EFFECT OF AUTOMATED INVENTORY SYSTEM ON THE PRODUCTIVITY OF SELECTED FLOUR MILLS COMPANIES IN NIGERIA

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Many manufacturing firms are still using manual-tracking systems to manage their inventories, which is very time-consuming. The automated inventory system usage has had little application in many manufacturing firms in Nigeria which often leads to the problems of stock-out and low productivity. The study sought to ascertain the extent at which automated inventory system affect the productivity of selected Flour mill manufacturing companies in Nigeria. The study had a population size of 2,237, out of which a sample size of 776 was realized using Krejcie & Morgan formula at 5% error tolerance and 95% level of confidence. The instrument used for data collection was primarily questionnaire. Out of 776 copies of the questionnaire that were distributed, 641 copies were returned while 135 were not returned. The survey research design was adopted for the study. The hypothesis was tested using simple linear regression statistical tool. The finding indicates that selected Flour mill companies automate their inventory system to a moderate extent. The Enterprise Resource Planning (Mean = 4.72, Std. Dev. = 1.207) and Materials Requirement Planning System (Mean = 4.10, Std. Dev. = 1.547) were prominent automated inventory management tools used by selected Flour mill manufacturing companies. The finding revealed that automated inventory system significantly influenced the productivity of the Flour mills companies ($\beta = 0.614$; $t = 2.547$; $F= 62.805$; $p< 0.05$). The study concluded that automated inventory system affects the productivity of selected Flour mills manufacturing companies in Nigeria. The study also concluded that selected Flour mills manufacturing companies use Enterprise Resource Planning and Materials Requirement Planning to increase productivity and reduce the manufacturing lead-times. The study recommended that Flour mills manufacturing companies should fully adopt automated inventory systems in inventory management as this will greatly improve the performance of the procurement function. Enterprise resource planning and materials requirement planning system should also be integrated by the companies.
Keywords: Automated Inventory System, Productivity and Manufacturing firms

1. INTRODUCTION

One of the common problems faced by the manufacturing firms in Nigeria is poor inventory management that would affect the performance of organization (Adamu, 2016). Effective inventory management has become a critical issue for firms' productivity. Many large manufacturing firms have saved millions of dollars in costs and decreased inventories while improving efficiency and customer satisfaction through various inventory management practices (Chapman, Ettkin, & Helms, 2000). This is because inventory management results to integration of better production methods to minimize costs and wastages. Inventory management also enables the manufacturing firms to control materials used and stored in the company with the objective of providing exactly what is required where and when it is required employing a minimum of residual stock thus incurring the least possible cost (Agha, 2010).

Automation involves the functioning of systems and equipment in desired manner at the proper time under control of mechanical or electrical devises that operate without or with minimal human intervention. Automation refers to a variety of applications using computer technology, which includes the generic software, such as word processing, spread sheet and database applications, or specially written records management applications (Mbuvi, Namusonge, & Arani, 2016). Computers can be stand alone, or linked using networks (LANs, WANs, intranets, or the Internet), and can use a wide range of peripheral devices such as scanners, bar code readers, printers and among others.

In order to realize the benefits of effective inventory management, manufacturing firms should attempt to automate their inventory management operations (Kitheka, 2012). According to Mbuvi, et al. (2016), automation of inventory control could be a better solution, which is a set of hardware and software based tools that automates the process of inventory management. Despite the accrued benefits from automation of inventory, many of manufacturing companies in Nigeria have not been able to incorporate technology in their inventory management. The research by Owoeye, Adejuyigbe, Bolaji, and Adekoya (2015) (2015) and complemented by Nsikan, Etim, and Ime (2015) showed that majority of flour mills companies in Nigeria have not yet adopted automated management system. They have majorly concentrated on manual and mathematical models of inventory management. The absence of automation has resulted to unmatched order cycle, inappropriate planning and monitoring the level of inventory. The studies also reported that majority of inventory managers and staffs responsible for stock management in these companies do not adequately have knowledge or mechanics and applications of modern inventory management models and tools.
The reasons highlighted by researchers for the non-adoption of computer system in inventory management include the cost of installation, management support, maintenance costs amongst others. These challenges do not enable the flour mills companies in Nigeria to properly predict production requirements (Owoeye et al., 2015). It further created minimal utilization of resources, high operating costs and inappropriate planning leading to poor work efficiency, and low productivity (Nsikan, et al., 2015; Owoeye et al., 2015). Moreover, Chandra (2010) lamented that most companies set profit goals but few set productivity goals. The productivity aspect of inventory management is often overlooked or is not adequately looked after in most of the industrial undertakings (Chandra, 2010). Automated inventory management systems have not been extensively embraced by many flour mills companies in Nigeria. In addition, existing studies on inventory management in flour mills companies in Nigeria have not address the extent to which the failure to adopt computerized inventory management has influence the productivity of flour mills companies. Therefore, to what extent has automated inventory management influence productivity of flour mills companies in Nigeria? The design and development of an automated inventory control system for the Flour mills companies in Nigeria will no doubt bring immeasurable relief from the problems associated with the manual system. The objective of this study, therefore, is to investigate the effect of automated inventory management on productivity of flour mills companies in Nigeria.

2.0 LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1 AUTOMATED INVENTORY SYSTEM

Automation is the replacement of human workers by technology (Ebunobi, 2012). It is the use of technology or computers to control and process data reducing the need for human intervention. Mbuvi et al. (2016) contend that automated inventory system is the integration of sub-functions involved in the management of inventory into a single cohesive system. It is software installed on the computer systems that enables a firm to keep a check on the inventory levels by performing the automatic counting of inventories, recording withdrawals and revising the stock balance. Kamau and Kagiri (2015) defined automation inventory system as referring to an inbuilt system for placing orders in computer systems that automatically generates a purchase orders to the supplier when the minimum level of the stock or the reorder point is reached. Widmer (2016) viewed automated inventory management system (IMS) as a program that adds, edits, deletes, and transfers firm's product data for it. It allows firms to pull product data from their suppliers website using a data feed, normally in the form of an XML or CSV file (although it may come in other file types), and push that data to their website. According to WiseGeek (2017) manual, automated inventory systems track each item or product used in production or retail sales through an inventory software system. When the minimum quantity of an item is reached, an order can be placed immediately and automatically to restock that item. This process takes into account the time
needed for an order to be placed and for the company to receive and restock the item. Widner (2016) identified the benefits of automated inventory management as high quality product images, save time, reduce canceled orders, increased data accuracy, and near-instant product updates.

There are various automated inventory systems tool that have been designed by experts to solve inventory related problems in manufacturing industry. These technology include:

a. **Barcoding:** This is an automated method of inventory management which involves the use of series of parallel vertical lines to assign a unique identity code to an item (Owoeye et al., 2015).

b. **Radio Frequency Identification Data (RFID):** This is a tag that contains a silicon chip that carries an identification number and an antenna that is able to transmit the number to a reading device (Owoeye et al, 2015).

c. **Active RFID technology:** This technology uses fixed tag readers assigned throughout a warehouse such that anytime an item with an RFID tag passes the reader, the movement of the item is recorded in the inventory management software (Ebunobi, 2012).

d. **Passive RFID technology:** requires the use of handheld readers to monitor inventory movement (Ebunobi, 2012). Because RFID technology has a reading range of up to 40 feet using passive technology and 300 feet using active technology, it greatly increases the accuracy of moving inventory around a warehouse (Hamlett, 2006).

e. **Enterprise Resource Planning (ERP):** Enterprise resource planning, is a computer network system that uses a database of information that is company-wide accessible. ERP is designed to replace paper-based systems by analyzing data from all areas of a company's resources. By using an ERP management system, a company's inventory is stored on a database that is comprised of physical stock, costs, vendor accounts, and lead-times for re-ordering stock.

f. **Manufacturing Resource Planning (MRP):** It is a computerized technique that assists in production planning and inventory control (Owoeye, et al., 2015). Gbadamosi (2013) described the MRP as a computer based planning and control system designed to handle large volumes of data so as to produce more timely and accurate information for decision making purposes. It enables orders to be tracked throughout the entire manufacturing or distribution points. It synchronizes ordering and delivery of materials and components with production requirements to achieve planned and controlled inventories and ensures that required items are available at
the right time of usage and not much earlier (Stevenson, 2015).

2.2 PRODUCTIVITY

Productivity refers to measure describes how well the resources of an organization are being used to produce goods and services (Ngumi, 2015). In production, productivity measures the relationship between products manufactured and the resources used to create them. It is measured by comparing the quantity of output, that is, desired results with the quantity of one or more inputs, that is, resources used, to produce that output (Jurison, 1997). It is expressed as the ratio of output to input (Roach & Stephen, 1998). Productivity indicates how effectively resources are being used in the production of various goods and is increased by producing more with fewer amounts of resources or producing the same amount with fewer resources (Jurison, 1997). Productivity also relates to competitiveness: if two firms both have the same level of output but one requires less input because of higher productivity, that one will be able to charge a lower price and consequently increase its share in the market. Or that firm might elect to charge the same price, thereby reaping a greater profit (Ondiek & Odera, 2012). Kamau (2011) argued that the concept of productivity is linked closely with the issues of efficiency and encompasses several efficiency elements such as price efficiency, allocative efficiency, technical efficiency and scale efficiency. The overall productivity level of an organization depends on all these elements (Kamau, 2011). Efficiency, however, is generally seen as the ratio of the time needed to perform a task to some predetermined standard time.

From the foregoing review, it is crucial that every firm develops and uses a comprehensive set of productivity indicators that allows them to closely measure the extent to which an undertaking has the right quantity of inventory in the right place at the right time, that is, the productivity of their investment in inventory.

2.3 AUTOMATED INVENTORY SYSTEM AND PRODUCTIVITY

Many studies have been done on the influence of design and implementation of automated inventory system on the productivity of firms (Nsikan et al., 2015; Mbuvi et al., 2016; Kitheka & Gerald, 2014; Wanjohi, Mugo, & Wagoki, 2013; Namagembe & Munene, 2016; Susan & Joseph, 2015; Kitheka & Gerald, 2014; Haiyan & Sarathchandra, 2015). Haiyan and Sarathchandra (2015) argued that many organizations are still using manual-tracking systems to manage their inventories, which is very time-consuming. But some researchers emphasize that companies that adopted modern technology in managing its inventories succeed more than those who rely on outdated methods of inventory control (Wanjohi et al., 2013). As noted by Susan and Joseph (2015), automated inventory system could influence all stages of inventory management, as well as counting and monitoring of inventory and anticipating inventory needs, including inventory handling requirements. The influence of
automated inventory system on a firm's operational performance is well documented in the literature. Wanjohi, et al. (2013) found positive linear relationship between electronic inventory system and customer service delivery. Kitheka and Gerald (2014) found that inventory management automation influenced the performance of the Supermarkets in Western Kenya. Susan and Joseph (2015) find out that many business firms have adopted automated inventory system in their operations and it has brought more positive effects than negative effects.

However, other researchers have concluded that automated inventory system usage has had little application in many manufacturing firms which leads to the problems of stock-out and low productivity (Kitheka & Gerald, 2014; Mbuvi & Namusonge, 2016; Namagembe & Munene, 2016). Mbuvi and Namusonge (2016) found out that majority of staff of manufacturing firms do not have adequate skills of information technology and this has slowed down the automation of inventories. It was also found out that automated inventory system with regards financial accessibility was disappointing, resulted into little investments. On the basis of the foregoing, it is hypothesis that automated inventory system does not have statistically significant influence on the productivity of selected Flour Mills companies in Nigeria.

Based on the above discussion, it is hypothesize that:

\[ H_0: \text{Automated inventory system does not have significant influence on the productivity of the selected Flour Mills companies in Nigeria} \]

2.4 THEORETICAL FOUNDATION

This study was guided by Adaptive Structuration Theory (AST) proposed by Anthony Giddens in his Constitution of Society in 1984, which was an attempt to reconcile social systems and the micro/macro perspectives of organizational structure. Structuration theory demonstrates that ICTs are structured by users in their contexts of use (Barley 1986; Orlikowski, 1992; Walsham, 1993; Weick, 1990). AST is a viable approach in studying how information technology affects effective inventory management in an organization because it examines the change from distinct perspectives (Koin, Cheruiyot, & Mwangangi, 2014; Ondari & Muturi, 2016). AST is relevant in today's inventory management practice due to the expanding influence that advancing technologies have had with regard to the human-interaction aspect of AST and its implication on socio-biologically inspired structuration in security software applications (Ramakrishna, 2005). AST theory presents specific advances in information technology that are driving organizational changes in the areas of business alignment, IT planning, and development show that AST is being used as a driving force of effective management within organizations. The study uses the theory to investigate how complexity of inventory management is influenced by Information Technology (Ramakrishna, 2005). In conclusion, AST is a viable approach in studying how information technology affects effective inventory management in an organization because
it examines the change from distinct perspectives.

Although AST is an influential model in explaining how groups appropriate different ICTs through social construction (Hollingshead & Contractor, 2002; Spears, Lea, Cornelius, Postmes, & Harr, 2002), the theory has however been criticized on many reasons by researchers. According to Contractor and Eisenberg (1990, p. 143): “There is no such thing as a pure technology. To understand technology one must first understand social relationships.” Hollingshead and Contractor (1990) further argue that while AST is often used to explain how ICT use unfolds in complex processes, it is critiqued for being indeterminate, vague, and difficult to “test” in a given context. Rice (1992) has argued for more theoretical structure and a need to identify the underlying processes that might explain or predict ICT use. Similarly, Baym argues that researchers are left “without precise pointers about where to look or what to look for in search of appropriation” (1995, p. 150). Orlikovski (2000) argues against the notion that ICTs embody certain stable structures and are “static and settled artifacts with built-in arrays of fixed and determinate structures” (p. 406).

3. METHODOLOGY

3.1 RESEARCH DESIGN

This study adopted a cross-sectional survey research design. A cross-sectional survey offers the opportunity to collect data across different flour mills companies and test this relationship. With respect to the time period over which data will be collected, which will be one point in time across the various flour mills companies, a cross-sectional survey was found appropriate. Further, it was ideal because the researcher intended to collect descriptive data that was accorded statistical treatment to allow for hypothesis testing to come up with objective conclusions (Cooper & Schindler, 2013).

3.2 POPULATION

The primary population for this study consisted of all the flour mills companies in Nigeria and the secondary population was all flour mills companies listed on the Nigerian Stock Exchange. According to Sterling Capital (2015), there are four (4) quoted flour mills companies namely: Dangote Flour Mills, Flour Mills of Nigeria Plc, Honeywell Flour Mill Plc and Northern Nigeria Flour Mill Plc out of which three (3) companies (that is, Dangote Flour Mills, Flour Mills of Nigeria Plc, and Honeywell Flour Mill Plc) constituted the focus of this study. The target population therefore consists of two thousand, two hundred and thirty seven (2,237) employees in charge of inventory management and policy of the selected flour milling companies operating in Nigeria that is, Dangote Flour Mills, Flour Mills of Nigeria Plc, and Honeywell Flour Mill Plc. These companies control over 65% of the market (Leadcapital, 2008). They have a total installed capacity (production) of 15,360 metric tons per day with Flour Mills of Nigeria Plc controlling 49% (Sterling Capital, 2015).
3.3 SAMPLE AND SAMPLING TECHNIQUE

The sample for this study was limited to three (3) listed flour milling companies in Nigeria out of four (4) listed flour milling companies on the Nigerian Stock Exchange. The three selected flour milling companies for the study; namely Dangote Flour Mills Plc, Flour Mills of Nigeria Plc, and Honeywell Flour Mill Plc are located in Lagos State. Beside, these three companies have the largest percentage of total installed capacity in the industry: Dangote Flour Mills Plc (29%), Flour Mills of Nigeria Plc (49%) and Honeywell Flour Mill Plc (10.8%). In addition, the Flour Mill Group, with majority stakes in Northern Nigeria has an estimated 60% share of the market. The study was conducted among the top management, middle management staff and low level management of the three selected flour milling companies in the following departments: procurement, production, warehouse, distribution and value chain support. The researcher used these departments because of their connection and direct involvement in inventory management. Leedy and Ormrod (2012) advised that the target population should be a set of all individuals relevant to a particular study and must be defined in terms of elements, geographical boundaries and time.

Having established the population of study, multi-stage sampling procedure was used to select the subjects of study. In the first stage, the researcher stratified the flour mills companies in Nigeria into two namely: listed and non-listed flour milling companies. According to Sterling Capital (2015), there four quoted flour milling companies in Nigeria while the remaining eighteen flour milling companies are not quoted. The four companies control over 65% of the market in Nigeria. In the second stage, proportional stratified sampling technique was used to select 3 companies out of the 4 quoted flour mills companies in Nigeria. These were 75% of the total number of quoted flour mills companies in Nigeria. Three companies were finally chosen because Flour Mills of Nigeria controls the largest stake of the Northern Nigeria Flour Mill. In the last stage, simple random sampling was used to select a sample size of 776 from the population of 2,237 at 3.5% error tolerance and 96.5% degree of freedom using Krejcie and Morgan (1970) sample size determination table. 641 (82.6%) of the questionnaire distributed were returned while 135 (17.4%) of the questionnaire distributed were not returned.

3.4 DATA COLLECTION INSTRUMENT

The study used structured questionnaire as data collection instrument. This study used closed-ended questions which is one where responses are restricted to small set of responses that generate precise answers to develop the empirical (Mwangangi, Guyo, & Arasa, 2015). The reason for the choice of this instrument is advantage of high response rate and minimum intervention bias from the researcher. A six-point modified Likert scale type was used to elicit responses for every questions in the questionnaire, and this covers extremes of 'very often' and 'rarely' and 'very high' and 'very low'. This scale is expected to increase the reliability of the responses; and also to gain more effective screening power (Sin...
The instrument consists of three (3) sections: section A deals with the demographic variables in which the respondents were asked to provide some basic background information; section B was focused on automated inventory system while section C was put in place to assess productivity. The questionnaire was adopted from combination of sources and modified to meet the need of this study. Automated inventory system questions were gathered from Kitheka and Gerald (2014); Kitheka (2012). Productivity questions were collected from Ndirangu (2014); Nyabwanga & Ojera, (2012).

### 3.5 PILOT STUDY

A pilot study was conducted to determine whether potential respondents would have difficulties in understanding or interpreting the questionnaire. Seventy eight (78) conveniently sampled respondents forming 10% of sample from each category were asked to give the needed information for piloting. Fink (2013) suggests that for most student questionnaire the minimum number for a pilot is 10% of the sample size. The pilot test refine the questionnaire so that respondents will have no problems in answering the questions and there will be no problems in recording the data. The pilot study also focused on ensuring validity and reliability were achieved.

The study used construct validity which was established using exploratory factor analysis. The main measures used to test the validity of the instrument in exploratory factor analysis include: Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, and Bartlett's test of sphericity. The results of the EFA show high values of the KMO for all the variables and significance of the Bartlett's test of sphericity at 0.000 which indicate the suitability of the research data for structure detection. The reliability test was done using internal consistency method. The result gave a reliability coefficients (Cronbach's Alpha) for the constructs ranged between 0.804 and 0.882 indicating a high degree of consistency.

### 3.6 DATA PROCESSING AND ANALYSIS

The study used descriptive and inferential statistical techniques to process and analyze the data. The descriptive statistics was first used to analyze responses of the respondents to the various questions for each of the variables using frequencies, percentages, mean and standard deviation. Inferential statistic was used test the hypothesis. Simple linear regression analysis was used to determine effect of automated inventory management system on productivity in the selected flour mills companies. The hypothesis was tested at 95 percent confidence level (level of significance, $\alpha = 0.05$). The regression model developed for the study is presented below:

$$\text{Prod} = \alpha + \beta_1 \text{AIMS} + \epsilon \quad \text{.......................... Eq. 1}$$

Where:

- $\text{Prod} = \text{Productivity}$
\( \beta_0 = \text{Constant term} \)
\( \beta_i = \text{Parameter to be estimated} \)

AIMS = Automated Inventory Management System

\( \varepsilon = \text{Error term} \)

The apriori expectation for the stated models can be given as follows. It is expected that automated inventory system would have significant influence on productivity of an organization, that is, their ability to produce more goods. Previous studies like Susan and Joseph (2015) discovered that automated inventory system influence all stages of inventory management, as well as counting and monitoring of inventory and anticipating inventory needs, including inventory handling requirements. Wanjohi, et al. (2013) reported a positive relationship between electronic inventory system and productivity of manufacturing firms in Kenya. The quantitative data obtained from the questionnaire were analyzed using the Statistical Package for Social Sciences (SPSS) version 24.0 for windows.

4. **ANALYSIS, RESULTS AND DISCUSSIONS**

A total of 776 copies of questionnaire were sent out to the representative companies that formed the sample size. Out of the copies of questionnaire sent out, 641 were properly filled and returned, which represent 82.6% response rate which was considered adequate for the study. The other 135 questionnaires were lost or not included in the analysis, due to the problems from respondents and some contained incomplete information. The high response rate recorded by the researcher was attributed to the data collection procedures. These methods facilitated the whole process of data collection hence the high response rate.

4.1 **DESCRIPTIVE ANALYSIS**

This section shows results of descriptive statistics of the responses of participating employees of selected flour mills companies in Nigeria with respect to automated inventory system and productivity. Frequency, percentages, mean and standard deviation were used to present the findings. The mean scores of the responses for automated inventory system were interpreted as follows: 1.00-1.49 implied that automated inventory system is not adopted at all; between 1.50 and 2.49 implied very low extent; between 2.50 and 3.49 implied low extent; between 3.50 and 4.49 implied moderate extent; between 4.50 and 5.49 implied that great extent; and between 5.50 and 6.00 implied adoption of automated inventory system to a great extent. The standard deviation on the other hand describes the distribution of the response in relation to the mean. It provides an indication of how far the individual responses to each item vary from the mean. A standard deviation of more than 1 indicates that the responses are moderately distributed, while less than 1 indicates that there is no consensus on the responses obtained. The results are presented in Tables 4.1 and
4.2 respectively.

Table 4.1: Descriptive Analysis of Automated Inventory System

<table>
<thead>
<tr>
<th>Automated Inventory System</th>
<th>Not at all</th>
<th>Very low extent</th>
<th>Low extent</th>
<th>Moderate extent</th>
<th>Great extent</th>
<th>Very great extent</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Automation of the system</td>
<td>30</td>
<td>13</td>
<td>27</td>
<td>194</td>
<td>196</td>
<td>181</td>
<td>4.65</td>
<td>1.250</td>
</tr>
<tr>
<td>Electronic Point of Sales (E-POS)</td>
<td>175</td>
<td>51</td>
<td>72</td>
<td>46</td>
<td>225</td>
<td>72</td>
<td>3.49</td>
<td>1.852</td>
</tr>
<tr>
<td>Electronic Data Interchange Technology (EDI)</td>
<td>130</td>
<td>62</td>
<td>81</td>
<td>193</td>
<td>97</td>
<td>78</td>
<td>3.47</td>
<td>1.642</td>
</tr>
<tr>
<td>Radio Frequency Identification Device (RFID)</td>
<td>130</td>
<td>87</td>
<td>75</td>
<td>152</td>
<td>120</td>
<td>77</td>
<td>3.43</td>
<td>1.683</td>
</tr>
<tr>
<td>Vendor Managed Inventory (VMI) systems</td>
<td>107</td>
<td>40</td>
<td>69</td>
<td>167</td>
<td>176</td>
<td>82</td>
<td>3.80</td>
<td>1.615</td>
</tr>
<tr>
<td>Enterprise Resource Planning (ERP)</td>
<td>14</td>
<td>15</td>
<td>65</td>
<td>158</td>
<td>182</td>
<td>207</td>
<td>4.72</td>
<td>1.207</td>
</tr>
<tr>
<td>Bar-coding</td>
<td>124</td>
<td>92</td>
<td>69</td>
<td>115</td>
<td>176</td>
<td>65</td>
<td>3.50</td>
<td>1.691</td>
</tr>
<tr>
<td>Materials Requirement Planning System (MRP)</td>
<td>48</td>
<td>84</td>
<td>59</td>
<td>152</td>
<td>160</td>
<td>138</td>
<td>4.10</td>
<td>1.547</td>
</tr>
<tr>
<td>Linkages of your computers with those of Suppliers</td>
<td>176</td>
<td>84</td>
<td>66</td>
<td>105</td>
<td>139</td>
<td>71</td>
<td>3.25</td>
<td>1.789</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.82</td>
<td>1.586</td>
</tr>
</tbody>
</table>

Source: Field Survey Result, 2016
Table 4.1 shows opinions of respondents on various issues about automated inventory system in the selected flour mills companies in Nigeria. By combining responses under very great extent, great extent, and moderate extent together, majority (89.1%) of the respondents indicated that flour mill companies to a great extent generally automate their system. From the analysis, 53.3% of the respondents indicates that the companies are using Electronic Point of Sales (E-POS) to a moderate extent, 57.4% also assert that the companies use Electronic Data Interchange Technology (EDI) to a moderate extent, 54.4% claimed that the companies moderately use Radio Frequency Identification Device (RFID), 66.4% stated that companies are using Vendor Managed Inventory (VMI) systems to a high extent, 85.3% to a very high extent indicated that the companies are using Enterprise Resource Planning (ERP) in their automation, 55.5% affirmed that the Flour Mills companies used Barcoding to a moderate extent, 70.2% asserted that the companies use Materials Requirement Planning System (MRP), while 50.8% of the respondents concurred that Flour Mills companies do not link their computers with those of suppliers. The results show that the Enterprise Resource Planning (ERP) and Materials Requirement Planning System (MRP) were used to a very great extent (mean = 4.72, std. dev. = 1.207) and (mean = 4.10, std. dev. = 1.547) respectively. On average, these systems were rated very high. These were followed by Vendor Managed Inventory (VMI) systems (mean = 3.80, std. dev. = 1.615), Bar-coding (mean = 3.50, std. dev. = 1.691), Electronic Point of Sales (E-POS) (mean = 3.49, std. dev. = 1.852), Electronic Data Interchange Technology (EDI) (mean = 3.47, std. dev. = 1.642), Radio Frequency Identification Device (RFID), (mean = 3.43, std. dev. = 1.683), and Linkages of your computers with those of Suppliers (mean = 3.25, std. dev. = 1.789). The linkages of the companies' computers with those of Suppliers was rated very low on average score. The findings also show that general automation of the system was used to a moderate extent by the companies (mean = 3.65, std. dev. = 1.250).

The average mean of the responses was 3.82, which suggests that majority of the respondents were agreeing to the statements in the automated inventory system. However, the answers varied as shown by a standard deviation of 1.586.

Table 4.2 presents descriptive analysis of productivity in the sample companies. Means between 1.00 and 1.49 implied that productivity is very low; between 1.50 and 2.49 implied low; between 2.50 and 3.49 implied fairly; between 3.50 and 4.49 implied fairly high; between 4.50 and 5.49 implied that high; and between 5.50 and 6.00 implied productivity is very high. A standard deviation of more than 1 indicates that the responses are moderately distributed, while less than 1 indicates that there is no consensus on the responses obtained.
Table 4.2: Descriptive Analysis of Productivity

<table>
<thead>
<tr>
<th>Productivity</th>
<th>Very Low</th>
<th>Low</th>
<th>Fairly Low</th>
<th>Fairly High</th>
<th>High</th>
<th>Very High</th>
<th>Mean</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve availability of product</td>
<td>24</td>
<td>0</td>
<td>1</td>
<td>61</td>
<td>229</td>
<td>326</td>
<td>5.26</td>
<td>1.069</td>
</tr>
<tr>
<td></td>
<td>3.7%</td>
<td>0.0%</td>
<td>0.2%</td>
<td>9.5%</td>
<td>35.7%</td>
<td>50.9%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth Orientation</td>
<td>24</td>
<td>0</td>
<td>18</td>
<td>99</td>
<td>361</td>
<td>139</td>
<td>4.86</td>
<td>1.031</td>
</tr>
<tr>
<td></td>
<td>3.7%</td>
<td>0.0%</td>
<td>2.8%</td>
<td>15.4%</td>
<td>56.3%</td>
<td>21.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in inventories wastages</td>
<td>25</td>
<td>10</td>
<td>18</td>
<td>161</td>
<td>244</td>
<td>183</td>
<td>4.78</td>
<td>1.168</td>
</tr>
<tr>
<td></td>
<td>3.9%</td>
<td>1.6%</td>
<td>2.8%</td>
<td>25.1%</td>
<td>38.1%</td>
<td>28.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased sales</td>
<td>24</td>
<td>5</td>
<td>55</td>
<td>178</td>
<td>233</td>
<td>146</td>
<td>4.61</td>
<td>1.168</td>
</tr>
<tr>
<td></td>
<td>3.7%</td>
<td>0.8%</td>
<td>8.6%</td>
<td>27.8%</td>
<td>36.3%</td>
<td>22.8%</td>
<td></td>
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</tr>
<tr>
<td>Labour savings</td>
<td>32</td>
<td>14</td>
<td>54</td>
<td>221</td>
<td>193</td>
<td>127</td>
<td>4.42</td>
<td>1.241</td>
</tr>
<tr>
<td></td>
<td>5.0%</td>
<td>2.2%</td>
<td>8.4%</td>
<td>34.5%</td>
<td>30.1%</td>
<td>19.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase in quality of products</td>
<td>53</td>
<td>0</td>
<td>18</td>
<td>110</td>
<td>274</td>
<td>186</td>
<td>4.73</td>
<td>1.352</td>
</tr>
<tr>
<td></td>
<td>8.3%</td>
<td>0.0%</td>
<td>2.8%</td>
<td>17.2%</td>
<td>42.7%</td>
<td>29.0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduction in out of stocks of items</td>
<td>43</td>
<td>1</td>
<td>52</td>
<td>190</td>
<td>215</td>
<td>140</td>
<td>4.49</td>
<td>1.291</td>
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<td>6.7%</td>
<td>0.2%</td>
<td>8.1%</td>
<td>29.6%</td>
<td>33.5%</td>
<td>21.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved level of output</td>
<td>29</td>
<td>10</td>
<td>46</td>
<td>122</td>
<td>277</td>
<td>157</td>
<td>4.68</td>
<td>1.220</td>
</tr>
<tr>
<td></td>
<td>4.5%</td>
<td>1.6%</td>
<td>7.2%</td>
<td>19.0%</td>
<td>43.2%</td>
<td>24.5%</td>
<td></td>
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</tr>
<tr>
<td>Growth in total sales</td>
<td>24</td>
<td>9</td>
<td>69</td>
<td>233</td>
<td>196</td>
<td>110</td>
<td>4.40</td>
<td>1.155</td>
</tr>
<tr>
<td></td>
<td>3.7%</td>
<td>1.4%</td>
<td>10.8%</td>
<td>36.3%</td>
<td>30.6%</td>
<td>17.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quality of products/services</td>
<td>27</td>
<td>30</td>
<td>40</td>
<td>79</td>
<td>253</td>
<td>212</td>
<td>4.77</td>
<td>1.323</td>
</tr>
<tr>
<td></td>
<td>4.2%</td>
<td>4.7%</td>
<td>6.2%</td>
<td>12.3%</td>
<td>39.5%</td>
<td>33.1%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.7</td>
<td>1.201</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Field Survey, 2016

Tables 4.2 explains respondents’ opinions regarding productivity of the selected Flour Mills companies. By adding responses under fairly high, highly and very high together, data on Table 4.18 shows that 96.1% of the respondents indicated that there is very high improved availability of products in the companies. The result also reveals that 93.4% of the respondents specified that growth orientation of the companies is very high. The result further shows that reduction in inventories wastages is very high in the companies. 91.7% of the respondents were identified with the statement. Furthermore, the result shows that there is high increased sales with 86.9% of the respondents confirming that. The findings of this study reveals that 84.4% of the respondents indicated labour savings in the companies is
Moreover, the results indicate that 88.9% of the respondents asserted that there is high increase in quality of products in the companies. The findings further shows that 84.9% of the respondents indicated that there is high reduction in out of stocks of items in the Flour Mills companies. The findings reflects that 86.7% of the respondents maintained that there is high improve level of out in the companies. In addition, the findings reveals that 84.1% of the respondents specified that growth in total sales in the companies is high. Finally, the result shows that 84.9% of the respondents averred that quality of product/services rendered by the companies are high. From the findings of influence of automated inventory system on productivity, the respondents strongly agreed on improve availability of product (mean = 5.26, std. dev. = 1.069) and growth orientation (mean = 4.86, std. dev. = 1.031). These were followed by reduction in inventories wastages (mean = 4.78, std. dev. = 1.168), quality of products/service (mean = 4.77, std. dev. = 1.323), increase in quality of products (mean = 4.68, std. dev. = 1.220), increased sales (mean = 4.61, std. dev. = 1.168), reduction in out of stocks of items (mean = 4.49, std. dev. = 1.291), labour saving (mean = 4.42, std. dev. = 1.241), and growth in total of output (mean = 4.40, std. dev. = 1.155).

Combining the results in Tables 4.1 and 4.2, it can be seen that automated inventory system and productivity have positive pattern of increase as productivity which suggests a possible causal relationship between the variables. This finding provides answer to the research question and thus assists to achieve the objective of study.

**Hypothesis Testing**
In order to test the hypothesis, simple regression analysis was performed. The data for automated inventory system and productivity were created by summing responses of all items for each of the variable. The results of the regression are presented in Tables 4.3;

<table>
<thead>
<tr>
<th>Model Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Automated Inventory System
The regression analysis of automated inventory system and productivity is presented in Table 4.3. The results show that automated inventory system has a significant influence on firm productivity ($\beta = .614, p<0.05$). The result of this analysis conformed to the apriori expectation of positive influence of automated inventory system on productivity. The $t$ value of 2.547 and $p$-value of 0.001, implies that the coefficient of the model parameter is statistically significant at $p = 0.001$ which is less than 0.05 adopted for the study. Further, $F$-statistic = 62.805 with $p$-value of 0.001, implies that the regression model was statistically significant in explaining the influence of automated inventory system on productivity. In addition, the Table shows that 48 percent of the variation in productivity is attributable to automated inventory system ($R^2 = .477, p<0.05$). However, the model does not explain 56.3 percent of the variation in productivity, suggesting that there are other factors associated with automated inventory system, which were not captured in the regression model. Overall, regression results indicate that automated inventory system has positive influence on productivity. The regression model that explains the influence of automated inventory system on productivity can thus be stated as follows:

$$Prod = 47.483 + 0.614\text{AIMS}$$

Where:

- Prod = Productivity
- AIMS = Automated Inventory System

The regression equation shows that taking all factors constant at zero, the productivity of the selected Flour Mills companies was 47.483. The Beta value, coefficient of automated inventory system is 0.614, which implies that for one unit increase in the use of automated inventory system by Flour Mills companies, productivity increases by 0.614, other predictors held constant. This result implies that automated inventory system has a significant and positive influence on the productivity of the selected Flour Mills companies. Therefore, the null hypothesis ($H_0$) which states automated inventory system does not have
DISCUSSION

The test of hypothesis was to ascertain whether automated inventory system has significant effect on the productivity of the selected Flour Mills companies in Nigeria. The findings revealed that automated inventory system significantly influenced the productivity of the Flour Mills companies. This findings is in consonance with Ngumi (2015) investigated inventory management practices and productivity of large manufacturing firms in Narobi, Kenya. The study revealed that inventory Management Practices positively affect the productivity of large manufacturing firms in Narobi, Kenya. The findings also revealed that effective inventory management has become a critical issue for firm's productivity. Also, the findings revealed that large manufacturing firms have saved millions of dollars in costs and decreased inventories while improving efficiency and customer satisfaction through inventory management practices. The result is in line with the findings of Adu-Fosu (2016) who tested the relationship between Inventory Management and Productivity in Ghananian Manufacturing Industries. The findings revealed that no significant relationship exist between inventory management practices at Guinness Brewery Ltd and productivity such that the inventory management practices were not significantly related to productivity. The findings is in harmony with the system theory. According to Bertalanffy (1972), system theory is the trans-disciplinary study of systems in general, with the goal of elucidating principles that can be applied to all types of systems at all nesting levels in all fields of research. System theory emphasize that all organizations in a way interact with the outside world as they are often systems or as they seek to develop systems. It shows that sections of organizations interact amongst themselves in exchange of key information and materials. For instance, procurement, transport and the stores departments are part of the entire supply chain (Lysons & Farrington, 2006). They hence depend on each other, share and exchange many things such that if the operations of the stores department are automated, the transport and procurement departments cannot left out.

The findings of this study is supported by the findings of Haiyan and Ranathunga (2015) that there is a statistically strong support for the improvement of efficiency and accuracy of automated inventory management system in inventory control. The study also shows that the practicability of implementing an automated inventory management system and validated the design by comparing the performances of the manual system and the automated system. The study concludes that automated inventory management system help to increase the efficiency of inventory management, improve the accuracy and quality of the asset tracking process, and reduce human errors.

The result also agrees with the findings of Piyachat (2015) that medium and large companies employees who operated machines had their performance at 80-90% based on the measurement by using cycle of take time received from customers, or set standard time
using time and motion study. Additionally, Owoeye et al. (2014) found that the use of computer programmed software in inventory management is the best tool to maintain stock levels that set the three main costs, holding cost, ordering cost and stock-out costs are at a minimum. Kitheka and Ondiek (2014) study on inventory management automation and the performance of Supermarkets in Western Kenya revealed that inventory management automation affected the performance of the supermarkets and that there was a positive linear relationship between inventory management automation and the performance of the supermarkets in Kenya. This finding supported Mongare and Nasidai (2014) findings that technology has had bigger impact on inventory control in terms of efficiency, ease of accessing information and accuracy thereby affecting organizational performance. Also, Arshad, Shoai, and Khan (2000) concluded that computerized stored inventory system would help improve the efficiency of the store department. It is timeliness, accurate, reliable, consistent, faster, efficient and easy to use.

5. CONCLUSION AND RECOMMENDATIONS
The objective of this study was to analyze the effect of automated inventory management system on the productivity of flour mill companies in Nigeria. The study established that the flour mills companies in Nigeria have adopted and used automated inventory system to a moderate extent and that both Enterprise Resource Planning (ERP) and Materials Requirement Planning System (MRP) are employed in the companies. A very high improved availability of products and growth orientation were achieved by the flour mills companies that had adopted automated inventory system. The companies were also able to not only save costs on labour but also achieve high improve level of out through adoption automated inventory management system. It was established that automated inventory system had significant effect on the productivity of the Flour mills companies in Nigeria. This suggests that the adoption and implementation of automated inventory system enhance the operational performance of flour mills companies. The result therefore enlightened the inventory management practitioners in manufacturing industry in Nigeria on the importance of internal inventory management practices to boost their operational performance and also assisted the inventory managers in decision makings regarding determination of appropriate level of inventory to be kept in the firm stores in order to guarantee that customers are given adequate and proper service level. Based on the results, findings and conclusions, the study recommends to the management of Flour mills manufacturing companies in Nigeria to adopt automated inventory systems in inventory management as this will greatly improve the performance of the procurement function. Enterprise resource planning and materials requirement planning system should be integrated by the Flour mill companies. The management of Flour mills companies in Nigeria should therefore make available the critical resources for the adoption and installations of such systems and must create culture that support use of the system.
REFERENCES


