

Achieving Quality Printout through Preventive Maintenance Practices: Evidence from Alpha and Omega Press in the Kumasi Metropolis

Ebenezer Kofi Enninful¹, Abraham Boakye-Amponsah², Benjamin Lamptey³,
^{1,2,3}Department of Graphic Design Technology, Takoradi Technical University,
Email: kennifix@yahoo.com, boakyeamponsahabraham@yahoo.com

Quality output, Preventive and Maintenance schedules in press houses at Takoradi, Accra, Kumasi, Tema and many other parts across the country are practiced for optimum benefits and results. Nonetheless, Alpha and Omega Printing Press remains the best in the metropolis that practices constant and speedy maintenance on their machines. These proper maintenance routines have enabled them to satisfy and retain their customers to date via quality prints of all their works. The study's primary purpose was to establish a relationship between Preventive and Maintenance practices on printing machines and the quality of printing output of Alpha and Omega Printing Press, Kumasi metropolis in the Ashanti Region of Ghana. In the literature review, the researchers gathered related topics and treated them as such concerning the field of study. The study in terms of the research design, adopted a mixed-method approach of descriptive research and a quantitative research approach. As regards the research methodology, the questionnaire and the focus group discussion were the main instruments employed for gathering the needed data from the respective study respondents. The researchers administered the questionnaire and moderated the focus group discussion to ensure the validity and reliability of the data gathered with the instruments mentioned above. The population for the study included some employees and customers of Alpha and Omega Printing Press. A simple random sampling method was employed in the study, which falls under the probability sampling method. The data gathered from the employees of the press house established that there is a link between Preventive Maintenance on printing machines and the quality output of the press house, which makes them the best in the Ashanti Region. The researchers also deduced from the study that Preventive Maintenance on printing machines impacts the entire press

production process. From the evidence, the impact increased automation, reduced the printing machines' failure rate, ensured consistent quality output, and increased productivity on a regular basis.

Keywords: *Quality, Output, Machines, Press Houses, Preventive Maintenance.*

1.1 Introduction

Speed and accuracy are the major factors that give a press house a competitive edge over another. That could be a customer's basis for choosing one press house over the other. Speed refers to the rate at which a job or a contract given to a press house can be produced within the shortest possible time, and most customers associate speed with quality. Accuracy refers to the attribute or character of a produced work that meets the expectations of the customer and the company's objectives for the job at hand. Accuracy in printing refers to the quality of the printout, and several factors contribute to the quality of a printout. The technology a press house operates with can affect the quality of the work produced.

A typical example could be two press houses that operate with the offset lithography printing method, but press A uses a chord machine with a one-colour system. In contrast, press B uses a speed master five-colour unit. All other things being equal, the quality of output and production rate will differ from press A to Press B. However, when the availability of press A is equivalent to that of press B, and all other factors are held constant, their output varies. It means one press is practising good maintenance schedules while the other is not.

Quality within the press houses has become an issue that is craving a lot of attention and resources, and most press houses are investing a lot to meet the expectations of clients and customers. Consequently, it gives the press house a competitive edge over each other.

Quality must be defined in measurable and clearly stated terms to help the organisation take action based on tangible targets rather than hunches, experience, or opinions. According to Crosby (1979), quality means conformance to requirements. In the view of Diaz (2014), quality is defined as meeting or surpassing set standards or expectations. In addition, Diaz (2014) describes quality as "fitness for purpose or use; compliance; value addition".

In other words, quality can be said to be the property of a good, a service that meets a client's expectations, or a customer. Quality at the press houses is achieved chiefly based on one input during the production process; hence a good input will yield a quality output. Many factors influence the quality of output at various press houses, including the raw materials used in the manufacturing process, the level of expertise of the printer or machine minder and finally, the quality of the technology that will be used to produce the printout at the press house.



Concerning the materials that will be used, the management of press houses will ensure the buying and usage of quality materials for the production of goods or products to achieve brand loyalty in the minds of the customers or clients. The expertise or technical know-how of the machine minder or the machine operator also helps produce quality printouts since the actual duty of a machine operator is troubleshooting, that is, being able to print a high-quality job and identify errors in printouts or during the printing process. Finally, the machine technology used to print the works influences the overall quality of the process. It has the potency to make and unmake the whole print production process. After a while, most machines will lose their ability to print well unless the company that owns them has a good maintenance policy. These policies ensure that the machines used for production are maintained regularly; hence the quality of a machine is maintained.

Maintenance involves keeping the workplace and its structures, equipment, machines, furniture, and facilities in good repair and operating efficiently and safely. It includes many tasks like repairing, replacing, servicing, inspecting, and testing. The term could also be used to refer to keeping your staff safe, fit, and healthy. There are two main types of maintenance work. Preventative maintenance is usually planned and includes scheduled inspections, repairs, and replacements to ensure everything continues to work. It can be compared to the annual service of a printing machine.

Corrective maintenance is needed when things go wrong or breakdowns occur, demanding reactive action be taken to get things up and running again. It can be compared to having a repair carried out on a printing machine after some parts failed to work correctly. Observations from the researchers reveal that, in general, most printing press rarely practice preventive maintenance; instead, they practice corrective maintenance. Thus, some printing press houses wait till the machine used for the production process breaks down before maintenance is performed on the machine. That has been the trend in most instances because the machine minders do not see the direct implications of regular maintenance on the printing machines and the quality of their output.

The study was carried out to unearth credible findings on the positive impact of practicing preventive maintenance. Accordingly, the researchers deemed it appropriate to investigate the impact of preventive maintenance on the output of the press house and establish a link between preventive maintenance and the quality of the output of Alpha and Omega Printing Press. The study's outcome will educate press minders and press owners on the impact of preventive maintenance on the quality of their production process.

During an internship supervision programme within the metropolis, it was observed that some corporate entities that do not compromise on their corporate colours end up printing their works from Alpha and Omega Printing Press. The corporate industry players as well as individual customers within and outskirts of the Kumasi metropolis believed Alpha and Omega press is

the hub of printing in Kumasi, therefore prefer having their works printed there rather than from others within and environs of Kumasi metropolis. In addition, it was also observed that the quality of output of some press houses within Kumasi and its environs is low compared to that of printouts from Alpha and Omega. Hence, the need to research the impact preventive maintenance has on the production process of the printing press and establish a relationship between quality output and preventive maintenance. The research outcome will serve as a means to educate press owners and machine minders to improve the level of quality output at the various printing press.

1.2 Objectives of the Study

- To establish a link between Preventive Maintenance and quality output at Alpha and Omega Printing Press
- To investigate the impact of Preventive Maintenance on the press production process.

2.0 Literature Review

Although there is a varied theoretical framework developed to ensure adequate maintenance policies of a productive system, the framework regarded in this study includes the three thematic areas related to the study. According to Arbour (2019), they were the first to include Reactive maintenance (breakdown maintenance), also known as breakdown or run-to-failure, Reactive maintenance is pretty simple: fix things when they break. Since repairs are not planned, it is a good method to employ for equipment that is not essential for operations or has a low cost. In short, reactive maintenance often means more downtime and higher maintenance costs when it is not used strategically.

However, the second is, in the words of Rockwell (2019), Preventive Maintenance (Scheduled), also known as "proactive maintenance". This method involves periodically taking assets offline and inspecting or repairing them at predetermined intervals (usually time-based or event-based triggers). This theoretical framework approach aims to extend the useful life of an asset and prevent breakdowns from occurring. Many organisations employing preventive maintenance use CMMS software to trigger work orders when a PM is due. Noria (2010), expounds that this allows a facility to automate much of its scheduling efforts, which is a key ingredient of this preventive approach. As with all maintenance types, there are potential drawbacks to relying solely on preventive maintenance. If the PM schedule is not regularly monitored, audited, and improved, the bottom line is that if a preventive maintenance programme is used, it should go hand in hand with PM optimisation.

Furthermore, this particular theoretical framework explains that preventive maintenance (PdM) aims to predict failures before they happen so maintenance can occur at just the right time (Noria, 2010). PdM uses data from machine sensors and innovative technology to alert the maintenance team when a piece of equipment is at risk of failing (Noria, 2010). For example,

a sensor may use vibration analysis to alert the maintenance team that a piece of equipment is at risk of failing. At this point, it will be taken offline, inspected, and repaired accordingly.

Finally, the third, according to Veronica JaramilloJimenez, Nouredine Bouhmalaa & Anne Haugen Gausdalb (2020), illustrate that it is possible to carry out PdM via visual inspections of equipment. However, the easiest way to establish a predictive maintenance strategy is by using a CMMS to track metre readings. The advantage of PdM (over PM) is the potential for cost savings from reduced person-hours spent on maintenance and more insight into the performance and potential issues arising with the machine. Additionally, a reliance on data and sensor information means maintenance is determined by the actual condition of equipment rather than a best-guess schedule. This theoretical framework is directly linked to the study as many of the issues raised by Arbour (2019) are theorised and evidenced in the next write-up.

2.1 Definition of Maintenance

According to the Federal Standard (1037C), maintenance refers to any activity, such as tests, measurements, replacements, adjustments, and repairs intended to restore or retain a functional unit in a specified state. The unit can perform its required functions.

The definition stated above concerning the meaning of maintenance explains that maintenance is an activity and also states some of the activities that make up the maintenance process, including measurement, replacement, adjustments, and repairs. It also said that the goal of the maintenance work was to restore or keep the functional unit in a certain state.

In the second definition of maintenance, emphasis was laid on the idea that maintenance is an operational and functional check that could be a test carried out by a company on its machines to check how functional and operational they are. The Defense Logistics Agency defines maintenance as the operational and functional checks, servicing, repairing, or replacing of necessary devices, equipment, machinery, building infrastructure, and supporting utilities in industrial, commercial, governmental, and residential installations. The definition captured some of the activities that make up the maintenance process: servicing, repairs, and replacing. The definition did not limit the definition of maintenance to only machinery but infrastructure, supporting utilities, and residential installations.

According to AAP-6-Glossary of terms and definitions, maintenance refers to all actions taken to retain equipment in or to restore it to specified conditions until the end of its use, including inspection, testing, servicing, modification(s), classification as to serviceability, repair, recovery, rebuilding, reclamation, salvage, and cannibalisation. The routine, recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such a condition that it may be continuously utilised, at its original or designed capacity and efficiency, for its intended purpose.

The third definition of maintenance states that maintenance refers to all actions taken to retain or restore equipment in a specific condition. The definition stresses the importance of practising maintenance to restore or retain equipment in a specific condition. The retaining aspect refers to the potency of the process to keep the equipment in excellent working condition, while the restoration means reviving equipment into excellent working condition.

The definition also stated that maintenance is routine, recurring work required to keep a facility functional for its intended purpose. The definition did not limit itself to just the maintenance of machinery but other things like plants and buildings.

According to the European Federation of National Maintenance Societies (2016), maintenance refers to all actions that aim to retain or restore an item in or to a state in which it can perform its required function. The actions include combining all technical, administrative, managerial, and supervision actions.

From the fourth definition (EFNMS), it was noticed by the researchers that emphasis was put on the idea that maintenance actions are the combination of technology that requires a skilled person to repair or service a given machine. Corresponding administrative and managerial action involves steps taken by the company administrators to maintain a machine. Lastly, supervision action requires that a supervisor check if subordinates are carrying out suitable activities to ensure the maintenance of a machinery.

In general, maintenance is defined as the combination of all technical and administrative actions, including supervision to ensure that a system is in its required functioning state. (Reason, 2000; Swanson, 2001). Maintaining a system is usually related to maintenance actions such as repairing, replacing, overhauling, inspecting, servicing, adjusting, testing, measuring, and detecting faults in order to avoid any failure that would lead to interruptions in production operations (Duffuaa et al., 2001; Ismail et al., 2009). Parida et al. (2015) say that different factors can be used to measure the performance of maintenance systems.

The first definition talked about the activities that can make up maintenance. This information coincided with the third definition extracted from the AAP-6-Glossary of terms and definitions, the second definition by the Defense Logistics Agency, and the last definition. The first, third, and fourth definitions of maintenance emphasised maintenance functions, while the second definition elaborated on how maintenance can be carried out, even though the other definitions also captured that. The last definition stresses that maintenance is made up of a combination of some actions: technical actions, administrative, managerial, and supervisory actions.

Based on the definitions above, the researchers believe that maintenance is the systematic, recurring actions or activities that are carried out to either restore or retain a machine in excellent working condition at its original or designed capacity and efficiency.

2.2 Types of Maintenance

There are three types of maintenance; these are based on the nature of equipment before activity has been carried out on it, the type of activities carried out on it, and the objectives of the maintenance process. The three types of maintenance are; preventive, corrective, and predictive maintenance.

2.2.1 Preventive Maintenance

Preventive maintenance will prevent the breakdown and improve the output quality of the product and the machine's condition. Preventive maintenance is naturally carried out before any production interruption or significant breakdown. This maintenance is carried out at predetermined intervals. This preventive maintenance is the most successful one, and it is adopted in many organisations. The best way to perform preventive maintenance consistently is to develop operational checklists. The checklists should be made with the maintenance-activity steps in the right order, so they are easy to read.

The checklists should be initialled and dated by the person performing the maintenance. Establishing maintenance checklists and procedures for each piece of equipment maximises the preventive maintenance programme and helps accelerate training. The primary goal of maintenance is to avoid or mitigate the consequences of equipment failure. This may be done by preventing the failure before it occurs, which planned maintenance and condition-based maintenance help to achieve. It is meant to maintain equipment reliability by replacing worn parts before they break down.

The ideal machine maintenance programme would prevent any unnecessary or costly repairs. Maintenance activities include partial or complete overhauls at specified periods, oil changes, lubrication, and minor adjustments. Recording equipment deterioration also helps workers know when to replace or repair worn out parts. This way, they can fix or replace worn out parts before they cause the system to break down.

2.2.2 Preventative Maintenance

Corrective maintenance is a set of tasks destined to correct the defects found in the different equipment and communicated to the maintenance department by users of the same equipment. It is a maintenance task to identify, isolate, and rectify a fault so that the failed equipment, machine, or system can be restored to an operational condition within the tolerances or limits established for in-service operations. Corrective maintenance can be subdivided into "immediate corrective maintenance" (in which work starts immediately after a failure) and "deferred corrective maintenance" (in which work is delayed in conformance to a given set of maintenance rules). Corrective maintenance also called repair and restoration maintenance, is the most common type of maintenance performed. Corrective maintenance consists of repairing a broken or damaged piece of equipment to restore necessary operating conditions. Another part of corrective maintenance includes replacing abnormal or worn parts that are

causing films, plates, or production sheets to be out of specification. Restoration maintenance is about fixing things when they do not work, which is when equipment does not work. This is called "unplanned downtime."

2.2.3 Predictive Maintenance

Predictive Maintenance (PdM) techniques are designed to help determine the condition of in-service equipment to predict when maintenance should be performed. This approach promises cost savings over routine or time-based preventive maintenance because tasks are performed when warranted (*Predictive maintenance (PDM)* 2018). The central promise of predictive maintenance is to allow convenient scheduling of corrective maintenance and prevent unexpected equipment failures. By knowing which equipment needs maintenance, maintenance work can be better planned (spare parts, people), and what would have been "unplanned stops" are transformed into shorter and fewer "planned stops", thus increasing plant availability. Other possible benefits include longer equipment life, better plant safety, fewer accidents that have a negative impact on the environment, and better handling of spare parts. The key is "the right information at the right time."

Predictive maintenance differs from preventive maintenance because it relies on the actual condition of equipment rather than average or expected life statistics to predict when maintenance will be required. Some main components necessary for predictive maintenance are data collection and preprocessing, early fault detection, fault detection, time to failure prediction, maintenance scheduling, and resource optimisation. Predictive maintenance has also been considered one of the driving forces for improving productivity and one of the ways to achieve "just-in-time" in manufacturing (*Predictive maintenance (PDM)* 2018). Prediction maintenance takes preventive maintenance to a higher level. Prediction maintenance utilises more state-of-the-art technology to predict when equipment components will need maintenance before they fail. Scientific methods and accurate data analysis determine major maintenance and overhaul intervals. Prediction maintenance requires monitoring specific elements that could cause catastrophic failure of the equipment.

2.3 Importance of Maintenance

There are a lot of advantages or importance attached to the practice of maintenance on press machines. They include;

- Equipment maintenance is not only valuable for the scope of preventing breakdowns and thus lost time that could be spent being appropriately used, but it can be beneficial to the productivity of a machine and, by extension, an entire workflow. In the manner of a "well-oiled machine," an adequately serviced packing film machine can be sure to run at total capacity and work when it first arrives. A replacement would be costly, so keeping your machine a "well-oiled machine is most reasonable." It can be too easy to forget to keep your machine in tip-top shape. However, the benefits outweigh the hassle

that can be potentially a part of training, scheduling, and executing the tasks required to constitute proper service (Jon P. Mccalla United State District Judge, 2022)

- The safety ramifications of properly working machines cannot be overstated. According to OSHA, improper maintenance can, in their eyes, lead to unhealthy and dangerous situations in the work environment. Although the act of servicing machines can be a danger in itself, it is a significant preventative measure for exposing other workers to hazards. It is a simple, effective, savvy way to ensure the safety of an entire workspace and the particular safety of women or men working with a stretch wrap machine. Machines are initially sent with certain safety features. This is required by law. However, these systems can, like any other system, fail. Of course, the obvious solution to this, and all potential issues that could arise, long term or short term, can be solved by regular, proper, effective maintenance.
- Operator and machine safety. By performing regular preventive maintenance, you are assured that your equipment will operate under safe conditions, both for the machine and the operators. Possible issues can be nipped into the machine before they have a chance to cause harm.

- Machine Efficiency

Normal wear and tear can result in lower machine efficiency. Preventive maintenance assures optimal working conditions and conserves the life span of the equipment.

- Time Savings

Planned maintenance may cause a minor hindrance to production, but that is nothing compared to downtime caused by a breakdown. Because it is planned, production can propose the optimal time and factor in the nuisance. Preventative maintenance procedures take less time than emergency repairs and replacements.

- Accuracy and speed

Planned maintenance on a machine will improve the speed of the machine, that is, the rate at which work is being produced to meet the deadlines of clients or customers. Accuracy refers to how well the work meets the customer's needs and expectations.

- The elongated lifespan of machines

Good maintenance practices on a specific machine will elongate the machine's lifespan since maintenance will always ensure that parts that are worn out will be changed and the whole machine well cared for.

- Consistency in production:

Machines used for production over time cannot give out the same quality as they used to be when they were bought new, but with the help of quality maintenance, they will still be in their original condition.

Hence, there will be consistent production that does not deviate from customers' expectations.

- It is less costly.

One of the significant maintenance objectives is to restore or retain a machine. The cost involved will not be that expensive compared to buying a new machine of the same brand.

- It makes the working environment safe.

When machines are well-maintained, they don't pose a risk to workers or the people who work with them, making the work environment safe for everyone.

2.4 Preventive Maintenance

Preventive maintenance is planned maintenance of plant and equipment designed to improve equipment life and avoid unplanned maintenance activity. PM includes painting, lubrication, cleaning, adjusting, and minor component replacement to extend the life of equipment and facilities. Its purpose is to minimise breakdowns and excessive depreciation. Neither equipment nor facilities should be allowed to go to the breaking point. In its simplest form, preventive maintenance can be compared to the service schedule for an automobile. Preventive maintenance is predetermined work performed on a schedule to prevent equipment components' wear and tear or sudden failure. Preventive maintenance helps to protect assets and prolong the useful life of production equipment. Preventive Maintenance (PM) was introduced in the 1950s after recognising the need to prevent failure (Murthy et al., 2002). PM has been adopted for emerging technologies as an alternative to corrective maintenance (CM) since such systems are generally more complex than those based on hand tools. The basic principle of a PM system involves predetermined maintenance tasks derived from machine or equipment functionalities and component lifetimes. According to this, tasks are planned to change parts before they break and to be done during machine stops or shutdowns.

According to Simoes et al. (2011), PM is realised from two managerial and operational perspectives. The managerial point of view is about the help that assists people make decisions based on data (Soderholm et al., 2007).

Inputs for the managerial perspective include determining PM's objectives, planning to perform maintenance actions, and methods involved in solving any PM problem and systems' performance. The managerial perspective is also known as an outer process, as it bases decisions on history and analysis before executing PM actions. Meanwhile, the operational perspective refers to executing maintenance actions to sustain a system's capability to perform its intended functions (Bjorklund et al., 2010). In this perspective, technical things go into how PM is done inside the company. They are used as inputs for the outside process.

Both perspectives that prefigure PM are crucial for ensuring its effectiveness and efficiency. However, the managerial perspective is more critical in planning and determining suitable and

feasible solutions before carrying out a PM to meet its objectives. Without proper planning, PM actions could affect the system or other systems that may require further planning (Ab-Samat et al., 2012). Therefore, most attention should be given to planning as the key to connecting the managerial and operational perspectives. With the help of planning, PM can be used in a structured and systematic way to keep track of and extend the life of a system.

The guiding principle of preventive maintenance is the regular and systematic application of engineering knowledge and maintenance attention to equipment and facilities to ensure their proper function and reduce their deterioration rate. In addition to dedicated engineering, preventive maintenance encompasses regular examination, inspection, lubrication, testing, and adjustments without prior knowledge of equipment failure.

2.4.1 The Five Essential Preventive Maintenance (PM) Requirements

One primary objective of Preventive Maintenance is aimed toward retaining machinery in its original state or restoring machinery to its original working or functioning state, and this can only be achieved when the preventive maintenance programme or process has the following requirements:

- Top management leadership and absolute commitment. Management of an organisation refers to those in charge of planning, organising, and controlling every activity carried out on the company's premises. These leaders mostly commit by incorporating preventive maintenance into their company's objectives. In order to have a fruitful maintenance programme, the authorities or the leaders must show commitment since it has the potency to make or unmake the company.
- Compliance and discipline PPM must be a regular part of the schedule and capacity determination.
- Process operators should be involved and perform daily maintenance checks.
- The "true cost of poor maintenance" must be thoroughly understood as an initial estimate several times.
- Good preventive maintenance practices must be put into place immediately so that the facility can have an efficient production system delivering high-quality goods on time.

2.4.2 Preventive Maintenance Indicators

Indicators refer to any feedback or information received from various machines that prompt the machine operator that the machine needs preventive maintenance. The feedback, also known as indicators, is usually noticed through critical observation and the machine's efficiency. The indicators are as follows;

- Low equipment utilisation due to unscheduled stoppages
- A long period of waiting or idle time for machine operators during outages
- High scrap and rejects are indicative of quality problems.
- Higher than average repair costs due to neglect of proper lubrication, inspections, or service.

- Decrease in the expected life of capital investments due to inadequate maintenance
- decreased automation, and increased equipment redundancy.
- Delay in production; increased consumption of energy.

2.4.3 The Importance of Preventive Maintenance

- It improves system reliability and lowers the cost of replacement. System downtime.
- Reduced injury and lower total maintenance costs.
- There will be fewer urgent and emergency interruptions to operations due to equipment breakdowns.
- Level workloads and a stabilised workforce.
- reductions in the total labour required to keep facilities in good condition
- Controlled reductions in the inventory of materials and spare parts
- An increase in the volume of work that can be planned and scheduled repetitively, and a decrease in
- High priority, randomly occurring and unscheduled work.
- Reduced unnecessary damage to equipment

2.4.4 Process of Preventive Maintenance

Based on the definition of maintenance states that maintenance is the routine, recurring work required to keep a facility (plant, building, structure, ground facility, utility system, or other real property) in such a condition that it may be continuously utilised, at its original or designed capacity and efficiency, for its intended purpose. Maintenance is a systematic process, a series of activities coordinated to achieve the objective of maintenance, which is to retain and restore a machine. The preventive maintenance process is as follows;

- **Planning**

In the context of maintenance, planning encompasses activities that are undertaken with all maintenance resources, such as material requirements, labour requirements, time assignments, and technical references related to equipment, are determined and prepared prior to a task's performance (Duffuaa et al., 1999). In other words, inconsistent and unreliable procedures will result without proper planning, leading to interruptions in production. Therefore, proper planning is the preparation for performing necessary maintenance tasks on a priority basis by referring to the required resources. The information and schedule planning concept is briefly described as the general idea that systematically covers PM's elements. Planning means the formulation of a word in advance. Successful maintenance depends on maintenance planning only. So "what should be done" and "where should be done" are the primary criteria for successful maintenance. Maintenance planning may be effective if the department's past inspection data are available. The best way is to have a "history card" for each machine or instrument. Analysing the past data can only enable the management to build a confident work-planning structure. Comprehensive planning should be reflected in the master card in preventive maintenance. A weekly schedule may also be planned after preparing the "Master

maintenance schedule." A weekly schedule may also be planned. However, the activities required for effective maintenance are to be identified while planning.

At this stage of the preventive maintenance process, the machine's history is considered the machine's current nature. These factors will prompt the operator to incorporate activities into the maintenance process.

- **Scheduling**

Scheduling is the time phase of sequential activities. A maintenance schedule generally includes activities like inspection, repair (major or minor repair), and overhauling.

The inspection is done again, and a minor repair is performed. After the third inspection, a significant repair occurs, and the next overhaul comes. That means completing one repair cycle. The period of a repair cycle depends on the time intervals between the two activities.

If the interval is six months, the repair cycle is four years. The planning of time intervals may be influenced by past data on the machine, manufacturing instructions, and the complexities of the instruments.

- **Dispatching**

After planning and scheduling the preventive maintenance process, the next stage that comes to mind is the dispatch stage. At this stage, the company gives the workers the green light to carry on with the preventive maintenance activities.

- **Analysing**

A feed system is followed to evaluate the maintenance work done so far. In that system, a "work report" communicates "what has been done" against the planned work schedule and "what to do." Analysing such a report will enable the management to control and review the "maintenance planning." This stage shows whether the preventive maintenance process can restore the machine, which can be decided based on the feedback the operator of the machine will receive from the machine through the rate at which the machine operates, etc.

- **Controlling**

The person or thing used as a standard of comparison for checking survey or experiment results is referred to as the controlling. An effective control system should be maintained to enjoy full planning. A corrective measure must be followed whenever the plan deviates or does not occur as scheduled. For this, monitoring the total project is carried out, which provides information if any change of action is to be made in the course of work. The maintenance work order and report may be checked and compared during work. Whether work has been done, work needs are waiting for any spare time facing any administrative or technical difficulties and are continuously monitored. If the work has been done satisfactorily, it is recorded in the equipment history card as shown in the flow chart. In both ways, an information line should exist with superior personnel.

2.4.5. Preventive Maintenance Activities

Preventive maintenance activities refer to the various actions interlinked or coordinated to achieve a specified objective, either to maintain a machine in its original state or restore a machine from a bad, non-functional state to a good, working state. Many activities make up the preventive maintenance process, and they are as follows;

- **Inspections**

It refers to looking for damage, alignment, leaks, and cracks. All of which indicates either an equipment element has failed or is about to fail. Some inspections may include measuring and monitoring wear or degradation of performance while still within the operating specification. The data enables the team to predict the appropriate time to repair, refurbish, or replace the equipment.

- **Servicing**

It may include alignment, cleaning, clearing or replacing filters, and verifying sensor operation. These are just a few examples, and each piece of equipment may require one or more periodic PM tasks.

- **Lubrication**

Lubrication includes topping off oils or other fluids and flushing and replacing the fluid at times. Advanced PM work may include analysis to determine the working condition of the equipment, nature of wear, or timing for lubrication change. The analysis may also detect contamination.

2.5 Preventive Maintenance and Printing Press

Typically used for texts, the invention of the printing press is widely regarded as one of the most influential events in the second millennium, ushering in the period of modernity. Johannes Gutenberg introduced the printing press to the West in the Holy Roman Empire around 1440. Gutenberg, a professional goldsmith, developed a way to make movable metal types with a hand mould. He also used screw presses and other technologies to make a printing system.

Printing refers to the process whereby impressions are transferred from a textured surface onto a given surface with the help of ink and pressure. There are many printing processes within the printing industry, but there are four basic printing processes: offset lithography, gravure, relief, and screen printing. However, only the offset lithography printing process will be considered for the study at hand. Offset lithography is the printing process based on the principle of the antipathy of oil and water to transfer impressions from a textured surface to a suitable substrate like paper. A typical press comprises about four sectors or stages: the feeding, the registrations, the printing, and the delivery.



A typical press house production comprises three stages: the prepress, the press, and the post-press stages, and at each stage, preventive maintenance is carried out on the machines used. But for the sake of the study, the press aspect of the whole production process, specifically the printing machine's mechanism. In order to ensure a smooth running of the press, it is always advisable to consider preventive maintenance activities. Some preventive maintenance schedules are carried out daily at the press house, and some are carried out weekly, monthly, and yearly.

3.0 Methodology

In terms of the Research Design, the study employed mixed-method descriptive and quantitative research approaches respectively. However, as regards the research methods, the questionnaire and the focus group discussion were the primary instruments for gathering the needed data from the respective study respondents. Since the study is a case study centered on Alpha and Omega Printing Press, located within the Kumasi Metropolis, the target population was the workers and customers of Alpha and Omega. A population is the entire group that you want to draw conclusions about (Bhandari, 2020). Nevertheless, in the view of Creswell 2012, a population is a group of individuals who have the same characteristic. A sample is a subgroup of the target population that the researcher plans to study for generalizing about the target population (Creswell, 2012:12). More so, a sample is the specific group that you will collect data from. The size of the sample is always less than the total size of the population (Bhandari, 2020). The researchers adopted the random sampling procedure, which falls under the probability sampling process. With the random sampling method, all elements within the population were given an equal chance of being selected to answer the questionnaire. For the second sample, which represents the customers of the press house, the researchers used the convenience sampling method, which falls under the non-probability sampling method. This sampling method was used because the researchers needed to find customers at the printing press's place of business to hand out the questionnaire and obtain accurate statistical data on respondents' perceptions. The questionnaire was composed of closed-ended and open-ended questions derived from the objectives of this study. Two sets of questionnaires were used for the study: one was meant for the workers (machine minders or operators), and the other was meant for the press's customers. The questionnaire that was administered to the customers contains some questions that helped establish that Alpha and Omega Printing Press produces quality printouts that meet customers' expectations. The other questionnaire administered to the 11 workers aimed to establish that Alpha and Omega Press practices an excellent preventive maintenance schedule. The other set asked questions about the quality of the press output or the preventive maintenance practices of the press activities.

Furthermore, including the focus group as a data-gathering instrument was vital to the study. It requires grouping people linked to a topic to be discussed through experience or knowledge. Thus, a focus group of 31 people was selected because those respondents had been to Alpha and Omega Press before and had the opportunity to examine their printouts.



Validity of a research instrument assesses the extent to which the instrument measures what it is designed to measure (Robson, 2011). It is the degree to which the results are truthful. So that it requires research instrument (questionnaire) to correctly measure the concepts under the study (Pallant, 2011). Questions to be discussed concerning the study topic were drafted in a questionnaire format with both open and closed-ended questions embedded. Thirty-one questionnaires were given to the respondents, and ample time was given to respond to them appropriately and in the presence of the researchers. Prior to the administering the questionnaire the researchers carried out pilot testing to identify any flaws in them to reduce measurement errors and test for consistency. A statistical calculation of the outcome of the data was performed with the help of suitable computer software, Microsoft Word, Tables and Graphs to represent the information. Responses to the questionnaire sent out were 100% retrieved.

4.1 Results and Discussion of Findings

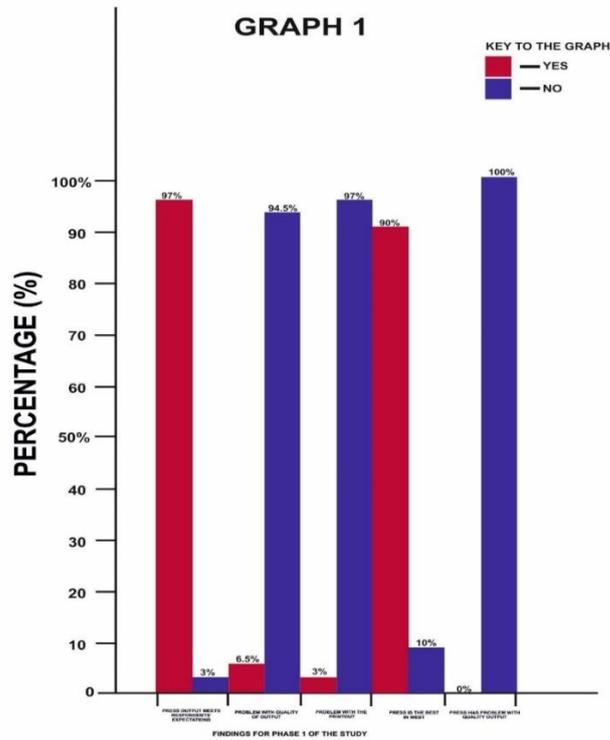
This section presents analysis and findings concerning the study's objectives: to establish a link between preventive maintenance and the quality of output at the press house; and, secondly, to investigate the impact of preventive maintenance on the press production process at Alpha and Omega Press.

4.2 Presentation of Findings

The presentation of the study's findings was based on the questionnaires administered to the press workers as mentioned above and the questionnaires given to the respondents that took part in the focus group discussion concerning the problem mentioned above. The study's findings have been presented in two folds, the first phase of the presentation represents the outcome of the focus group discussion, and the second phase represents the outcome of the questionnaires administered to the workers of Alpha and Omega Printing Press.

4.2.1 Findings for Phase 1 of the Study

During Phase 1 of this study, 31 questionnaires were administered. Below is the respondents' outcome of the questions that were asked about whether the press output meets their expectations.



Findings for Phase 1 of the Study
Source: Researchers' Field Survey, 2021

Graph 1 shows respondents' responses about how the press house's printout meets their expectations. Out of the 31 respondents, 30(97%) of the total respondents, are of the view that the press output meets their expectations, while one person (3%) is of the view that the press output does not meet their expectations. Based on this outcome, the researchers believe that when it comes to meeting the expectations of the clients or customers, they are always at their peak.

Nonetheless, Graph 1 shows the respondents' responses, whether they have a problem with their printed works about the quality of the printout or not.

The second item in Graph 1 shows respondents' responses to the problems associated with their printed works and quality standards. From the second item in Graph 1, it was realised that 2(6.5%) of the respondents believe that they have problems with the printout in relation to the quality of the printout. However, 29(93.5%) respondents' observed that they do not have any problems with their printouts due to the quality output of the press house. This assertion demonstrates that Alpha and Omega Press always considers its customers' high expectations and produces works that meet those standards.

The third item on Graph 1 shows the respondents' responses to their exact problems with their printout.

The third item shows the respondents' problems with the press house's output quality. This item also represents a follow-up question to item No. 2, which shows the number of respondents who have problems concerning quality printouts. As regards the views from the two respondents who said they had problems with the printout from the press house, one was of the view that the printout sometimes contains a ghosting effect, which is a printing mistake whereby an impression is repeated on the same substrate, but one appears pale, giving the complete printout a ghostlike effect. Nevertheless, the second person could not pinpoint the problem associated with the printout.

The fourth item on the graph shows the respondents' responses, whether they agree or disagree with the statement that Alpha and Omega Press is the best in the Ashanti region.

The fourth item represents respondents' ideas on the issue of whether Alpha and Omega Press is the best in the Ashanti Region. In connection with the table, 3(10%) of the respondents believe Alpha and Omega Printing Press is not the best printing press in the Ashanti Region. On the other hand, 28(90%) of the respondents believe Alpha and Omega Printing Press is the best press house amongst the others within the Ashanti Region. From Table 4.4, it can be deduced that Alpha and Omega Printing Press, as regards printing quality, is the best in the Ashanti Region.

The fifth item shows the number of respondents who think the Alpha and Omega Printing press has problems with quality output.

The fifth item shows the respondents' views on the statement, "Does Alpha and Omega Press have problems with the quality of output?" None of the respondents agreed with the statement, which shows that Alpha and Omega Press is one of the best press houses regarding quality production. 31(100%) of the total respondents answered "no" to the statement. These responses from respondents are thought to be based on their experiences printing their works at the Alpha and Omega Printing Press.

Table 4.1 below shows why the above-stated press is considered the best in the Ashanti Region.

Table 4.1: Reasons why Alpha and Omega Press is the best in the Ashanti region

Response	Frequency	Percentage (%)
Quality Output	25	81
Time Consciousness	2	6
Good customer relation	1	3
Incomplete	3	10
Total	31	100

Source: Researchers' Field Survey, 2021

Table 4.1 above shows why some respondents agree that Alpha and Omega Printing Press is the best in the Ashanti Region. 25(81%) of the respondents hold the view that Alpha and Omega Printing Press is considered the best in the Ashanti because of its quality output, and 2 (6%) of the respondents are of the view that because the above press house is time conscious and deadline-conscious, they are regarded as the best in the Ashanti region. One-third (3 out of 3) of respondents believe the press office has a good relationship, that is why they are regarded as the best in the Ashanti region. In addition, 3(10%) showcased that the questionnaire was unanswered.

Table 4.2 below shows the motivating factors for printing at Alpha and Omega Printing Press.

Table 4.2: Motivating factor for printing at Alpha and Omega Press

Response	Frequency	Percentage (%)
Quality Output	14	45
Time Consciousness	2	7
Good customer relation	6	19
Moderate Pricing	9	29
Total	31	100

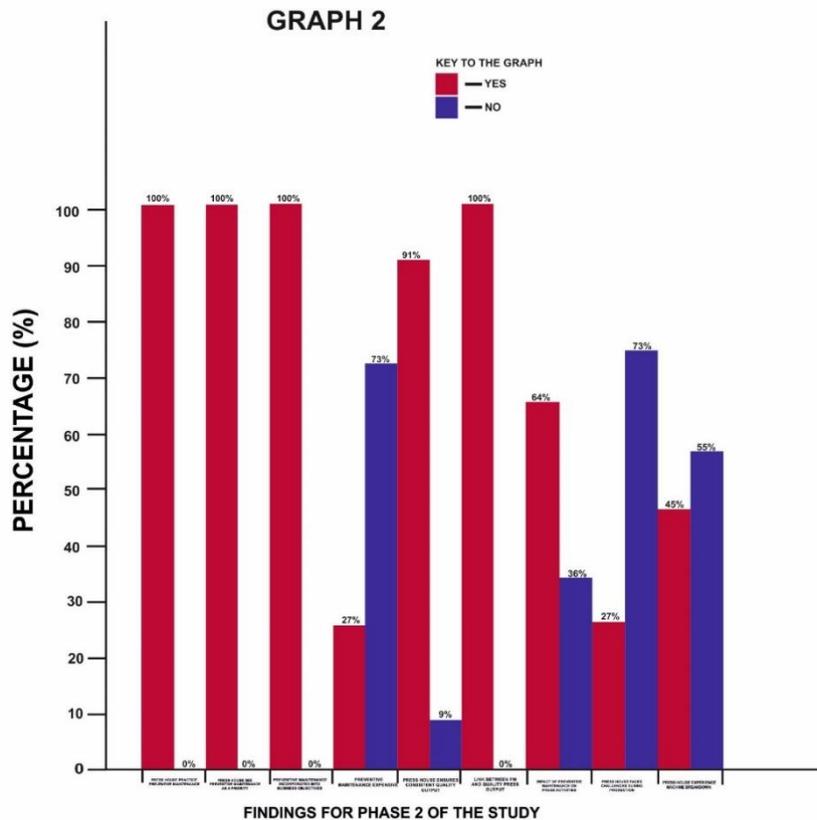
Source: Researchers' Field Survey, 2021

Table 4.2 shows the motivating factors that make them print their works at Alpha and Omega Printing Press. Nevertheless, 14(45%) of the respondents trust that the quality output of Alpha and Omega Press always motivated them to print at their press. More so, 2(7%) of the total population of respondents are of the view that because the press mentioned above house is time conscious, they always want to do business with them. On the other hand, 6(19%) of the respondents are motivated by their quality customer relation they exhibit at the premises. As stated by 9(29%) respondents, moderate pricing was the motivating factor for working with Alpha and Omega Printing Press. These responses implied that customers of the press are confident that whenever they send their works to the press, they will be satisfied with the final outlook of their jobs.

4.2.1 Findings for Phase 2 of the Study

During the second phase of the study, the company's employees became the respondents to the second set of the questionnaire. The respondents used were those workers that were directly related to the machines used during the print production process. A total of 11 questionnaires were administered to the respondents, and below is the outcome of the questions that were asked;

Graph 2 shows the respondents' opinions about whether the press house practices preventive maintenance.



Source: Researchers' Field Survey, 2021

Item 1 on Graph 2 shows the press house employees' response, whether they practice preventive maintenance or not.

All 11 respondents believe the press house practices preventive maintenance on the printing machines. This represents all of the respondents. These figures from the table prompted the researcher to believe that something special about preventive maintenance makes the press house put some of its resources into such an activity.

Item 2 on Graph 2 shows the respondents' opinions if the press house prioritises preventive maintenance.

Item 2 on Graph 2 represents the feedback received from the employees of the press house on the issue of preventive maintenance being the press house's number one priority. All the 11 (100%) respondents accepted as true that the press house sees preventive maintenance as the number one priority. This indicates that the Press Manager or the Machine Operator is constantly conscious of the regular preventive and maintenance of the machines being used daily.

Item 3 on Graph 2 shows the respondents' opinions if the press house has preventive maintenance schedules incorporated into the company's objectives.

Item 3 on Graph 2 represents the feedback received from the employees of the press house on the issue of preventive maintenance schedules being incorporated by the press house as part of the business objectives. All 11(100%) respondents believe that the press house has incorporated preventive maintenance schedules into the press house's business objectives. The 11 respondents represent the total number of respondents, which means no one disagreed with the statement. This implies that the press house's preventive maintenance is part of the press's core values to meet their clients' overwhelming patronage.

Item 4 on Graph 2 shows the respondents' opinions on whether the preventive maintenance process is more expensive than corrective maintenance.

Item 4 on Graph 2 represents the employees' views of the above-stated press house regarding whether preventive maintenance is more expensive than corrective maintenance. From the table, it was noticed that 3(27%) believe that preventive maintenance is expensive compared to corrective maintenance. The rest of the respondents 8(73%) believe preventive maintenance is less expensive than corrective maintenance.

Item 5 on Graph 2 shows the respondents' opinions if the press house can ensure the consistency of quality output.

From Item 5 on Graph 2, out of 11 respondents that were questioned on the issue of the press being able to ensure consistent quality output, 10(91%) of the population were of the view that the press can ensure consistent quality output, while 1(9%) of the respondents were of the view that the press house stated above cannot ensure the consistent quality output.

Item 6 on Graph 2 shows what people think about whether or not press preventive maintenance and press house quality output are linked.

Item 6 on Graph 2 above shows the number of employees within the press house that agree that there is a link or relation between preventive maintenance and quality press output. All 11(100%) agree that there is a link between the preventive maintenance practices of a press house and the quality of the output of the same press house.

Item 7 on Graph 2 below shows the opinions of the employees of the Press House on whether preventive maintenance can affect press activities or not.

Item 7 on Graph 2 shows the respondents' response to the questionnaire on the issue of the potency of preventive maintenance affecting the press activities within the press house. Nonetheless, 4 (36%) of the respondents do not believe preventive maintenance can affect press activities. Nonetheless, 7(64%) agreed that preventive maintenance has the potency to affect press activities, whether positively or negatively. This makes the researchers believe there is a link between the press flow of activities and preventive maintenance on the various machines used for production.

Item 8 in Graph 2 below shows the respondents' opinions on whether the press house they work with faces challenges during the press production process.

From item 8, Graph 2 shows the response of the employee of the press house. Out of the 11 respondents, 3(27%) think the press house faces some challenges when it comes to the production process of the press house. Nevertheless, 8(73%) believe that the press house does not have any problems or does not face any challenges in the press production process. The feedback from the questionnaires hinted to the researcher that there might be something good and impactful about carrying out preventive maintenance on the printing, which has reduced the machines' failure rate.

Item 9 on Graph 2 below represents the feedback received by the researcher about the question, "Does Alpha and Omega Press experience machine break down?"

Item 9 on Graph 2 shows the employee's response to whether the press house experience machine breaks down or not. Of the 11 respondents, 5 of the respondents, representing 45%, believe that the press house does experience machine breakdown during the production process, while 6 of the respondents also believe that the press house does not experience machine breakdown. The feedback points out that the press house might have experienced a machine breakdown, but the question is, how often does that problem occur? A good preventive maintenance schedule can tell if a machine will not work during production.

Table 4.3 below shows why the above-stated press house practice preventive maintenance on the printing machines.

Table 4.3: Reasons for Preventive Maintenance

Response	Frequency	Percentage (%)
Quality output of the press	6	55
Constant functioning of machines	3	27
No Idea	2	18
Total	11	100

Source: Researchers' Field Survey, 2021

Table 4.3 shows why the press house does not practice preventive maintenance. Out of the 11 respondents, 6(55%) trust that the press practices preventive maintenance to ensure quality output from the printing machine. However, 3(27%) are certain that the press house practices preventive maintenance because it ensures the constant functioning of the printing machines. However, 2(18%) were grouped with those who responded that they had no idea about the item.

Table 4.4 below shows the opinions of the respondents or the employees of the company on how the company ensures consistent quality output. Below are the various measures put in place by the press house.

Table 4.4: Measures to Ensure Consistent Quality Press Output

Measures	Frequency	Percentage (%)
Strict Supervision	1	9
Constant Maintenance of Printing Machines	7	64
No Idea	3	27
Total	11	100

Source: Researchers' Field Survey, 2021

Table 4.4 represents measures the press house takes to ensure consistent quality output. One (9%) of the respondents believed that the press house ensures consistent quality output through strict supervision. 7(64%) believe that the press ensures consistent quality output through the constant maintenance of the printing machines. Nonetheless, 3(27%) of the respondents provided 'No Idea' answers to the questionnaires.

Table 4.5 below shows the respondents' opinions about how preventive maintenance on printing machines affects press activities.

Table 4.5: Effect of Preventive Maintenance on Press Activities

Effect	Frequency	Percentage (%)
Consistent Running of Printing Machines and quality	6	55
No idea	5	45
Total	11	100

Source: Researchers' Field Survey, 2021

Table 4.5 above shows the respondents' response to how preventive maintenance affects the press activities within the press mentioned above the house. The feedback received from the respondents is as follows: 6(55%) believe that preventive maintenance, when carried out regularly, ensures the consistent running of the printing machines, and the quality of the press house will also be ensured. The remaining 5(100%) claimed they had no idea. It could mean that respondents had little or no knowledge about the item.

Table 4.6 below shows the responses of employees of the company and the challenges the press house faces during the production process.

Table 4.6: Challenges Faced During Production

Challenges	Frequency	Percentage (%)
Component of machine failure	2	18
Component of machine do not fail	9	82
Total	11	100

Source: Researchers' Field Survey, 2021

Table 4.6 represents some of the press house's challenges during production. On the table, it is captured as incomplete or irrelevant. Out of the 3 respondents who answered in Table 4.19, the press house faces challenges during production—listed some of the challenges demanded by the questionnaire. Two of the three respondents said that during production, the components of some components or parts of the printing machines failed to function, which means only 18% of the total population of respondents. However, the remaining 9(82%) believe that the press house does not face any challenges during the production process.

4.3 Discussion of Findings

This section discusses the study's findings based on the results. The discussions are based on the research objectives formulated earlier. The study's objectives are two: The first part is discussed based on establishing a link between preventive maintenance and the quality output of the press house. The second part delves deeper into preventive maintenance's impact on the press production process.

4.3.1 Establishing a Link between Preventive Maintenance and Quality Press Output

The study's primary objective was to establish a link between preventive maintenance carried out on printing machines and the quality of output of the printing machine and the press house. In order to establish this link, the researcher identified a press house within the geographical scope of the study. The basis for selecting Alpha and Omega Printing Press was the consistent quality output of the press house. This was the researchers' ideology, which was based on a careful observation made during a number of visitations, but to make the basis more ethical and factual, a questionnaire was drafted and administered to a focus group. Questions that were asked during the focus group discussion were geared towards establishing that when it comes to the quality of press output within the Ashanti region, Alpha and Omega Printing Press is the best amongst the rest. The basis for selecting the members for the focus group discussion was whether the person had been to the press house before, had seen their printout before, if the person was into the printing media as a means of communication, and if the person had little knowledge of press quality printouts. The outcome of the focus group discussion was presented in a series of graphs and tables above.

Item 1 on Graph 1 represents the response of the members that participated in the focus group discussion on whether the output of the press mentioned above house meets their expectations. 30 respondents out of 31 believe that the output meets their expectations. Looking at the statement made by Juran in his handbook on quality control, 'Quality means those features of products which meet the consumer's needs and thereby provide consumer satisfaction' (Juran, 1988).

Based on this statement and the outcome of Item 1 on Graph 1, it is clear that the members of the focus group discussion were pleased with the press house's output, implying that the press



house produces high-quality works or printouts that meet the expectations of their clients or customers.

In addition, Item 2 on Graph 1 shows the feedback received from the members regarding whether they have problems with printouts from Alpha and Omega Press, 29(93.5%), are of the view that they do not have any problems with the press output of the press mentioned above. The figures in Item 2 on Graph 1 also attest that the above press house is the best for the printout's quality. The reason has been that the customers of the press house do not have problems with the press house's output, which means customer satisfaction is achieved. Tables 4.1 and 4.2 show the participants' responses if it is possible to consider Alpha and Omega Printing Press as the best in the Ashanti Region and the reasons for that consideration. Furthermore, 28(90%) said the press house could be considered the best in the Ashanti region. From Table 4.2, the reasons for the consideration were as follows: 25 of the participants said that the press house produces quality printouts; 2 of the participants were of the view that the press house meet deadline and are time-conscious; and lastly, 1 participant assumed that the press house has good customer relations. Based on the reasons for consideration and the above attributes, the researchers could deduce that the Alpha and Omega press is rated high in terms of quality printing output.

The ISO (9000) definition of quality states that the totality of features and characteristics of a product or a service bears the ability to satisfy implied needs. The definition implies that a product can be considered quality or service can be considered quality when it meets customers' expectations, and Items 1 and 2 show that the press output is the best in the Ashanti region. After establishing that the above-mentioned press house is the best for quality press output, the next thing was the facts that show the link between the quality of the press output and preventive maintenance of the press machines.

The study's second phase required gathering data on the above-mentioned press houses concerning preventive maintenance practices. Nonetheless, Graph 2 and Tables (put number) show the feedback received from Alpha and Omega Printing Press employees.

The figures from Item 1 on Graph 2 show the feedback received from the employees of the press house about the statement if the press house practices preventive maintenance on the printing machines. Item 2 on Graph 2 shows the employees' views on whether the press house sees preventive maintenance as a priority or not. Of the 11 employees that the questionnaires were administered to, all of the 11 employees believed the press house practices preventive maintenance. Their reason for practicing preventive maintenance on the printing machines is presented in Table 4.3. From Table 4.3, out of 11 respondents, 6 of the employees are of the view that in order for the press house to ensure consistent quality output of the printing machines, that is why they practice preventive maintenance, and 3 of the remaining respondents also believe the reason why the press house practices preventive maintenance on the printing



machines is to ensure the constant running of the machines. Their reasons, gathered from their answers to the questionnaires, show the importance of preventive maintenance, as highlighted in an article by Valvan Baling System (2015).

From Item 2 on Graph 2, all the questionnaires were administered; employees agreed that the press house takes preventive maintenance as a priority.

Item 3 on Graph 2 was also considered. The figures in Graph 2 show the employees' responses to whether the press house has incorporated the preventive maintenance schedule into their business objectives. The outcome was that all the respondents agreed that the press house had incorporated preventive maintenance schedules into the business objectives of the press house. However, there is a situation that baffles the researcher's mind even though some of the workers believe preventive maintenance is expensive per Item 4 on Graph 2 but has still been incorporated into the company's objectives.

According to Simoes et al. (2011), preventive maintenance is realised from two perspectives: the managerial and the operational. The managerial perspective refers to the support for decision-making that facilitates data analysis (Soderholm et al., 2007).

These two statements about preventive maintenance show that for it to be effective, it should be a collaborative effort between the managerial aspect of the press house and the operational aspect of the press house.

Miller (1996) stated that total quality management is an ongoing process where top management makes whatever essential steps to enable everyone in the organisation in the course of performing all duties to establish and achieve standards that meet or exceed the needs and expectations of their customers, both, external and internal.

Based on Miller's statement, the researchers believe that preventive maintenance is a top management function of the press mentioned above to ensure that the quality standards of its customers will be met and hence achieve customer satisfaction. Item 6 on Graph 2 and Table 4.4 shows the employees' responses to whether there is a link between preventive maintenance and press quality output and what the press does to ensure consistent quality output, respectively. From Item 6 on Graph 2, 11 respondents believe there is a link between quality press output and press preventive maintenance. A follow-up question was asked about how the press ensures consistent quality output. The responses of the employees are displayed in Table 4.4. From Table 4.4, 7(64%) of the employees believe that constant maintenance of printing machines ensures consistent quality press output. As stated by one of the employees, strict supervision was another way the press house could maintain or ensure consistent quality press output. This outcome attests to the statement made by Miller (1996) on total quality management.

The researchers believe that because the management of Alpha and Omega Press has noticed an excellent Preventive Maintenance practice on the print machines will ensure consistent quality press output. Due to this, the management and the workers, even though preventive maintenance is expensive, still have incorporated their schedules into the company's objectives, as stated in Item 3 on Graph 2. The press house has also noticed the relation between press quality output and the printing machine's maintenance. That is why they have considered Preventive Maintenance as the number one priority, as shown in Item 2 on Graph 2.

4.3.2 Impact of Preventive Maintenance on Press Activities

This section of the discussion aims to bring to bear the impact of preventive maintenance on Alpha and Omega press activities. The key to any success in the production process is the constant care of the machines used in the production process. Effective preventive maintenance will preclude any significant problems with the printing machines and maximise the press house's output. In order to make the discussion more factual, specific tables were taken into consideration.

The impact of preventive maintenance can be both positive and negative. Frequent preventive maintenance on press machines will reduce the output of the press house since the whole process takes time and generates additional costs for the press house. Also, too infrequent preventive maintenance on printing machines will lead to a fall in the efficiency of the machines and reduce productivity at the press house. However, a timely preventive maintenance schedule on the press has the potential to maximise machine efficiency and quality output at the press house.

Table 4.3 is the response of the employees to the reason why they perform preventive maintenance on the printing machines.

From Table 4.3, out of 11 respondents, 6(55%) of the employees that partook in the study, said the reason for practicing preventive maintenance is to ensure the quality output from the press, while the other 3 are of the view that it ensures the consistent running of the machines.

Preventive maintenance plays an important role in avoiding or mitigating potential stoppages and disrupting equipment or machinery from occurring in daily operations. To achieve desired manufacturing performance, ability, dependability, and effective maintenance management are required (Lazim, 2016). This statement made by Lazim shows that preventive maintenance impacts the press activities because it will ensure the smooth running of the machines, as stated by 3 employees of Alpha and Omega press as presented in Table 4.3.

In manufacturing systems, preventive maintenance plays a fundamental role in keeping and improving the operational condition of machines and the output product quality Angius et al., (2017). Item 4 on Graph 2 shows the employees' response concerning the potency of preventive



maintenance on the press to ensure consistent quality output. 10 out of the 11 employees believe that preventive maintenance on the press can ensure consistent quality output.

Upon the analysis of the questionnaires that the company's employees answered, the researchers deduced that there are many ways preventive maintenance can positively impact press output. From Table 4.3, it was noticed that preventive maintenance ensures the consistent quality of output and constant running or function of the printing machines. Item 8 on Graph 2 also shows that good preventive maintenance on the printing machines will reduce the challenges the press will face during the production process and reduce the rate at which the press will experience machine breakdown during the press production process, as shown in Item 9 on Graph 2.

4.4 Implication to the Research and Practice

The findings of this study should help other printing owners, machine minders, printers and all others who matter in the printing industry to prioritise their preventive maintenance schedules for optimal printouts at all times.

5.1 Conclusion

Preventive maintenance of the printing machines positively impacts the printing machines and the press production process. It ensures the printing machines' continuous functionality and consistent quality press output. Angius et al. (2017) In addition, looking at the feedback received from the respondents, the researchers believe that because Alpha and Omega Press practices preventive maintenance on their printing machines, they are known to be the best in the Ashanti region. Preventive maintenance on the printing machines keeps them in good condition and reduces their failure rate. This establishes the relationship of the printing machines' preventive maintenance with the quality of press output. Lastly, in today's market of decreasing profit margins, it is essential to establish a press maintenance schedule and follow it thoroughly. An initial two to four months without following a maintenance schedule may not show many problems. However, after this, if a maintenance programme is not followed, the downtime costs and excess paper waste due to repairs will far outweigh the costs of a good maintenance programme.



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