Effects of computerised maintenance management systems on performance of selected manufacturing companies in Enugu state, Nigeria

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ABSTRACT

This study assessed the effects of computerised maintenance management systems (CMMS) on the performance of manufacturing companies in Enugu State, Nigeria. This paper was based on two research questions and two research hypotheses to guide this study in other to achieve the research objectives. The study was purposively done by sampling five manufacturing companies from Enugu State. Data were collected through questionnaire, data collected were analysed using descriptive analysis tools such as frequency, percentages and weighted average, while the hypotheses statement were tested using Pearson product moment of correlation analysis. The results of the analysis show that manufacturing industries in Enugu State have not fully integrated their firm with computerisation and it has not enhanced the procurement downtime of machine parts. Also, none of the five manufacturing companies sampled uses an automated or computerised system for the acquisition of materials. However, most of the manufacturing companies are using a computerised recording system, and CMMS was found significantly influencing the working efficiency of their equipment and machines (at 0.801 and sig value = 0.034). Also, it was established that the adoption of computerised maintenance management system significantly affects the performance of manufacturing companies in Enugu State (at 0.891 and sig value = 0.003). The study recommends for full integration of CMMS as well as designing the organisational structure in a way to welcome integration of computerised maintenance management system.

Keywords: system, maintenance, management, computerised, performance

1. INTRODUCTION

The era we live in is a time of great change where most daily activities and business process run on computers and information technology. Therefore an organisation can either get computerised (when its operations are digital) or deformed (if it is still running its processes manually) (Monday, 2014). Organisations will have to assimilate masses of data and convert that data into information, to form conclusions about that information and make critical decisions leading to the achievement of business objectives and decision-making (Reddy, Srinivasu, Rikkula, & Rao, 2009). Thus, for an organisation, being fully computerised is as important; it is essential for the survival of the enterprise and gives the company a competitive edge (Nowduri, 2012). All organisations, firms, and corporations need to run maintenance of their facilities at different points, running necessary support when needed helps optimise the organisation’s output and performance in general (Fawzi, 2013). The support and maintenance of organisational machines and devices can be run using enterprise systems or maintenance support systems.

The Computerised Maintenance Management Systems (CMMS) is one of the enterprise systems that can be deployed in firms for systems upkeep. It has now become one of the means of enhancing and optimising the efficient running and maintenance of organisations’ equipment. Maintenance management directly involves managing the control of maintenance activities (Olumoye, 2013). Availability is the function of a good support system; this means that any item demanded by the production team will always get to them in time. A good maintenance management system makes machines and facilities available and running.

In the manufacturing companies of today issues that involve the installation and maintenance of facilities, day-to-day running of the manufacturing operations in the factory cause problems and leads to incurring unplanned costs (Alaa, 2015). Therefore, the need to see all these issues sorted out is a recurring decimal in the management of these organisations.

Aggressive, efficient use of information technology is the core business strategy; for this reason, the use of an enterprise solution (Enterprise solutions: enterprise software or enterprise application software (EAS) are computer software used to run the processes of an organisation. Examples are SAP, Oracle etc.) like CMMS has emerged as the core of successful information management, and the enterprise backbone of many organisations. CMMS is designed on the premise that all critical information and maintenance will be integrated into a unified database (Brous, 2012; Al-Hammad, 2011). However, in practice, things have worked differently for various manufacturing companies, and there have been many studies on CMMS. Al-Hammad (2011) investigated challenges facing CMMS systems implementation in Kenya. Beni (2014) evaluated the successful implementation of CMMS at National Iranian Gas Company. These studies have largely focused on previous success factors of implementation. Noor & Md Azree (2014) did a study which revealed that CMMS approach is a necessary investment that institutions need to implement to remain competitive. Based on the above research works and other literature that was reviewed, no substantive research has been done geared towards the effects of CMMS in the performance of manufacturing companies in Enugu State, Nigeria thus the need for this research.

Objectives of the Study

This research was conducted with the following objectives:
To evaluate the extent to which CMMS affects the performance of manufacturing firms in planning and management of organisations’ equipment and facilities maintenance to avoid outright breakdown of the system

To evaluate the extent to which CMMS affects the manufacturing firms in the area of proper recording of the activities of each manufacturing unit which includes but not limited to procurement, work scheduling and reporting of work orders which should be available for management scrutiny.

2. LITERATURE REVIEW

The Concept of Maintenance Management

Maintenance management involves inspecting, servicing and maintaining the existing facilities and equipment, their modification and installation, storekeeping and workforce administration (Bagadia, 2006). The maintenance department of every organisation handles the responsibility of keeping the maintenance cost per production of an item as small as possible while maintaining high product quality. Adequate maintenance reduces downtime of equipment and eliminates the cost of corrective maintenance (Noor & Md Azree, 2014). Dhillon (2002) explains that maintenance management provides sufficient information and support to the organisation on equipment in line with the responsibilities of the maintenance department.

Bagadia (2006) stated the following simple steps for maintenance management; request, approval, plan, schedule, work performance, data recording, accounting for costs, management information development, updating equipment history and providing management control reports. The following reviews briefly the events that occur during each of these steps.

- **Request:** Requests to perform maintenance work are communicated verbally, manual writing, e-mails, etc.
- **Approval:** occurs at the supervisory level, in some organisations maintenance supervisors often handle simple jobs (small expenditures); while significant expenses require approvals from several levels of management.
- **Plan:** Ensure resources are available (material, labour, tools, equipment, etc.). The planning step can take many forms.

In line with the steps Bagadia (2006) also stated the following policies and procedures as used for maintenance support objectives, they are:

- **Maintenance schedule:** No maintenance scheduling can be 100% efficient, unforeseen equipment breakdowns and work requests will reduce the efficiency of the schedule (Brous, 2012). The best support system in an organisation will achieve about 70-90% efficiency while the most efficient scheduling program will have a lead time of 16-72 hours. When there is less time allotted the maintenance will be inefficient and more time will usually be needed due to emergency work requests.
- **Work requests:** considers the steps to initiate work requests and to have assigned priority ratings. These could be preventive maintenance work requests or emergency (unplanned) maintenance work requests (Bagadia, 2006).
- **Workforce controls:** The policies and procedures indicate the type of workforce needed to carry out any given job to know if we should use direct labours or outsource (Kris, 1987; Olabanji, Gonese, & Tafadzwa, 2014).
- **Maintenance controls:** These are on paper in line with the standardised communication forms for reporting process for management personnel. The policy also states ways of controlling maintenance costs in the organisation (Bagadia, 2006).

Inspite of the policies and procedures of maintenance management support objectives Bagadia (2006) stated that there are still significant problems that occur in organisations in maintenance management some of which are:

- **Lack of maintenance management models:** There is a lack of models that could improve the understanding of the underlying dimensions of support. Support is somewhat “underdeveloped” with a lack of effective prevention methodologies and the integration of said methods in manufacturing companies (Alexander, 1996; Ali & Younes, 2013).
- **Broad diversification of maintenance problems:** Maintenance is composed of a set of activities for which it is tough to find procedures and information support systems in one place to ease the improvement process of high-level variety in the technology used to manufacture the product(Kris, 1987). It also occurs in businesses within the same productive sector; hence, it has been difficult to design an efficient methodology of general applicability.
- **Lack of plant/process knowledge and data:** These are the primary constraints experienced by managers, supervisors, and operators in implementing suitable policies for maintenance (Alexander, 1996; Nowduri, 2012).
- **Time constraints:** Many managers do not have the required time to carry out proper maintenance problems analysis. Day to day actions and decision-making activities distract them from these fundamental activities to improve support.
- **The paucity of top management support:** there is little or no leadership to foster maintenance improvement programs, and fear of an increase in production disruptions are other common causes of maintenance under-development in organisations.
• **The implementation of advanced manufacturing technologies**: Within the last two decades the nature of the production environment has continuously changed as a result of the application of advanced manufacturing technologies and just-in-time production systems (Chungi & Bakar, 2001). This change has allowed many companies to manufacture products massively in a highly efficient and customised way. Although, the growth in automation and the decrease in buffers of inventory in the factory plants have undoubtedly put more pressure on the maintenance system because the disruption to production flows can quickly become costly by rapidly disrupting a significant portion of the operation. In highly automated plants, the limitations of computer controls, the integrated nature of the equipment, and the increased knowledge requirements make it harder to diagnose and solve hardware problems. These challenges make maintenance crucial to operations management to stay productive and be profitable. When human intervention in this highly automated environment is required, the problems are usually complex and challenging to solve.

• **Environmental factors and critical safety**: In addition to technology and process-related issues previously mentioned new and more significant safety and environmental considerations such as emerging regulations put pressure on a maintenance manager and add complexity to his job function. The management of every organisation must have to pay attention to the safety and environmental factors within the organisation in order to make the best out of their business.

**Maintenance Management System (MMS)**

Maintenance Management Systems (MMS) are designed to optimise the management of deferred maintenance and capital improvement activities throughout the service of the equipment in the organisation. The maintenance and capital improvement are achieved by using standardised procedures to document, prioritise field facility, equipment, needs and report accomplishments (Beni, 2014). Bagadia (2006) stated that MMS is a management tool for planning and budgeting deferred maintenance, capital improvement, equipment repair, replacement, and building projects. The MMS documentation starts at the ground level with the identification of capital improvement, deferred maintenance, construction, equipment replacement, installation and repair needs by field station managers (Kris, 1987; Dhillon, 2002). The system involves the writing of reports that show maintenance inputs in various ways such as by maintenance codes, by equipment and facility category, by priorities, by project cost estimates, and by project expenditures. The Service must show documentation of all deferred maintenance and construction of appropriation projects in the MMS before they are eligible for funding. The MMS aims to streamline the vast maintenance information system to improve the productivity of a factory/plant. A good MMS makes equipment and facilities available (Magbagbeola & Arogundade, 2011). The fundamental steps of maintenance management program in Figure 1 shows how maintenance routines are generated and run in organisations.

![Maintenance Management Flowchart](image)

**Computerised Maintenance Management Systems (CMMS)**

Brous (2012) defined CMMS as an application software designed to assist in the planning, management, and administrative procedures required for efficient maintenance. It is used to optimise maintenance for complex plants, which develops processes and functional models that are useful for analysing other plants with small modifications (Beni, 2014). Many of maintenance management and administrative procedures which used to be manual can be done automatically with a computer using CMMS software. The maintenance-related data can be typed directly into the computer (Ensour & Alinizi, 2014) rather than written on paper.
and reports can be generated on demand by computer or automatically rather than manually sorted and typewritten. According to Al-Hammad (2011), a good CMMS should have the following objectives:

- Maintenance of existing equipment by reducing equipment downtime and maximising the operating life of the equipment
- Inspection and service of equipment by executing the preventive maintenance work within the constraints of production schedules
- Installation or major refurbishing of the equipment
- Support store keeping by minimising spare parts inventory
- Craft administration by reducing the productivity of the workforce.

In achieving the above objectives, a maintenance manager requires a substantial amount of timely information. In manual systems, many support staff is needed to collect and present the need information through excessive paperwork.

**Functions of CMMS**

CMMS automate most of the logistical functions performed by maintenance staff and management. CMMS come with many options and have many advantages over manual maintenance tracking systems (Bagadia, 2006). Depending on how complex the chosen systems are, typical CMMS functions may include but not limited to the following (Al-Hammad, 2011):

1. Work order generation, prioritisation, and tracking of equipment/component.
2. Historical tracking of all work orders generated which become sort-able by equipment, date, person responding.
3. It is used to track both unscheduled and scheduled maintenance activities.
4. It stores maintenance procedures as well as all warranty information by parts.
5. CMMS stores all technical procedures or documentation by components.
6. It provides real-time reports of operations and ongoing work activities.
7. It is used in preventive maintenance for run-time- or calendar-based work order generation.
8. Automatic recorders are used to complete parts and materials inventory control.
9. Personal Digital Assistant (PDA) interface to streamline input and work order generation.
10. Outside service call/dispatch capabilities.

**Benefits of CMMS**

CMMS eliminates paperwork and manual tracking activities; this is one of its greatest advantages, thereby ensuring the productivity of operation staff (Noor & Md Azree, 2014). The functionality of a CMMS lies in its ability to collect and store information in an easily retrievable format (Al-Hammad, 2011). Noor & Md Azree (2014) also looked at the other benefits of CMMS to include these:

1. Detection of impending problems before a failure occurs resulting in fewer failures and reduced complaints from customers.
2. It provided a higher level of operations and planned maintenance activities that enable a more efficient use of staff resources.
3. Analysis of inventory control to enable better spare parts forecasting and eliminate shortages hence minimising the inventory available.

CMMS maintains optimal performance of equipment thereby reducing downtime and increasing durability (Beni, 2014).

**CMMS Modules**

These systems are automated databases that enable an organisation to track and monitor equipment service requirements and history. The most generally used CMMS consists of two modules:

1. Equipment inventory records: this contains one file for each device; the file contains information unique to that piece of equipment, such as equipment model, serial number, installation date, facility, location, and information regarding the next maintenance inspections (Rogers, 2005).
2. Equipment maintenance and repair records: This document contains summary data on the past and ongoing maintenance and repair task run on the machine (Shaw & Haynes, 2004).

Al-Hammad (2011) stated the following as the Basic Modules in Standard CMMS:

1. Equipment/ Asset Data - Information about equipment/ assets to be maintained.
2. Inventory/ Stores Data - Information about parts, spares, and industry items.
3. Employee Data - Information about employees who will charge time to a work order, in particular, their hourly rates.
4. Work Order Processing - Creating, tracking, charging, and completing work orders.
v. Preventive Maintenance - Creating preventive maintenance plans and associating them with equipment/asset records and schedule frequencies.
vi. Planning - Planning work orders to specify who is to perform the work, materials needed instructions and other information.

vii. Scheduling - Scheduling when jobs are to be performed as well as scheduling labour to perform them.
viii. Inventory Processing - Issues, returns, replenishment, and cyclical inventory processing of parts and materials
ix. Purchase Order Processing - Purchase requests, purchase orders, and receipts of parts and materials

All systems need modules, files or functions necessary for fundamental maintenance needs. Table 1 shows main modules in standard CMMS. Some systems offer other features that are not required but certainly add value to the network. These include (Varcoe, 1993):
i. Bills of Materials - The breakdown of equipment/asset item into its parts.
ii. Bar Code Capacity - Barcode printers and readers for the part and inventory labelling, equipment/asset labelling, and work order identification.
iii. Graphics Importing - The software lets you import drawings, schematics, and other documents into the CMMS from other systems.
iv. Report Writer - A program that allows for the development of custom reports.
v. Modifiable Screens and Reports - The ability to change the layout and content of CMMS screens and reports.

Each organisation must decide, based on its needs, what the CMMS should do and how it should do it. With a large number of systems available in the marketplace, there is almost a guarantee that one of them will be fit for any given organisation (Walters, 1999; Bagadia, 2006).

Comparison of CMMS and Manual system
Beni (2014) compared the CMMS and manual or paper system with regards to how both systems generate reports as shown in Figure 2.

<table>
<thead>
<tr>
<th>Procedure Performed</th>
<th>Types of Effort Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work Order</td>
<td>CMMS</td>
</tr>
<tr>
<td>Initial Entry</td>
<td>System Compiled and Printed</td>
</tr>
<tr>
<td>Hand Compiled and Written</td>
<td>Backlog Reports</td>
</tr>
<tr>
<td>Planning &amp; Scheduling</td>
<td>System Compiled and Printed</td>
</tr>
<tr>
<td>Close Work Order</td>
<td>Hand Compiled and Printed</td>
</tr>
<tr>
<td>History Development</td>
<td>System Compiled and Printed</td>
</tr>
<tr>
<td>Management Reporting</td>
<td>System Compiled</td>
</tr>
</tbody>
</table>

Fig. 2: System Effort Required for Maintenance Work Orders CMMS vs. Manual Paper System
Source: (Al-Hammad, 2011)
Brous (2012) explained further that CMMS can also be referred to as any of the following in different organisations by different software producers:

- Enterprise Asset Management (EAM)
- Enterprise Resource Planning (ERP)
- Computerised Maintenance Management Information System (CMMIS)
- Integrated Information Management System (IIMS)

However, these CMMS packages represent a system in which the main functionality is to maintain the computer database of an organisation’s maintenance operations (Noor & Md Azree, 2014). Ideally, a CMMS is a means to achieve world-class support (Brous, 2012), it offers a platform that guides management in analysis and decision making (Beni, 2014). CMMS packages can provide management with reports and statistics, detailing performance in the major areas and highlighting problematic issues (Folkes, 1988; Bagadia, 2006). The functionality of CMMS is in its ability to collect and store data in an easily retrievable format (Alexander, 1996; Bagadia, 2006).

**Organisational Performance**

According to Hellriegel & Slocum (2008), a key motivational principle states that performance is a function of an entity’s level of ability and motivation. This formula often expresses this principle:

\[ Performance = f(ability \times motivation) \]

In line with this principle, no task can be fully performed unless the entity that is to carry it out can do so (Hellriegel & Slocum, 2008; Kamel, Lakhder, & Ammar, 2012). Regardless of an organisation’s competence, however, ability alone is not enough to ensure performance at a high level. A manufacturing organisation must also want to achieve a high degree of performance in its production; this is in line with Elger (2009), who has it, that to perform is to take actions that involve skills and knowledge to produce a good result. The performer could be one person or a group of people or even the organisation (Hellriegel & Slocum, 2008; Elger, 2009).

Alaa (2015) explains that continuous production is the focus of any organisation, and it is only through performance that organisations can exist, sustain their growth and progress. Product quality is an important variable considered in business management and arguably the most important indicator of the performance of any organisation (Gavrea, Ilies, & Stegerean, 2011). Although the concept of performance is prevalent in the academic literature, its definition is ambiguous because of its many meanings. For this reason, there is not a universally accepted definition of this concept. Initially, Georgopoulos & Tannenbaum (1957) defined performance as the extent to which organisations, viewed as a social system fulfilled their objectives. Performance evaluation during this time focused on work, people and organisational structure as the most important factors. Later, when organisations have begun to explore new ways to evaluate their performance, performance was defined as an organisation’s ability to exploit its business environment for accessing and using the limited resources (Ali & Younes, 2013; Alaa, 2015). It is in line with the description that Fawzi (2013) identified organisational objectives to be more complicated than initially considered (Uwaloma, Jimoh, & Anijesushola, 2012). Thus, managers now understand that an organisation is successful if it accomplishes its goals (effectively) using minimum resources (efficiency)(Gavrea, Ilies, & Stegerean, 2011). Also, organisational theories that followed supported the idea of an organisation that attains its performance objectives on the limitations imposed on it by the lack of resources (Lusthaus & Adrien, 1998; Fawzi, 2013). In this context, profit became one of the many indicators of performance. Lebans & Euske (2006) provided a set of definitions to illustrate the concept of performance:

- Performance is a set of financial and non-financial indicators which offer information on the degree of achievement of objectives and results in line with predetermined goals (Brophy & Wynne, 1997; Sonnentag & Frese, 2002).
- Performance is continuously changing and requires judgment and interpretation (Georgopoulos & Tannenbaum, 1957; Eboh, 2008).
- We can illustrate performance by using a virtual representation of reality to describe how current actions may affect future results (Elger, 2009).
• Performance can be seen and understood by different people from their perspective and various works of life depending on the person involved in the assessment of the organisational performance (e.g. performance can be perceived differently by a person within the corporate environment compared to one from outside) (Roelofs, 2002).

In line with the above definitions Elger (2009) defined organisational performance as the natural outcome and result, which generates reliable data on the effectiveness and efficiency of programs in the organisation (Alaa, 2015). Organisational performance to some extent can be seen to comprise of the actual output or results of an organisation as measured against its intended outputs such as goals and objectives (Yuchtman & Seashore, 1967; Gavrea, Ilies, & Stegorean, 2011). Elger (2009) opines that it is necessary for organisations to make provisions for training and development of the staff in line with today’s management commitment concept to improve employee on work skill. Also, the communication network of the organisation must be adequate to ensure that vital information gets to all their people timely to improve productivity and performance in the business (Walters, 1999; Osa & Amos, 2014).

Manufacturing Companies
Manufacturing involves the conversion of raw materials into finished goods to meet customers’ demand (Magbagbeola & Arogundade, 2011). It involves resources like machines, components, parts, and even raw materials in manufacturing (Alexander, 1996; Economy Watch, 2010). It is mainly a man-machine setup with the division of labour in a large scale production (Web Finance Inc, 2016). The manufacturing industry is a conglomerate of companies involved in the processing of raw materials and resources for the creation of new commodities and value addition (Almashaqa, 2013). The manufacturing sector usually accounts for a significant share of the industrial sector in Nigeria. The final products from manufacturing can either serve as a finished good for sale to customers or as intermediate goods used in another production process (Economy Watch, 2010).

3. METHODOLOGY

The primary data used in this research work was obtained through the use of structured questionnaires. The questionnaires were designed and distributed to the offices of the listed manufacturing companies. This study was carried out on selected manufacturing companies in Enugu State Nigeria. The choice of Enugu State was for the convenience of the researcher and the manufacturing companies were selected based on the criteria was based on performance by Enugu State Ministry of Commerce and Industry (2015). In the course of this study the following manufacturing companies were studied (Finelib, 2015):
a. Emenite Limited  
b. Innoson Group  
c. Juhel Nigeria Limited  
d. Nigerian Breweries Plc  
e. Dalex Paints

The managers or heads of maintenance units of the companies were studied, and the population of the survey is 5. The managers and relevant staff were chosen by the researcher, which was one person (in charge) from each of the companies to ensure that relevant and appropriate information that will foster the progress of this research work were obtained. Information gathered showed that each manufacturing company had a name or acronym used for their maintenance section in line with the company’s regulation.

Level of Adoption of CMMS in Sampled Firms in line with Their Activities

This aspect examines the rate of adoption of CMMS to organisation activates the results is presented in Figure 1 in respect of individual activities in the respected sampled organisations in the study area.

The results in Figure 1 revealed that few among the sampled organisations (20%) were involved in the use of the computerised application to make an order. Likewise, 20% of the sampled organisation indicated using computerised application for communicating instructions to staff. More so, the results indicated that 40% of the sampled firms used the computerised application to carry out maintenance activities. However, only 20% of the sampled organisations indicated using CMMS for keeping organisation inventory. None of the sampled organisations indicated using CMMS for the acquisition of materials. Likewise, 60% of sampled firms indicated using the computerised application to keep account of the unit. Also, the majority of firms (80%) unanimously indicated that their firms relied heavily on computerised application in the aspect of recording updating. More so, most sampled organisations (60%) expressed using the CMMS to communicate completion of tasks from units to the authorities. These results indicated that most organisations are putting CMMS into use and many of their activities are yet to be integrated with modern organisation tool (automation).

Results from Analysis of Research Questions

Research Question 1: To what extent does the planning and management of the organisations’ machines equipment maintenance help in avoiding their outright breakdown?

### Table 1 Extents at Which the Utilisation of CMMS assists Planning and Management of Organisation’s Equipment

<table>
<thead>
<tr>
<th>S/n</th>
<th>Items</th>
<th>Very High Fx (%)</th>
<th>High Fx (%)</th>
<th>Moderate Fx (%)</th>
<th>Low Fx (%)</th>
<th>Avg N=5</th>
<th>Rmk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sudden breaking down of equipment</td>
<td>0(0%)</td>
<td>1(20%)</td>
<td>2(20%)</td>
<td>3(60%)</td>
<td>1.6</td>
<td>Low</td>
</tr>
<tr>
<td>2</td>
<td>Tediumness of troubleshooting faulty equipment</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>2(40%)</td>
<td>3(60%)</td>
<td>1.4</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Amount of time waste to order for the procurement of needed maintenance part</td>
<td>0(0%)</td>
<td>3(60%)</td>
<td>2(40%)</td>
<td>0(0%)</td>
<td>2.6</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Difficulties encounters in replacing the new parts</td>
<td>1(20%)</td>
<td>2(40%)</td>
<td>2(40%)</td>
<td>0(0%)</td>
<td>2.8</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Overall human efforts required to fix the faulty devices</td>
<td>2(40%)</td>
<td>2(40%)</td>
<td>1(20%)</td>
<td>0(0%)</td>
<td>3.2</td>
<td>High</td>
</tr>
</tbody>
</table>

Source: Survey analysis

The results of Table 1 depicted the respective perceptions of various firms on the contribution of CMMS in reducing their task of planning and management of their firms’ equipment. The results indicated that the frequency at which the firms are now experiencing sudden breaking down of equipment is low. This fact was pointed out by most respondents (60%), average = 1.6 this implies that as result of the usage of CMMS, the organisations no longer experiences sudden or complete breaking down of equipment. Moreso, the results indicated that the tedious of troubleshooting faulty equipment becomes less frequent as results of
using CMMS for planning equipment maintenance routine. This fact was established by most respondents (60%) from respective firms (average = 1.4).

However, the results on the Table 1 revealed that time is still wasted in the procurement of needed parts even after introducing CMMS. This fact was from the opinions of 60% of the sampled representatives from each organisation (average = 2.6). Likewise, 40% of the respondents expressed that their firms still experience difficulties in fixing back the newly procured parts inspite usage of CMMS in their firms (average =2.8). Moreso, 40% of the respondents unanimously expressed that their firms still depend majorly on human efforts to fix their equipment’s (average =3.2).

The results from Table 1 indicate that the CMMS has not been highly contributed to the equipment maintenance in the sampled organisations. This may not be unconnected with the fact that majority of the sampled firm only applied CMMS at the error of faults detector level not on procurement, replacement of parts or for initiation of self-corrective measure.

Table 2 Contribution of CMMS to Organisation Performance

<table>
<thead>
<tr>
<th>S/n</th>
<th>Items</th>
<th>Very High Fx (%)</th>
<th>High Fx (%)</th>
<th>Moderate Fx (%)</th>
<th>Low Fx (%)</th>
<th>Avg N=5</th>
<th>Rmk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Timely Task accomplishment</td>
<td>3(60%)</td>
<td>1(20%)</td>
<td>1(20%)</td>
<td>0(0%)</td>
<td>3.4</td>
<td>High</td>
</tr>
<tr>
<td>2</td>
<td>Accuracy of record</td>
<td>3(60%)</td>
<td>2(40%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>3.6</td>
<td>High</td>
</tr>
<tr>
<td>3</td>
<td>Detection laziness or sabotage act</td>
<td>4(80%)</td>
<td>1(20%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>3.8</td>
<td>High</td>
</tr>
<tr>
<td>4</td>
<td>Division of labour among staff</td>
<td>1(20%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>4(80%)</td>
<td>1.6</td>
<td>Low</td>
</tr>
<tr>
<td>5</td>
<td>Assisting firm to keep up with competing firms</td>
<td>1(20%)</td>
<td>3(60%)</td>
<td>0(0%)</td>
<td>1(20%)</td>
<td>2.8</td>
<td>High</td>
</tr>
<tr>
<td>6</td>
<td>Reduction in the excess cost of production</td>
<td>3(60%)</td>
<td>1(20%)</td>
<td>0(0%)</td>
<td>1(20%)</td>
<td>3.2</td>
<td>High</td>
</tr>
<tr>
<td>7</td>
<td>Meeting-up with deadline</td>
<td>2(40%)</td>
<td>3(60%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>3.4</td>
<td>High</td>
</tr>
</tbody>
</table>

Source: Survey analysis

The results in Table 2 revealed the contributions of CMMS to organisations’ performance. The results show that most respondents (60%) expressed high contribution of CMMS toward timely task accomplishment in their organisation (average= 3.4; High). Also, the accuracy of record is expressed high by 60% of the sampled respondents (average =3.6; High), it implies that as a result of the adoption of CMMS in their firm their firm records now become more accurate. More also, the majority of respondents (80%) unanimously rated the contribution of CMMS toward detection of laziness or sabotage in their organisation very high (average 3.8, High). However, the majority of respondents (80%) expressed that the adoption of CMMS in their firms has not eliminated issues of division of labour (average=1.6; Low). Moreso, 60% of respondents expressed that the used of CMMS is assisting their firms to keep up with competition (average = 2.8; High). The use of CMMS in the organisation is highly reducing excesses in the production cost, this fact was established by the majority (60%) of respondents (average = 3.2; High). Moreso, the adoption of CMMS aids the organisation in meeting their targeted time. This fact was expressed by most respondents (40%) that rated the contribution high (average =3.4; High). The results from this table indicated the contribution of CMMS toward the enhancement of various organisational activities. However, the CMMS is found not yet contributing towards enhancement division of labour among staff.

4. RESULTS FROM TESTING HYPOTHESIS

There is no significant relationship between level of adoption of CMMS in organisation and working efficiency of machines

Table 3 Results of Correlational Analysis on Relationship between Adoption of CMMS and Machine Efficiency

<table>
<thead>
<tr>
<th>Interval by Interval</th>
<th>Pearson’s R</th>
<th>Asymp. Std. Error</th>
<th>Approx. T</th>
<th>Approx. Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0.801</td>
<td>0.081</td>
<td>3.398</td>
<td>.034</td>
</tr>
</tbody>
</table>

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The results in Table 3 revealed the outcome Pearson Product Moment Correlation (PPMC) analysis between the level of adoption of CMMS and efficiency of organisation machine. The results depicted correlation value (0.801, sig-value = 0.034), this implies a significant relationship between the level of adoption of CMMS and efficiency of the machine. Therefore, we rejected the null hypothesis stated that there is no significant relationship between the level of adoption of computerised maintenance management in the organisation and working efficiency of machines. In a nutshell, the more the adoption of CMMS for the plan and maintenance of organisations equipment the more the efficiency of machines and equipment.

H2: There is no significant relationship between computerised maintenance management and performance of manufacturing companies

Table 4 Results of Correlational Analysis on Relationship between Adoption of CMMS and Performances of Manufacturing Companies

<table>
<thead>
<tr>
<th>Interval by Interval</th>
<th>Value</th>
<th>Asymp. Std. Error(^b)</th>
<th>Approx. T(^b)</th>
<th>Approx. Sig.(^c)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson’s R</td>
<td>.891</td>
<td>.013</td>
<td>8.736</td>
<td>.003(^c)</td>
</tr>
<tr>
<td>N of Valid Cases</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results in Table 4 revealed the outcome Pearson Product Moment Correlation (PPMC) analysis between the level of adoption of CMMS and performance of manufacturing companies. The results depicted correlation value (0.891, sig-value = 0.003), this implies a significant relationship between the level of adoption of CMMS and performances of manufacturing companies. Therefore, the null hypothesis stated that there is no significant relationship between the level of adoption of computerised maintenance management and performance of manufacturing companies is rejected.

5. FINDINGS OF THE STUDY

The following are the findings from this study:

1. The level of utilisation of CMMS among the manufacturing companies in the study area is still low.
2. Due to the low level of utilisation, the CMMS has not been highly contributed to the equipment maintenance in the sampled manufacturing companies.
3. The used of CMMS is enhancing of various organisational activities.
4. There is significant relationship between level of adoption of CMMS and efficiency of machine.
5. There is significant relationship between level of adoption of CMMS and performances of manufacturing companies.

6. DISCUSSION

This study found that the level at which the manufacturing companies are utilising the computerised maintenance management system is low. This may not be unconnected with the facts that majority of activities in most of these companies still depend on workforce instead of automation and application of computerised devices. More also, the responses from sampled firms indicated that the utilisation of computers is broadly limited to administration, record keeping and mailing system, while many other firm’s activities were yet to be integrated with computerised maintenance management system. This finding agrees with the finding made in the study conducted by Ali & Younes (2013) that most organisations in Nigeria are still mulling on the extent at which they will integrate the modern computerised application in their firms. Thus, minimal adoption of modern technology may affect the overall performance, efficiency and power of competition in organisations. The similar finding was also made by Noor & MdAzree (2014) that most manufacturing companies and major organisation in developing nations are still dragging feet towards total integration of computerised application for their operation (Al-Gharaibeh & Malkawi, 2013).

The findings from this study also indicated that as results of the low level of utilisation, the computerised maintenance management system has not been highly contributed to the equipment maintenance in the sampled manufacturing companies. This fact may be by the fact that majority of sampled manufacturing companies indicated using computerised application for monitoring or detecting errors and faults from their operating plants only. Whereas, computerised maintenance management system has not been deployed for losing and replacing faulty parts and this leads to wasting much of times as results of fixing the faulty parts of the machines. The good thing is that majority of manufacturing companies have introduced automatic faults monitoring or errors
detections applications that raise an alert when a particular part of the machines is about to break down or malfunction. This finding was in agreement with the findings made from the study conducted by Al-Gharaibeh & Malkawi (2013) that majority of the organisation in Nigeria are not able to fully integrated computerisation application into their services as results of their inability to overhaul their old age machinery. This view was also by the findings reported in the study carried out in North-east Nigeria, to determine the level of satisfaction workers in the manufacturing industries, by Ali & Younes (2013), that majority of activities in the manufacturing firms are still majorly relying on the workforce. More also, our finding of less integration of computerised application in planning and maintenance of machines and equipment agrees with the findings made by Ensour & Alinizi (2014) that in most African countries computerisation of firm equipment becomes a bottleneck as results insufficient funds to upgrade their machines to modern ones. Our finding also corroborates the earlier finding from the study conducted about the growth of industries in African nations by Magbagbeola & Arogundade (2011) that revealed a lack of modern technologies, over-dependent on human labour, poor management, as well as substandard practices as factors accounted for the low performance of manufacturing firms in Africa. This implies that manufacturing firms need to be moving from man-base activities to computerised based activities which require good planning, financial commitments and technology development.

More also, the findings from this study indicated that to some extent, the used of computerised maintenance management system in the sampled manufacturing firms for administrative activities is enhancing their performances. This finding may not be unconnected to the fact that majority of administrative roles deals with document, file and information which perfectly suited computerised application. Communication and interaction among various units, departments and authorities can be easily facilitated the use of the computerised application, and this can greatly enhance the rate at which documentation, record keeping, record updating and information movement will be achieved within any organisation. Therefore, integrating administrative activities with computerised application gives sampled manufacturing industries performance enhancement. This finding agreed with the finding made by Al-Gharaibeh & Malkawi (2013) that the use of computers and other ICTs equipment enhanced administration’s activities in many organisations. Our findings also agreed with the conclusion drawn by Reddy, Srinivasu, Rikkula, & Rao (2009) after found the importance communication in organisation activities that industries and firms can no longer be in isolation now that technology integration is high. Therefore, it now becomes imperatives for perfect man-machine interaction. However, this finding does not completely conform with the finding from comparison study carried out to compare how far are African industries compare to industries in advanced nations in the aspect computerisations, by Al-Gharaibeh & Malkawi (2013). It was revealed that industries in the African countries are far behind as results of poor dedication toward communication and global integration of ICTs.

The findings of this study also indicated a significant relationship between the level of adoption of computerised maintenance management system and performances of manufacturing companies. This finding showed how important the computerised maintenance management system is to the management of industries, the more the organisation is encouraging the use of modern tools and automation the more the expected efficiency and such is the outcome of this finding. Inspite the fact that sampled firms were not fully integrated communication into their activities, the little extent of their adoption of computerised maintenance management system is yielding good results. These findings agreed with the earlier finding made by Olabanji, Gonese & Tafadzwa (2014) that the utilisation of computerisation in any industry is related significantly to their performance. Also, our finding of the strong relationship of computerisation and organisation performance was also by findings made from respective studies by Ensour & Alinizi (2014), Al-Gharaibeh & Malkawi (2013) and Ali & Younes (2013). However, the study by Reddy, Srinivasu, Rikkula, & Rao (2009) reported contradicting finding that assessing effect of computerisation cannot be solely repressible for performance. Although, the focus of research is set on intervening factors, such as; organisation policies, management effectiveness, staff disposition to computerization, availability of technology, power or energy among others. However, keeping the intervening variable constant Al-Gharaibeh & Malkawi (2013) study revealed the discreet but strong relationship between computerisation and organisation performances.

Furthermore, the efficiency of computerisation in industries was linked with the efficiency of operators by Kamel, Lakhder & Ammar (2012) in their study that deliberate acts among members of staff especially designated officers to account for the failure of computerised maintenance management system. This view was also agreed to by Magbagbeola & Arogundade (2011) in their study that majority of African industries are suffering a setback as results of deliberate and mismanagement of firm among indigenous owned industries. The study also argues that diversion of funds various donor international bodies as well as converting firm properties into personal uses accounted for poor implementation of computerisation in many African countries. This assertion implies that origination may still be computerised with less performance if those responsible for acting at one point at time refuse or forget to do so. System analyst, database manager among other keys officer, can render the effectiveness of computerisation in industries useless. This view respectively held by Ensour & Alinizi (2014); and Al-Gharaibeh & Malkawi (2013) that whatever is the level of automation industries, the efficiency of machines lies on aman (operators/users).
7. CONCLUSION
The use of modern tools and latest technologies to drive performance has been known with the organisation for a long time. The modern days are witness mouth-watering effect of ICTs and its technologies in the production and performances rates of industries and standard organisation. The findings from this study had established that Nigerian manufacturing industries, especially, in Enugu State are moving toward computerisation, only that the pace are not fast enough considering the amounts of achievement been recorded in industries in advanced nations. More also, this study established that the use of computerised maintenance management system is one of the answers for prevention of sudden breakdown of machine and equipment as well as a good measure to extend the long working span of the equipment. This study also reaffirmed that the management of manufacturing industries become easier with computerisation, because the adoption of computerisation reduces the delay of passage of information, updating of records, retrieving of data, placing of order and interaction among units, staff and authorities.

RECOMMENDATIONS
Base on the findings and conclusion of this study the following are the recommendations
1. The manufacturing companies in Enugu State should fully integrate the CMMS software into their services and activities too ease the task of the workers and improve the overall organisational performance
2. The maintenance units in the manufacturing industries in Enugu State should ensure fully computerised compliant machines and equipment maintenance routine to aid their troubleshooting, installation or replacement of faulty parts.
3. The management in the sampled manufacturing companies in Enugu State should also guide against poor managerial attitudes and poor working conditions that can inhibit the performance of computerised maintenance management system in their respective firms.

SUGGESTIONS FOR FURTHER RESEARCH
This research was narrowed down to the manufacturing industries sector in Enugu State which is a small percentage of the industry in the state. We suggest the following for future research:
- Future work should look at the use of Enterprise Resource Planning as a whole and not just CMMS which is designed for an organisation that runs maintenance routines.
- A wide geographical area such as Nigeria should be studied to get a broad perspective of the research.
- Future work could also check how this enterprise software affects the employees of the organisation.

REFERENCE


