be strictly as specified by the manufacture, otherwise it can be a contributor to adhesive failure during production. The parts of ratios must be of exact as is required. Application technique is vital. Ensure content applied is what is required plus this uniformity obliged and kept throughout production time.

### **2.4 PROBLEMS ASSOCIATED WITH CARTRIDGES**

Faulty cartridge fitting is often a problem in print shops, especially cartridge clients using microchips. Many reasons help to cause the contrary. To sort it out, is to retrieve the solid cartridge. The cartridge most firmly hold onto the printer, if not so the microchip will not hold and link firmly to the printer ends. The printer end being dirty is caused by minute golden ink which tend to dry at the printer end hence the ends fail to grip the micro-chip and to link it to the cartridge. Use a tissue with a recommended liquid to clean both ends of cartridge as a solution to ensure the micro-chip is clean. When cartridges are out of date and have expired, ensure you buy one from your locality, since if purchased outside the border it may refuse to function with your printer because they may not be compatible. Ensure the white lines don't affect printing work by them being clogged. This problem is often with printers that are issued with peizo print head. Ensure printers don't stay idle for long to evade problems associated with piezo head which make ink dry and bloking small ink channels. Use of fake ink can cause a blocking problem and it can occur with any ink even those recommended by the manufacture, to solve it ensure the printer is used regularly. Also cleaning the head would be the best option. Images can

appear in central to the color used; so ensure you remove the breather tape at the top of the cartridge or else a partially blocked print head will affect production. To it do a print proof to identify inks giving wrong shades. One can be done by isolating the colors that give the wrong shade; counter confirm the removal of the tape, and that it is completely detached. Print Head error message deter production and it's a very fragile component of the printer. It's often a problem as it ages (printers). To solve the problem remove all cartridges, plug out print head, dust out all areas with contacts to power source and place it back and let printer be out of power for 20 minutes before switching it on. Reading of ink lever is vital. If prompted with such an issue, buy and fix new cartridges and ensure the printer is on at time of fixing the cartridge. Ink leaking from cartridge to the printer can be a negative issue hence establish a reputable supplier, because quake suppliers can use substandard models having poor fitting nobbs (seals).

### **3. OBJECTIVE OF THE STUDY**

To establish the effect of printing raw materials on quality. Quality is about meeting customers' needs and expectations by producing products or providing a service that has zero defects. In the process of achieving quality of a product there is need to use quality materials. This presents a theoretical review of the relevant literature and previous studies done on quality in the printing industry.

### **4. THEORETICAL REVIEW**

Time for environment control is an important act that individuals and institutions most embrace to create a conducive surrounding same created by design paper or desktop and as this takes place standards must be met and maintained by printed images. The density of ink on a substrate will be very appealing and enhance sales of a product because of the compatibility of the ink with the substrate. This part of this proposal explores quality performance theories in the printing industry.

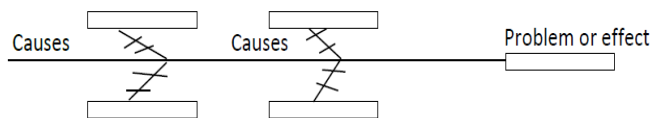
#### **4.1 FISHBONE THEORY**

This theory was proposed by Kaoru Ishikawa (1968). It states that qualities are those which put more attraction to human resource at production (Bowen, 2013). They include Pareto analysis, cause and effect diagrams of quality, stratification, check sheets, histograms, scatter charts and process control charts (Bowen, 2013). The theory focuses on tangible issues contributing failures. It highlights the data content, what degree of inconsistency can be identified? Is there a link to the factor? And finally which are the deviation that may require attention? Hence which techniques to be applied to control /it/ them.

Ishikawa knew that these techniques will be widely spread to all those working in an organization and apply them to assess production failures and to cultivate a culture of positivity to develop products and services. When the seven techniques are used together, they result in a strong content in quality

management. When these seven basic tools are used in tandem, they present a powerful kit in quality management in the printing process.

Figure 1: Fishbone Theory Ishakawa Fishbone or Cause and Effect (1968)



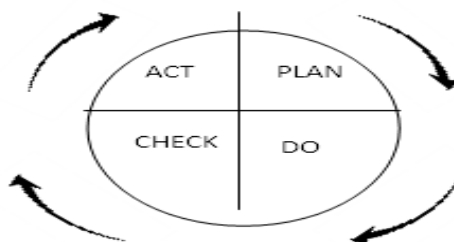
Source (Ishikiwa, K. (1968)

Fishbone theory is applicable to printing in areas where problems are identified, causes of problems are established and situations are obtained through data collection in order to satisfy a customer. Quality achievement in printing requires that skilled human resources are engaged, quality materials are used and equipment is maintained.

**4.2 PDCA THEORY**

Management is the cause of almost 100% of failure to meet standards. The theory discovered by Deming was a fourteen point plan which when used in any organization will yield success, even in public sector. The theory includes constant inspection of products and services, adoption of new philosophy as random inspection, amongst others (Bowen, 2013). According to Deming, if management adopted the plan; then organization would grow as a thriving enterprise. He also encouraged organizations on good and early establishing of goals, acting to produce the product itself, carrying out an auditing on product and on processes and in-case of any deviation from the set standard, correct it immediately. The PDCA can be referred to as continuous excellence model

Figure 2: Deming Cycle (1986)



Source (Deming, E. (1986).

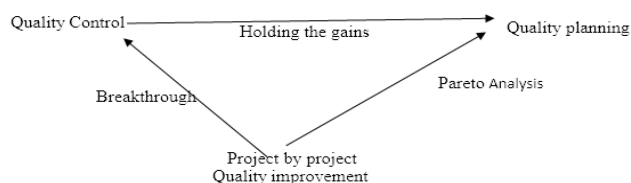
He (Deming) emphasizes on methods to doing work better. His ideas are constantly being added. Value to hence making clients to demand more and performance of the items(s) is equally being enhanced to meet demand.

**4.3 QUALITY TRILOGY THEORY**

The theory emphasizes audit standards that requires actions be outlined, value added to it are taken. The steps receives audit action in line to the set standards and arrangements are highlighted to hit performance targets and

standard by work using appropriate instruments and know-how (Pareto analysis). If supervised as explained above success will be witnessed, which will be a plus and evade spoilage and wastage.

Figure 3: Quality Trilogy (1988)



Source Juran, J. (1988).

Quality is linked to the consumer’s acceptance or to a content and highlighting factors requiring improvement in successive production process within the plant.

Juran’s stages of excellence advancement which include building consciousness for requirement plus a chance to development, set targets for higher level for attaining the set goals, provide training among others are still very effective in quality performance in printing industry (Miles, 2010). Juran not only concentrated to the final consumer also to other stake holders. Every production staff from pattern maker, user, and to merchant dealers need to add value to raw materials as products pass through stages for conversion value to value addition (Juran, 1988).

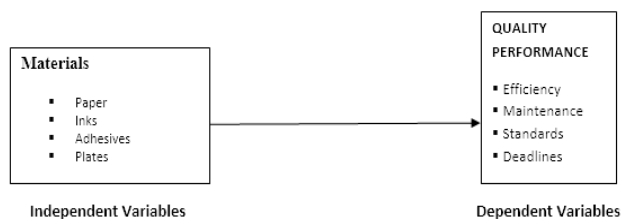
## 5. EMPIRICAL LITERATURE REVIEW

This covers the technical references in a field that is defined by an author and is typically accomplished by mention to former evaluations. These are past studies finding a relation with the variables of the topic.

### 5.1 PRINTING MATERIAL

#### 5.1.1 CONCEPTUAL FRAMEWORK

Rebecca & Iain, (2012) argued that the major aim of research should be to generate a theory from data. Conceptual frame work is a foundation on which the entire research study will be based. It seeks to relate, develop, describe and elaborate the networks of associations amongst the variables that were identified and relevant to problem situation. In order to hold knowledge, the theory should give analytical variations and context and to distinct and organise ideas such that acquired know-how is interpreted and translated to useful information.



## 6. METHODOLOGY

### 6.1 RESEARCH DESIGN

Explanatory and descriptive research design was adapted. Survey method of descriptive research was used to carry out the research. According to a study by Milano in 2013 survey method was seen to be effective in capturing the factors affecting quality in the printing industry. This method was applied as it determined and report the way things are. Survey method was used because it is an effective method that has been successfully utilised in various research studies in the printing industry, one of them being a survey of printing industries in California. In descriptive design the researcher looked at the analysis of quality performance in the printing industries in Nairobi.

### 6.2 TARGET POPULATION

This is the entire area where the research work is taking place. According to Mugenda & Mugenda (2013), it is repeatedly difficult to study the entire target population and thus scholars identify and define an experimentally manageable population.

Data was collected from a population of printing firms in NCBD. Since they were about 101 printing establishment in this region, the researcher collected data from 30 printing companies which represented over 30% of the population of printing companies in NCBD.

*Table 1: Location and Number of Printing Firms in NCBD*

Street	Number of firms
Ngariama Road	32
Kijabe Street	27
Haile Selassie Avenue	13
Kilome Road	29
TOTAL	101

*Source: (2017)*

### 6.3 SAMPLING AND DESIGN

A sample is a portion chosen from an area of study with analysing an area of study results would be drawn and a decision reached. Every character was covered by portion of this selected area. Representation of the specimen enhanced every person represented. The sampling method was through random process, which helped the researcher get the total number of respondents from the firms. In these firms the researcher collected data from two production managers, two quality assurance personnel and four machine operators.

The following formula, as provided by Israel (2011), was used to calculate the sample size in this study. A 95% confidence level and a level of precision of  $\pm 5$  were assumed. Therefore the total sampled respondents were 120.

Where:

n = Sample Size

N = Population Size

e = Level of Precision

*Table 2: Sample Size*

Street	Number of Firms	Sample Size
Ngariama Road	32	9
Kijabe Street	27	9
Haile Selassie Avenue	13	3
Kilome Road	29	9
TOTAL	101	30

*Source: Survey Data, (2017)*

## 7. DATA COLLECTION

Tools used to collect data were questionnaires, they are documents that are set. It consists of a list of structured questions, un-structured questions and Likert scale ones. Close ended questions have the advantage of collecting viable quantitative data while open-ended questions allow the respondents freedom of answering questions and the chance to provide in-depth responses. Questionnaires were preferred because they were efficient, cheap and easy to be administered. Respondents were managers, technical employees and quality assurance personnel of selected printing businesses. The questionnaires were filled by managers, technical employees and quality assurance staff of each selected firm.

## 8. DISCUSSIONS AND FINDINGS

### 8.1 MATERIALS AND QUALITY

The managers were asked to indicate the possible remedies in place for waste reduction. They wrote down various remedies that included: regular maintenance of equipment, training of the employees, using materials of high quality, purchasing print papers in ready sizes, proper servicing of equipment, training on materials management, timely disposal of equipment before it becomes obsolete, and sourcing from reliable suppliers.

The managers were then asked to explain the requisition process of acquiring materials. Their responses were, the general picture that was seen from the responses to this question was that this process varied across the various organizations. However, the general process involved the following steps: get quotations from suppliers, choose the one you want, place an order via phone call or form, receive and pay for the materials. Questionnaires required manager to highlight quality of material used in the organization. It is highlighted in the data represented below. Majority of them (43.3%) said their materials were of good quality, followed by those who said they were of average quality (30.0%) then by those who said they were of poor quality (20.0%), and lastly a few said they were of very good quality (6.7%). Highlighted in data representation in three below.

Table 3: Quality of Materials

Quality of Materials	Frequency	Percentage (%)
Very Good	2	6.7
Good	13	43.3
Average	9	30.0
Poor	6	20.0
Very Poor	0	0.0
Total	30	100.0

Source: Survey Data, (2017) n=30

Managers were then asked to explain two major sources of waste in their organization. From their responses the major sources of waste that were identified were: unskilled handling of materials, lack of proper equipment maintenance, incomplete jobs or spoiled jobs, poor storage, poor transport system, and late delivery of materials.

The table below indicates the managers' degree of agreement on various statements that indicate the effects of materials on quality. According to the study, quality and management of materials for print production leads to quality printed images. This is highlighted in material regression results page 11. Whether the substrate is wood, egg, paper, cloth, leather etc. the quality is very vital. In process of selection and subsequent acquisition of these materials and others not included here such as printing ink, fountain solution, adhesives etc. the printer should be cognizant of their properties, characteristics and compatibility with the printing processes. Failure to which there would be definite losses to the organization (Kimunga, 2009). The technicians gave the following reasons for waste reduction: to increase profits, to reduce production costs, and to improve productivity. Their degree of agreement or disagreement with various statements on effects of materials on quality is shown in table 4.

Table 4: Technicians' Opinions on Effects of Materials on Quality

Statement	Percentages (%)					Total
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
High quality printing materials are recommended for print production jobs	1.7	1.7	10.3	48.3	32.8	94.8
Waste percentage of materials affect printing businesses	0	3.4	0	53.4	36.2	93.1
Poor conditions of printing equipment can affect quality of printing materials	1.7	0	3.4	31.0	58.6	94.8
Printing machines operator can improve quality of print on printing material during production	1.7	6.9	6.9	37.9	41.4	94.8
Regular maintenance of printing equipment can boost quality production on a printed material	1.7	3.4	39.7	48.3	1.7	94.8
Storage facilities can affect quality printing materials	0	3.4	3.4	39.7	46.6	93.1
Our storage of printing materials can affect a printing organization	0	3.4	19.0	39.7	32.8	94.8

Source: Survey Data, (2017) n=60

From the table above it's proved that indeed materials affect quality of printed products. This is explained earlier in this research report that the quality of materials for print production determines the quality of the printed image. Whether the substrate is wood, egg, paper, cloth, leather etc. the quality is very vital. In process of selection and subsequent acquisition of these materials and others not included here such as printing ink, fountain solution, adhesives etc. the printer should be cognizant of their properties, characteristics and compatibility with the printing processes.

### 8.2 MATERIALS REGRESSION

The data beneath highlights a brief account for regression results for impact material has on quality.

Table 5: Materials Regression Results

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.401 <sup>a</sup>	.160	.130	.869
a. Predictors: (Constant), Quality of Materials				

Source: Survey Data, (2017) n=30

The table above shows the values for how variables can be predicted using a linear function coefficient, R<sup>2</sup> (the coefficient of determination), plus attainment difference in approximation. Adjusted R<sup>2</sup> (adjusted coefficient of determination), and the standard error of the estimate. The coefficient of correlation (R) was 0.401 which indicates a direct link connecting changed variables and variables being tested. The coefficient of determination (R<sup>2</sup>) was 0.160 indicating that materials explain 16.0% of materials in the research are of quality standard as linked to the above noted 16.0% percentage.

## 9. CONCLUSIONS AND RECOMMENDATIONS

### 9.1 CONCLUSION

Paper affects quality of printed products, especially where quality is determined at production time. In the process of selecting and subsequent acquisition of paper, the printer should be cognizant with paper properties (glossy, opacity, whiteness, brightness, and colour), characteristics (pick resistance, tear resistance, machine direction, dimensional stability, tensile strength, wettability and flatness) and compatibility. The study noted that print materials have effects on the quality of printed products. Therefore, correct handling, usage and storage of these materials is vital to producing high quality printed products. Printing materials are usually expensive and correct handling, usage and storage is important. The qualities of paper materials determine the quality of the printed images.

Ink must be able to print and to adhere to the substrate. Its properties must come from formulated ingredients (Colorant for pigments. Vehicle and modifiers). Ingredient determine ink characteristic and quality during production. Working property (viscosity, tack, body, length and other optical properties) are factors to be

considered for quality achievement. If these properties are incorporated in inks, the end product will be of quality desired.

Printing adhesives must be able to stick together two printed surfaces when need arises, and the two separate surfaces must bind and resist any separation. Print adhesives will not achieve its objective when it is contaminated with either grease oil or other impurities. Dirty substrates will automatically cause adhesives not to perform their tasks. Oils in hands can cause problems of improperly adhering if adhesives are to be used during production. To work, well mixed ratios must be consistent to standards set by the manufacturer. If all the mentioned are observed printing products produced and attached with adhesives will always become products of high quality.

Printing plates, are image carriers with the responsibility of transferring sharp images onto the substrates via blankets. The image areas of the plate must be ink receptive. None image areas must be water receptive (Water loving) and ink resistant. Good working plates must be easy to run on press and constitute quality image carrier. Plates must have annodic layer and a printing layer which must withstand many hours of production and press run, while the machine is in motion.

## **9.2 RECOMMENDATIONS**

Paper should be sourced (bought) from reliable suppliers who have a good history of honesty and are consistent to quality and who have maintained a trustworthy supply service of high quality materials. They must possess all the properties which are attached to paper as a material. Buy paper with dimensional stability, tensile strength, optical properties, and they must meet standard sizes and paper series specifications.

Printing inks bought must possess all the ingredients and which determines ink characteristics which include colorants, pigments, vehicles and modifiers. Inks must not be associated with problems relating to picking, peeling, dust, mottling and delamination. Inks must withstand the period of time, (one minute to more than ten years upon being used on a substrate). And at the same time ink must withstand environmental related negative effects.

Adhesives must be those which are compatible to surfaces they are supposed to bond. Adhesives bought must be free from contamination and to work well on surfaces which they are applied. The ratio for every adhesive should be as recommended by the technologist. Companies should set specifications on techniques of how to apply adhesives against surfaces, so as to produce a required quality product.

Printing plates should be sourced from recommended suppliers, they should withstand long period and hours of run without any damage. They should also be resistant to wear and resistant to minor surface abrasions. They should fulfil the ink water balance ratio. The printing layer, the anodic layer and the metal base should be well distinct at prepress stage. Plate image layer must avoid premature wearing. They must withstand mechanical plate wear, thus retaining print and avoiding chemical plate blinding.

**10. REFERENCES**

- Aguayo, R. (2012). *The American who Taught The Japanese About Quality*. London: Mercury Books.
- Babakus, E. &. (2013). An Empirical Assessment of the SERVQUAL Scale. *Journal of Business Research*.
- Bendell, T. (2011). *The Quality Gurus*. London: Department of Trade and Industry.
- Bowen, R. (2013, December 04). Ishiwaka Theory. Retrieved from CWIEP: <http://www.brighthubpm.com/methods-strategies/72443-theories-in-total-quality-management-tqm/>
- British Library Cataloging-in-Publishing Data. (2012). *Business Basics, Marketing*. Aldine House, Aldine Place: BPP Publishing Limited.
- Carman, J. (2014). Consumer Perceptions of Service Quality: An Assessment of the SERVQUAL Dimensions, *Journal of Retailing*.
- Chan, K., & Chan, K. (2010). The future trend on system-wide modelling in supply chain studies, *International journal of Advanced manufacturing technology*.
- Cole, G. A. (2011). *Management Theory and Practice, 7th Edition*. Aldine Place,: DP Publications.
- Crosby, P. (2013). *Quality and Me: Lessons from an Evolving Life*. Jossey-Bass.
- Deming, E. (1986). *Out of the Crisis: Quality, Productivity and Competitive Position*. Cambridge: Cambridge University Press.
- Ganguli, S. &. (2010). Service quality dimensions of hybrid services, *Managing Service Quality: An International Journal*.
- Gatobi, F. H., & Dr. Esther, W. (2014). Role of Supply Chain practices on Customer Satisfaction in the Printing Industry in Kenya. A case study of Morven Kester East Africa Limited, 1-2.
- Gupta, R., Sharma, B., & Bhalla, N. S. (2013). *Principles of Business Management 4th Sem*. New Delhi, India: KALYANI PUBLISHERS.
- Higgins JPT, G. S. (2011). *Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]*. The Cochrane Collaboration, Available from [www.handbook.cochrane.org](http://www.handbook.cochrane.org).
- Ian, F. (2011). *Modern Lithography*. Transatlantic Arts.
- Ishikiwa, K. (1968). *Guide to Quality Control*. Tokyo: JUSE.
- J, S., & B, O. (2010). *Management Services. Rethinking Lean Service*, 34-37.
- John, S., & David, O. (2012). Creating more dinner space for SMEs. Retrieved from [coulsonharney: http://www.coulsonharney.com/News-Blog/Blog/Creating-more-dinner-space-for-SMEs](http://www.coulsonharney.com/News-Blog/Blog/Creating-more-dinner-space-for-SMEs)
- Juran, J. (1988). *Juran on Planning for Quality*. New York: The Free Press.
- Kimunga, J. K. (2009). *Challenges Facing Small Scale Business Growth and Survival*. Nairobi: University of Nairobi.
- Kipphan, H. (2012). *Handbook of Print Media*. Heidelberg.
- Kitapci, O. D. (2013). The paths from service quality dimensions to customer loyalty. *Management Research Review*,.
- Logothetis, N. (2011). *Managing For Total Quality: from Deming to Taguchi and SPC*. New York: Prentice Hall.
- Milano, S. (2013). *Quality Control and Production In the Printing industry*. Sage Publishing: New Jersey.
- Miles, S., & Donna, S. (2010). *Quality and Productivity in The Graphic Arts*. Livonia, New York: Graphic Arts Publishing Company.
- MIT Press. (2011). *The New Economics for Industry, Government and Education*. Cambridge: MIT Press.
- Mugenda, O. M. (2013). *Research Methods – Quantitative & Qualitative Approach*. Nairobi: Acts Press.
- Nyongesa, M. (2014). world-bank-blames-slow-growth-of-kenya. Retrieved from [msmenewsnetwork: http://www.newsmenewsnetwork.com/index.php/middle-east-africa/news/item/2146-world-bank-blames-slow-growth-of-kenya%E2%80%99s-smes-on-exorbitant-cost-of-credit](http://www.newsmenewsnetwork.com/index.php/middle-east-africa/news/item/2146-world-bank-blames-slow-growth-of-kenya%E2%80%99s-smes-on-exorbitant-cost-of-credit)
- Opara, S. (2010). Small Scale Pritining as a viable business. Retrieved from [ijawmonitor: http://www.ijawmonitor.org/news.php?ct=3&article=515](http://www.ijawmonitor.org/news.php?ct=3&article=515)
- Patrick, M. (2013). MSE Authority Acting CHief Executive Officer. Retrieved from [smestoday: http://www.smestoday.co.ke](http://www.smestoday.co.ke)
- Porter, D. (2010). *Print Management*. Leatherhead, Surrey, UK: Pira International.

- Pride, W. M., Hughes, R. J., & Kapoor, J. (2010). Business. U.S.A: Houghton Mifflin Company.
- Rebecca, H., & Iain, C. (2012). Measuring Competence? Exploring firm Effects in Pahraceutical Research. Strategic Management Journal, 63-84.
- Richard, A. (2010). Supply chain management: concepts and cases. New Delhi: Prentice Hall.
- Rooney, B. (2015, October 5). Technology Reduces Employment in the Printing Industry. Retrieved from Qualityinfo: <https://www.qualityinfo.org/-/technology-reduces-employment-in-the-printing-industry>
- Sakyi, K. A. (2012). The Publishing Industry in Ghana.
- Schneider, B. &. (2012). Service Quality. Journal of Organizational Behavior.
- Sekaran, U. & Bougie, R. (2010). Research Methods for Business: A Skill-Building Approach, 5th Edition. West. Sussex, UK: John Wiley & Sons Ltd.
- Shuttleworth, M. (2013, 01 16). instrument-reliability. Retrieved from <https://explorable.com/>: <https://explorable.com/instrument-reliability>
- Songa, W. (2014, 11 01). Industrialisation Principal Secretary. Retrieved from [allafrica.com](http://allafrica.com/stories/201404110808.html): <http://allafrica.com/stories/201404110808.html>
- Vargo, S. &. (2013). Service-dominant logic: continuing the evolution, Journal of the Academic Marketing.
- Verma, V. (2015, August 16). Innovation: Further Challenge To The Printing Industry. Retrieved from LinkedIn: <https://www.linkedin.com/pulse/print-innovation-further-challenge-printing-industry-varsha-verma>
- W, P. (2011). Management Services. Is Performance Personal or In The System?, 40-47.