EFFECTS OF WAREHOUSE MANAGEMENT SYSTEMS ON PERFORMANCE OF MANUFACTURING FIRMS IN KENYA

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ABSTRACT

The manufacturing industry in Kenya contributes 14% to the country’s gross domestic product and employs over two million people (Republic of Kenya (RoK), 2013. The role of the manufacturing sector in the Kenya Vision 2030 is to create employment and wealth. The sector which is dominated by subsidiaries of multi-national corporations, contributed 13% of the GDP in 2004. However, the sector has seen a reduction in its contribution to GDP from 13.6 percent in the early 1990’s to 9.2 percent in 2012. There had been a decline in growth of the sector from 3.4 percent in 2011 to 3.1 percent in 2012. The real growth in the sector averaged 4.1% p.a. during 2006-2013, lower than the average annual growth in overall real GDP of 4.6%. The target population of the study was 455 respondents of the 455 large-scale manufacturing firms based in Nairobi. Stratified random sampling method was applied to come up with the sample size, since the population is considered heterogeneous. The study adopted a descriptive survey which is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals. The data was collected from respondents using self-administered questionnaires. The study established a significant relationship between influence of radio frequency identification (RFID), barcode technology, manufacturing resources planning (MRP-II), distribution requirements planning (DRP) and productivity in manufacturing firms in Kenya $\beta_1$, $\beta_2$, $\beta_3$ and $\beta_4$=(0.549, 0.673, 0.738 and 0.881) $p= (0.001,0.004,0.003$ and 0.001)$<0.05$. The study concluded that WMS provide flexible, automated support in processing all goods movements and in managing stocks in the manufacturing firms. The study recommends that the manufacturing firms in Kenya should employ WMS in order to streamline the operations of the firms and maximize the performance. To adopt the RFID, barcode technology, MRP-II and DRP allows firms to track every unit down to the lowest level of detail for improved order fulfillment and inventory accuracy.

Key Words: Warehouse management systems, Performance of manufacturing firms.
1. INTRODUCTION

1.1 Background of the Study
The study explored the effects of WMS on performance of manufacturing firms in Kenya. The warehouse management has been paper-intensive for sometimes in its coordination of a multitude of activities, but this has changed with the introduction of warehouse management systems (WMS) in the global businesses. These systems span from simple computer automation systems to high-end, feature-rich management programs that improve order picking, facilitate better dock logistics, and monitor inventory management. WMS often utilize automatic identification and data capture (AIDC) technology, such as barcode scanners, mobile computers, wireless local area networks (LANs) and radio frequency identification (RFID) to efficiently monitor the flow of products (Waldner, 2012). Once data has been collected through WMS, there is either batch synchronization with or a real-time wireless transmission to a central database. The database can then provide useful reports about the status of goods in the warehouse. Warehousing refers to the activities involving storage of goods in a systematic and orderly manner and making them available when needed. Warehousing creates time utility by bridging the time gap between production and consumption of goods (Hilmola and Lorentz, 2011).

1.1.1 Global Perspective of Warehouse Management Systems
Globally, all manufacturers are striving to attain an ideal WMS in which every equipment is automated and integrated with the computer systems which minimize the effort put on to perform the manual operation and cuts down the cost for the operation (Kumar, 2014). In the present competitive world, organizations must implement some sophisticated technologies like RFID, barcodes, manufacturing resources planning (MRP-II) and distribution requirements planning (DRP) effectively in order to stay in the competition (Hancke, 2012). Warehouses are the most important parts of a logistic system in a company and they contribute about 20% of logistic costs. Baker & Canessa (2011) mentioned that the capital and operating cost of warehouses in USA is about 22% of logistic costs and it is 25% in Europe. It shows that warehouses are significant from cost perspective and should be well-designed and work with high performance in order to reduce costs as much as possible and improve the efficiency. Although warehouses are related to high cost, but a well-managed warehouse system is required for it is the key concept of modern supply chain system and has an important role to lead the company to be successful in today's business
world (Baker and Canessa, 2011). There are also missions that should be done such as: achieving transportation economies, achieving production economies, providing customers with a mix of products instead of a single product, providing temporary storage of material to be disposed or recycled, providing a buffer location, and for trans-shipments. Therefore, in all manufacturing plants, a center is needed to sort raw materials, parts and products, and it plays a critical role in company’s logistic success.

1.1.2 Regional Perspective of Warehouse Management Systems
The main problem in the warehouses of most manufacturing industries within the region is that the old and conventional methods which are obsolete are combined with very crowded conditions. This may result in very slow material movement and leads to increase in inventory holding costs and also increase in the operating costs. The businesses will not tolerate this increase in manufacturing costs, hence there is always a quest for newer and better methods. The enablement of electronic data interchange (EDI) helps facilitate timely exchange of purchase orders, invoices, advance ship notices and other business transactions with enterprise resource planning (ERP), accounting or other business systems connected seamlessly via electronic means. In today’s world, warehouse management is considered as an indivisible part of all businesses. If effectively and efficiently organized and managed, the warehouses can deliver safe custody of materials, clear monitoring and accountability, distribution of the right goods at the right time whenever required in the right condition to all user departments, maximum profitability with the minimum investment through ordering cost and carrying of materials. It provides service and controls function of the flow of materials entering and distributed at a company.

1.1.3 Local Perspective of Warehouse Management Systems
The importance of warehousing has increased in Kenya during the recent decade. The storage facilities have become value adding centers, responding to market changes with maximized corporate profitability (Kumar, 2014). Manufacturing firms utilize warehouses to serve the markets, hold raw materials, work-in-process, finished goods, other supplies, and thus provide means for appropriate customer service in the local, regional and international environment prone to long lead time and disruptions (Hilmola and Lorentz, 2011). Koumanakos (2011) in his International Journal of Productivity and Performance, states that an efficient WMS helps companies cut expenses by minimizing the amount of unnecessary products in storage and by keeping lost sales to a minimum by having enough stock on hand to meet demand and at the same time, making sure that the stock is not in excess in order to avoid obsolescence and thus more losses. According to Awino and Gituro (2011), large companies mainly focus on becoming efficient and flexible in their manufacturing methods in order to handle uncertainty in the business
environment. The firms also need different strategies to manage the flow of goods from the point of production to the end user. The study explored the effects of WMS on performance of manufacturing firms in Kenya. The target population was 455 warehouse managers of the 455 firms which are based in Nairobi and its surrounding areas.

1.1.4 Warehouse Management Systems
WMS is a complex software package that helps manage inventory, storage locations, and the workforce to ensure that customer orders are picked quickly, packed, and shipped (Bartholdi III & Hackman, 2014). WMS is a database driven computer application which improves the efficiency of the warehouse by directing putaways and to maintain accurate inventory by recording warehouse transactions. The systems also direct and optimize stock based on real-time information about the status of bin utilization. WMS often utilizes AIDC technology, such as barcode scanners, mobile computers, wireless LANs and potentially RFID to efficiently monitor the flow of products. The primary purpose of a WMS is to control the movement and storage of materials within a warehouse and process the associated transactions (Henri, 2013). Typical roles of a WMS include directing and sharing transaction data for the picking, replenishment, and putaway operations. The system may be standalone applications although most modern ERP systems have modules with corresponding functionalities. According to Lidström (2013), Dusseldorp proposed in 1996 that WMS can be divided into three types, which are separated by the functionality features it possesses: Basic WMS, Advanced WMS, and Complex WMS. The basic WMS support stock and location control only and is mainly used to register information. Storing and picking instructions may be generated by the system and possibly displayed on RF-terminals. The warehouse management information is simple and focuses on throughput mainly. The advanced WMS is able to plan resources and activities to synchronize the flow of goods in the warehouse, and focuses on throughput, stock and capacity analysis. The complex WMS optimizes the warehouse or group of warehouses. Information is available about where each product is (tracking and tracing), where it is going to and why (planning, execution and control). Furthermore, a complex system offers additional functionality like transportation, dock door, and value added logistics planning which help to optimize the warehouse operations as a whole (Grönroos & Voima, 2013).
1.1.5 Manufacturing Firms in Kenya
The manufacturing firms in Kenya are small and relatively diverse, but they are the most sophisticated in East Africa. Kenya has a vibrant manufacturing industry which offers a variety of products that meet world class standards. According to the website of the Kenya Association of Manufacturers (KAM), (2011), they have 615 member companies, of which 455 are in Nairobi and its surroundings. The industry continues to grow from strength to strength since the late 1990s despite challenges in the operating environment. Food, clothing and textile subsectors accounts for over 73% of the sector which is a representation of the complete picture of the industry. Food, beverages and tobacco constitute over 73% of total production turnover in the agro-processing industry. About 87% of the total registered manufacturing firms in Kenya are active and majority of these firms are locally owned (Bigsten et al, 2010). The manufacturing firms in Kenya have been classified by various scholars and researchers based on different characteristics. Some authors classified firms based on the quality of service or production, the size of the work force, and the numbers of facilities. In Kenya, according to the KAM directory (2010/2011) large-scale manufacturing firms have more than 100 workers, medium-scale firms have from 51 to 100 workers, small-scale manufacturing firms have from 11 to 50 workers, and micro-scale firms are those with 10 or fewer workers.

1.2 Statement of the Problem

The manufacturing sector in Kenya enjoyed modest growth rates averaging 4 percent over the last decade (KAM, 2012). However, the sector has seen a reduction in its contribution to GDP from 13.6 percent in the early 1990’s to 9.2 percent in 2012 (RoK, 2012). According to (Kenya National Bureau of Statistics (KNBS), (2013), there had been a decline in growth of the sector from 3.4 percent in 2011 to 3.1 percent in 2012. Employment growth rate in the sector decreased from 3.25% in 1970s to 1.87% in 2000s (World Bank, 2013). The value added to the economy by the
manufacturing sector has declined from 15.3% of gross domestic product (GDP) in 2004 to 13.9% in 2014. The decline in growth of manufacturing sector is as a result of inadequate and poor modern technology systems to manage their warehouses among other factors. The firms need to invest in WMS to reduce operational costs and increase performance accuracy through real-time control of operations, easier communication throughout the supply chain, and higher levels of automation. Most of studies conducted on performance of manufacturing firms in Kenya have not focused on the effects of WMS. There is little or no empirical literature available to this study on effects of WMS on performance of this important sector of the economy. Awino (2011) conducted a study on supply chain management in large private manufacturing firms in Kenya. Tozay (2012) conducted a study on warehouse location and design decisions among large scale manufacturing firms in Nairobi, Kenya. Awino and Gituro (2011) conducted a study on supply chain management best practices in large private manufacturing firms in Kenya. Nyaoga, Magutu and Aduda (2015) conducted a study on the link between supply chain strategies and firm performance of large-scale manufacturing firms in Kenya. It is against this background that the study sought to establish the effects of WMS on performance of manufacturing firms in Kenya. The study bridge the gap by seeking answers to the research question: what is the effect of WMS on performance of manufacturing firms in Kenya?

1.3 Research Objectives

i. To determine the influence of radio frequency identification on performance of manufacturing firms in Kenya.

ii. To establish the influence of barcode technology on performance of manufacturing firms in Kenya.

iii. To determine the influence of manufacturing resource planning on performance of manufacturing firms in Kenya.

iv. To establish the influence of distribution requirements planning on performance of manufacturing firms in Kenya.

2. LITERATURE REVIEW
2.1 Theoretical Review

2.1.1 Critical Theory
The study was based on critical theory in establishing influence of RFID system on performance of manufacturing firms. Critical theory goes beyond a descriptive account of how things are, to examine why they have come to be that way, and how they might otherwise be. Critical theory is a reflective theory which gives agents a kind of knowledge inherently productive of enlightenment and emancipation. Critical theory is a form of archaeology that attempt to get beneath common-sense understandings in order to reveal the power relationships and interests determining particular technological configuration and use. The Critical theory of technology combines insights from philosophy of technology and constructivist technology studies to ensure that RFID system is achieved to improve accuracy of inventory location and labour management in warehouse. A framework is proposed for analysing technologies and technological systems at several levels of manufacturing processes. The Internet opens fantastic new opportunities for human communication, and is inundated with commercialism. Critical theory of technology offers a platform for reconciling many apparently conflicting strands of reflection on technology. Only through an approach that is both critical and empirically oriented, is it possible to make sense of what is going on WMS.

2.1.2 Adaptive Structuration Theory
The adaptive structuration theory (AST) will assist the study in determining the influence of barcode technology system on performance of manufacturing firms in Kenya. Based on AST, the study intends to determine the effects of barcode technology on warehouse management. The theory was first proposed by Anthony Giddens in his constitution of the society in 1984, which was an attempt to reconcile social systems and the micro/macro perspective of organizational structure. Desanctis and Poole borrowed from Giddens in order to propose AST and the rise of group decision support systems in 1996. AST provides the model whereby the interaction between advancing information technologies, social structures, and human interaction is described, and which social structures, rules, and resources provided by information technology(IT) as the basis for human activity. AST is a viable approach in studying how IT affects warehouse management because it examines the change from distinct perspectives.
2.1.3 Theory of Scientific Management
The study was based on scientific management theory to determine the influence of MRP-II system on performance of manufacturing firms in Kenya. The theory basically consists of the works of Fredrick Taylor in the late nineteenth and early twentieth centuries (1856 to 1915). According to Taylor, scientific management theory can be seen in nearly all modern manufacturing firms and many other types of businesses. His imprint can be found in production planning, production control, process design, quality control, cost accounting, and even fitting a job to a person. He also stated that if one understands the principles of scientific management, then one will be able to understand how manufacturers produce their goods, manage their employees, and improve production effectiveness and efficiency. Taylor introduced time and motion studies to fix performance standards. He fixed performance standards for time, cost, and quality of work, which leads to uniformity of work. As a result, the efficiency of the workers could be compared with each other (Ramaa, Subramanya, & Rangaswamy, 2012).

2.1.4 Theory of Constraints
The theory of constraints (TOC) guides the study in establishing influence of DRP on the performance of manufacturing firms in Kenya. Many manufacturing firms lack proper DRP system that hinders proper functions of warehouses. This is a major constraint that hinders global consumers to have ability to access produced goods. TOC is a management paradigm that views any manageable system as being limited in achieving more of its goals by a very small number of constraints (Gupta & Snyder, 2011). The theory was conceived by Goldratt in 1984 as a methodology for identifying the most important limiting factor (i.e. constraint) that stands in the way of achieving a goal and then systematically improving that constraint until it is no longer the limiting factor. In manufacturing, every process has a constraint or bottleneck and focusing improvement efforts on that constraint is the fastest and most effective path to improved profitability.

2.1.5 Business Process Reengineering Theory
The business process reengineering (BPR) theory assists the study in evaluating the performance of manufacturing firms in Kenya. BPR theory is a business management strategy, originally pioneered in the early 1990s, focusing on the analysis and design of workflows and business processes within an organization. BPR theory aimed to help organizations fundamentally rethink
how they do their work in order to dramatically improve customer service, cut operational costs, and become world-class competitors. BPR theory seeks to help companies radically restructure their organizations by focusing on the ground-up design of their business processes. According to Desel, Pernici & Weske (2014), a business process is a set of logically related tasks performed to achieve a defined business outcome. Re-engineering emphasizes a holistic focus on business objectives and how processes are related to them, and encouraging full-scale recreation of processes rather than iterative optimization of sub processes.

2.2 Conceptual Framework

![Conceptual Framework](image)

**Independent Variables**

**Dependent Variable**

**Performance of Manufacturing Firms**

1. Increased Productivity
2. Improved Customer Satisfaction
3. Cost Reduction

**Radio Frequency Identification**

1. Transmission of information
2. Identification of goods
3. Facilitation of collection and sharing data

**Barcode Technology**

1. Accurate label reading
2. Accurate identification of information
3. Improved operational efficiency

**Manufacturing Resources Planning**

1. Effective planning of resources
2. Efficient procuring of materials
3. Reduction of wastes

**Distribution Requirements Planning**

1. Planning & completing customer orders
2. Managing flow of materials
3. Integrating records & information

**2.2.1 Radio Frequency Identification**

RFID is a form of automatic identification and data capture (AIDC) technology that uses electric or magnetic fields at radio frequencies to transmit information. RFID system can be used to identify many types of objects, such as manufactured goods and people (Waldner, 2012). Each object that needs to be identified has a small object known as an RFID tag affixed to it or embedded within it. The tag has a unique identifier and may optionally hold additional information about the object. Devices known as RFID interrogators or readers wirelessly communicate with the tags to
identify the item connected to each tag and possibly read or update additional information stored on the tag (Kebo, Staša, Beneš, & Švub, 2013). Both the tag and interrogator are two-way radios. Each has an antenna and is capable of modulating and demodulating radio signals. This communication can occur without a line of sight and over greater distances than other AIDC technologies. RFID communication can occur without optical line of sight, because radio waves can penetrate many opaque materials at greater speeds because many tags can be read quickly (Kebo, Staša, Beneš, & Švub, 2013).

2.2.2 Barcode Technology

Barcode technology has been used for decades and during this time has proved itself as a reliable performer when supporting SCM (Jinxiang, Goetschalckx & McGinnis, 2011). Identification processes that rely on AIDC technologies are significantly more reliable and less expensive than those that are not automated. The most common AIDC technology is barcode which uses optical scanners to read labels. Most people have direct experience with barcodes because they have seen cashiers scan items at supermarkets and retail stores. Barcodes are enormous improvement over ordinary text labels because personnel are no longer required to read numbers or letters on each label or manually enter data into an IT system, they just have to scan the label. The innovation of barcodes greatly improved the speed and accuracy of the identification process and facilitated better management of inventory and pricing when coupled with information systems.

2.2.3 Manufacturing Resources Planning

MRP-II is defined by the American Production and Inventory Control Society as a method for the effective planning of all the resources of a manufacturing company. MRP-II is a direct descendant of the Material Requirements Planning (MRP-I) system which is a set of techniques that uses bills of material, inventory, data and a master production schedule to calculate the requirements for materials in a manufacturing company. The MRP-I system was initiated in the 1960s and was spearheaded by a team of IBM innovators comprising of Joe Orlicky, George Plossl, and Ollie Wright who sought to create a structured methodology for planning and scheduling materials for complex manufactured products. Over the past 30 years, MRP system has spawned an entire industry in manufacturing and professional services. It has evolved hand in hand with technological advancements in the computer hardware industry.
2.2.4 Distribution Requirements Planning

 DRP is the method used by supply chain entities to plan orders in the whole supply chain taking into account the inventories to be kept along with buffer or safety stock, and placing the orders with the manufacturer to replenish inventories to meet customer orders integrating records and information. DRP is a method used in business administration for planning orders within a supply chain. DRP enables the user to set certain inventory control parameters (like a safety stock) and calculate the time-phased inventory requirements (Feigin, Katircioglu & Yao, 2013). DRP efficiently carry out the whole process of completing customer orders by minimizing shortages and reducing the overall costs comprising of ordering, transporting and inventory holding.

2.2.5 Performance of Manufacturing Firms

 According to PwCIL (2010) and Okoth (2012), Kenya’s large-scale manufacturing subsector has a challenging history in terms of performance and unstructured strategy. Performance of the manufacturing firms was assessed using a set of variables given that performance is multi-dimensional term. In this study, performance will focus on the flow of goods within the warehouse, transmission of information, identification of goods, facilitation of collection and sharing data, accurate label reading, accurate identification of information, improved operational efficiency, effective planning of resources, efficient procuring of materials, reduction of wastes, planning and completing customer orders, managing flow of materials, integrating records and information, the correct information is captured and relayed, increased productivity, improved customer satisfaction, and cost reduction in manufacturing.

The service performance reports include order on time service report, fill rate or completeness of order report, and accuracy of the orders filled. The cost performance reports include productivity of the personnel by warehouse function, space utilization, budget for the warehouse, and allocation of costs to all operations. The performance reports can be easily attained by computer systems by giving certain commands through which the managers can find out the status of the warehouse performance. Computers play a very important role in a warehouse and slowly but steadily all the businesses are heading towards ‘The Ideal Warehouse’ concept with the help of the latest technological developments in the field of computers and advanced equipment.
2.3 Empirical Review

2.3.1 Radio Frequency Identification

Kolarovszki & Vaculík (2013) conducted a study on WMS based on selected automatic identification technology in Slovakia. The aim of the study was the design and partial realization of WMS using RFID technology, enabling recording arrival and departure of goods in the warehouse and assigns each item. In their research, they aimed to create a configuration for warehouse management using RFID technology and they focused on the software part of the essence of the whole application in the warehouse management. The study described processes from entering goods into production to identification of goods and also palletizing, storing, bin transferring and removing goods from warehouse. The identification processes that rely on AIDC technologies are significantly more reliable and less expensive than those that are not automated. RFID offers many advantages because it relies on radio frequencies to transmit information rather than light, which is required for optical AIDC technologies. The study concluded that managing inventory control is possible in several ways, but it chose the path Coding RFID tags with subsequent creation of applications for warehouse management. The software named as AMP2 met the expectations and they said that it is possible to manage stock through it. In their case, it was a model example but experience from abroad showed that more and more logistics companies tend to use technologies such as RFID.

2.3.2 Barcode Technology

Jeng-An and Chiou-Shann (2013) conducted a research study on 2D Barcode Image Decoding in Taiwan, China. They revised the traditional decoding procedure by proposing a serial of carefully designed preprocessing methods. The decoding procedure consists of image binarization, Quick Response (QR) code extraction, perspective transformation and resampling, and error correction. Binarization is an important process for accurately recognizing black-and-white module in QR code images (Zhou, Liu and Li, 2010). By these steps, they could recognize different types of QR code images. Their experiment results showed that their method was accurate and their method could decode images in real time than the traditional decoding procedure. According to the encoding type of barcodes, they divided barcode into two categories: one-dimensional barcode and two-dimensional barcode. One-dimensional barcode typically consists of varying widths and spacing
of parallel lines. Moreover, two dimensional barcode is a graphical image that stores information both horizontally and vertically. Two-dimensional barcode compared with the one-dimensional barcode has the following advantages: (1) high data capacity; (2) no additional storages; (3) error correction ability.

### 2.3.3 Manufacturing Resources Planning

Vorster (2010) conducted a study on the need for a MRP-II system within a manufacturing company in South Africa. The findings revealed that the current lack of an effective MRP-II system is hampering the profitability of Euro-Plastifoam. The research has shown that communication, inventory control and the management of material resources is a matter of concern and that material resource planning plays an interlinking role in assuring that production activities are performed effectively. The current ineffective communication and lack of up to date information makes it difficult for management to plan ahead. MRP-II system is a method for the effective planning of all resources of a manufacturing company. Ideally, it addresses operational planning in units, financial planning in dollars, and has a simulation capability to answer ‘what if’ questions. It is made up of a variety of functions, each linked together; Business Planning, Production Planning, Master Scheduling, Material Requirement Planning and Capacity Requirement Planning. The outputs from these systems are integrated with financial reports such as the business plan, purchase commitment report, shipping budget, inventory projection in dollars, etc. In general, MRP-II functions can be grouped into three macro elements, namely Top Management Planning, Operation Planning and Execution. Manufacturing organizations can be broadly divided into sales, logistics, production, engineering and supporting functions. The development of MRP-II links up all these functions together with coverage much greater than what is being focused by traditional Material Requirements Planning (MRP-I). The theory of MRP-II has been well discussed in many literatures.

### 2.3.4 Distribution Requirements Planning

Feigin, Katircioglu and Yao (2013) conducted a research on the contributions and importance of DRP system in the supply chain. DRP provides the basis for integrating supply chain inventory information and physical distribution activities with the Manufacturing Planning and Control System (MPCS). DRP manages the flow of materials between firms, warehouses and distribution
centers. It links firms in the supply chain by providing planning records that carry demand information from receiving points to supply points and vice versa. DRP starts in the marketplace and some firms gather information on inventory levels and product usage from customers. This knowledge of customer requirements provides firms with the opportunity to make-to-knowledge.

2.3.5 Performance of Manufacturing Firms

Elger (2010) conducted a study on the Theory of Performance. The theory develops and relates six foundational concepts to form a framework that can be used to explain performance as well as performance improvements. To perform is to produce valued results. A performer can be an individual or a group of people engaging in a collaborative effort. Developing performance is a journey, and level of performance describes location in the journey. Current level of performance depends holistically on six components: context, level of knowledge, levels of skills, level of identity, personal factors, and fixed factors. Three axioms are proposed for effective performance improvements. These involve a performer’s mindset, immersion in an enriching environment, and engagement in reflective practice. The performance of a system, for example a WMS, depends on the components of the system and on the interactions between the components. Similarly, level of performance of an individual or an organization depends on the following components: level of identity, level of skills, level of knowledge, context of performance, personal factors and fixed factors.

2.4 Research Gaps

The empirical indicates that it is evident that study in the area of WMS has been done but not in a comprehensive approach to the effects of WMS on performance of manufacturing firms in Kenya. A few studies that have been done indicate that studies have focused on the implementation and benefits of WMS, location and designs of warehouses, and selection of the right WMS provider. Karimi & Namusonge (2014) carried a study on the role of information technology on warehouse management in Kenya. Ramaa, Subramanya & Rangaswamy (2012) conducted a study on impact of WMS in a supply chain in India. Huang Min (2010) carried a study on general use of warehouse management system software in Singapore. Harold (2010) carried a study on implementation of warehouse management system. Kolarovszki & Vaculík (2013) carried a study on warehouse management system based on selected automatic identification technology in Slovakia. Tozay
(2011) conducted a study on warehouse location and design decisions among large scale manufacturing firms in Nairobi, Kenya.

The empirical reviewed indicate that there are gaps on the study topic of effects of warehouse management on performance of manufacturing firms in Kenya. Previous studies which have been undertaken have shown that warehouse management has a positive impact on performance, but efforts to improve warehousing operations in these manufacturing firms is being given very little attention. Because of this research gap, as well as minimum effort to implement or delayed implementation of recommended performance standards as highlighted in the problem statement, this research will be quite timely and is bound to benefit the manufacturing firms or industry (Root, 2013). This study intends to fill pertinent gaps in literature by studying the selected independent variables on the relationship between the warehouse management and the performance of manufacturing firms in Kenya. This study will add value to the existing literature by providing empirical evidence on the influence of warehouse management on performance of manufacturing firms in Kenya, and fill the existing contextual and conceptual gaps.

3. METHODOLOGY

3.1 Research Design
The study adopted the descriptive research design. Research design is defined as a plan, structure and strategy of investigation conceived to obtain answers to research questions and control variance.

3.2 Target Population
The target population was 455 large-scale manufacturing firms in Kenya. The unit of analysis was the large-scale manufacturing firm. In Kenya, according to the KAM directory (2010/2011) large scale enterprises have more than 100 workers, medium enterprises have from 51 to 100 workers, small enterprises have from 11 to 50 workers and micro-enterprises are those with 10 or fewer workers.

3.3 Sampling
Stratified random sampling method was applied to come up with the sample size, since the population in different large-scale manufacturing firms is considered heterogeneous, implying that a simple random sample will be unrepresentative. The stratified random sampling technique was appropriate for the researcher to come up with the sample size, because the target population is
heterogeneous or of mixed sectors referred to as stratum. The stratified technique was ensuring that each sector in the target population has an equal chance of being selected.

3.4 Data Analysis
The collected data was analyzed by the use of descriptive statistics. The information was codified and entered into a spreadsheet and analyzed using frequencies and percentages obtained from Statistical Package for Social Sciences (SPSS).

4. FINDINGS

4.1 Radio Frequency Identification (RFID)

4.1.1 Transmission of Information
The study sought the respondents response on the level at which they agreed with the given statements that relate to the influence of transmission of information on performance of manufacturing firms. From the finding, majority of the respondents indicated that accurate transmission of information reduces manufacturing costs, increases productivity and improves customer satisfaction as indicated by mean of 4.89, 4.69 and 4.63 with standard deviation of 0.76, 0.74 and 0.63. This is in line with Wamba, Coltman & Michael (2011) who stated that RFID technologies can support the redesign of business processes; improve data quality; real-time data collection; synchronization and information sharing between the players of supply chain hence influencing the performance of firms.

Table 1: Influence of transmission of information on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
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<tbody>
<tr>
<td>Accurate transmission of information increases productivity</td>
<td>4.69</td>
<td>0.74</td>
</tr>
<tr>
<td>Accurate transmission of information improves customer satisfaction</td>
<td>4.67</td>
<td>0.63</td>
</tr>
<tr>
<td>Accurate transmission of information reduces manufacturing costs</td>
<td>4.89</td>
<td>0.76</td>
</tr>
</tbody>
</table>

4.1.2 Identification of Goods
The study sought the respondent’s level of agreement with the statements that relate to the influence of identification of goods on performance of manufacturing firms and results presented
on Table 4.9. From the findings, majority of the respondents strongly agreed that proper identification of goods reduces manufacturing costs, increases productivity and improves customer satisfaction as indicated by mean of 4.90, 4.85 and 4.72 with standard deviation of 0.74, 0.64 and 0.60. This is in line with Kebo, Staša, Beneš, & Švub, (2013), who stated that RFID technology is adopted to facilitate the collection and sharing of data in a warehouse. The findings also agree with Kolarovszki & Vaculík (2013) who stated that identification processes that rely on RFID technologies are significantly more reliable and less expensive than those that are not automated.

Table 2: Influence of identification of goods on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper identification of goods reduces manufacturing costs</td>
<td>4.90</td>
<td>0.74</td>
</tr>
<tr>
<td>Proper identification of goods improves customer satisfaction</td>
<td>4.72</td>
<td>0.60</td>
</tr>
<tr>
<td>Proper identification of goods increases productivity</td>
<td>4.85</td>
<td>0.64</td>
</tr>
</tbody>
</table>

4.1.3 Facilitation of Collection and Sharing of Data

Respondents were requested to indicate their response on the level of agreement with the given statements concerning influence of facilitation of collection & sharing of data on performance of manufacturing firms and results presented on Table 4.10. From the findings, majority of the respondents strongly agreed that timely collection and sharing of data reduces manufacturing costs, increases productivity and improves customer satisfaction as indicated by mean of 4.88, 4.83 and 4.70 with standard deviation of 0.87, 0.78 and 0.69. This is in line with the findings of Kolarovszki & Vaculík (2013) who concluded their study that RFID technology is adopted to facilitate the collection and sharing of data in a warehouse. They further stated that RFID makes it possible to collect reliable data from entering goods into production to identification of goods and also palletizing, storing, bin transferring and removing goods from warehouse.

Table 3: Influence of facilitation of collection and sharing of data on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timely collection and sharing of data increases productivity</td>
<td>4.83</td>
<td>0.78</td>
</tr>
</tbody>
</table>
Timely collection of data improves customer satisfaction 4.70 0.69
Timely collection of data reduces manufacturing costs 4.88 0.87

4.2 Barcode Technology

4.2.1 Accurate Label Reading
From the findings, majority of the respondents strongly agreed that accurate label reading of products reduces cost of operations, increases productivity and improves customer satisfaction as indicated by mean of 4.94, 4.88 and 4.83 with standard deviation of 0.83, 0.76 and 0.62. This is in line with the findings of Jinxiang, Goetschalckx & McGinnis (2011) who stated in their study that barcodes greatly improved label reading of goods and facilitated better management of inventory in warehouse.

Table 4: Influence of accurate label reading on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accurate label reading of products increases productivity</td>
<td>4.88</td>
<td>0.76</td>
</tr>
<tr>
<td>Accurate product label reading improves customer satisfaction</td>
<td>4.83</td>
<td>0.62</td>
</tr>
<tr>
<td>Accurate label reading of products reduces cost of operations</td>
<td>4.94</td>
<td>0.83</td>
</tr>
</tbody>
</table>

4.2.2 Accurate Identification of Information
The study sought the respondents’ level of agreement with the given statements concerning influence of accurate identification of information on performance of manufacturing firms and results presented on Table 4.12. From the findings, majority of the respondents strongly agreed that accurate identification of information reduces cost of operations, increases productivity and that accurate identification of information improves customer satisfaction as indicated by mean of 4.71, 4.67 and 4.60 with standard deviation of 0.69, 0.69 and 0.65. This is in line with Jinxiang, Goetschalckx & McGinnis (2011), who stated that the innovation of barcodes greatly improved the speed and accuracy of the identification process and facilitated better management of inventory and pricing when coupled with information systems.

Table 5: Influence of accurate identification of information or data on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
</table>

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Accurate identification of information increases productivity 4.67 0.69
Accurate identification of data improves customer satisfaction 4.60 0.65
Accurate identification of information reduces cost of operations 4.71 0.69

4.3 Manufacturing Resources Planning (MRP-II)

4.3.1 Effective Planning of Resources
From the findings, majority of the respondents strongly agreed that effective planning of resources reduces manufacturing costs, increases productivity and improves customer satisfaction as indicated by mean of 4.81, 4.77 and 4.73 with standard deviation of 0.76, 0.64 and 0.61. This agreed with the findings of Monk & Wagner (2012) that MRP-II is a system with simulation capabilities that enable predictions to be made beforehand, and involves every facet of business from planning to execution.

Table 6: Influence of Effective Planning of Resources on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective planning of resources increases productivity</td>
<td>4.77</td>
<td>0.64</td>
</tr>
<tr>
<td>Effective planning of resources improves customer satisfaction</td>
<td>4.73</td>
<td>0.61</td>
</tr>
<tr>
<td>Effective planning of resources reduces manufacturing costs</td>
<td>4.81</td>
<td>0.76</td>
</tr>
</tbody>
</table>

4.3.2 Efficient Procuring of Materials

Table 7: Influence of Efficient Procuring of Materials on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient procuring of materials increases productivity</td>
<td>4.71</td>
<td>0.68</td>
</tr>
<tr>
<td>Efficient procuring of materials improves customer satisfaction</td>
<td>4.70</td>
<td>0.60</td>
</tr>
<tr>
<td>Efficient procuring of materials reduces manufacturing costs</td>
<td>4.77</td>
<td>0.70</td>
</tr>
</tbody>
</table>
4.3.3 Reduction of Wastes
The respondents were requested to indicate the level to which they agreed with the given statements that relate to the influence of reduction of wastes on performance of manufacturing firms. The results are presented on Table 4.16. From the findings, majority of the respondents strongly agreed that reduction of wastes reduces manufacturing costs, increases productivity and improves customer satisfaction as indicated by mean of 4.87, 4.69 and 4.60 with standard deviation of 0.87, 0.69 and 0.78. This implies that manufacturing resources planning lead to reduction of wastes hence influencing productivity of manufacturing firms. This is in line with Monk and Wagner (2012) who state that MRP-II provides a general control structure that breaks the production control problem into a hierarchy based on time scale and product aggregation which reduces any wastes during production.

Table 8: Influence of Reduction of Wastes on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of wastes increases productivity</td>
<td>4.69</td>
<td>0.69</td>
</tr>
<tr>
<td>Reduction of wastes improves customer satisfaction</td>
<td>4.60</td>
<td>0.78</td>
</tr>
<tr>
<td>Reduction of wastes reduces manufacturing costs</td>
<td>4.87</td>
<td>0.87</td>
</tr>
</tbody>
</table>

4.4 Distribution Requirements Planning (DRP)

4.4.1 Planning and Completing Customer Orders
The respondents were requested to indicate their level of agreement with the given statements that relate to the influence of DRP system on performance of manufacturing firms. This is in line with Feigin, Katircioglu & Yao (2013), who stated that DRP enables the user to set certain inventory control parameters and calculate the time-phased inventory requirements.

Table 9: Influence of Planning & Completing Customer Orders on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and completing customer orders increases productivity</td>
<td>4.72</td>
<td>0.87</td>
</tr>
</tbody>
</table>
Planning and completing customer orders improves customer satisfaction 4.70 0.86
Planning and completing customer orders reduces manufacturing costs 4.88 0.97

4.4.2 Managing Flow of Materials
From the findings, majority of the respondents strongly agreed that Managing flow of materials reduces manufacturing costs, increases productivity and improves customer satisfaction as indicated by mean of 4.89, 4.85 and 4.79 with standard deviation of 0.94, 0.86 and 0.79. This implies that influence managing flow of materials due to the DPR supply chain method used by manufacturing firms in Kenya. The results agreed with Feigin, Katircioglu & Yao (2013) who stated that DRP provides the basis for integrating supply chain inventory information and physical distribution activities with the Manufacturing Planning and Control System.

Table 10: Influence of Managing Flow of Materials on performance of manufacturing firms

<table>
<thead>
<tr>
<th>Statements</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing flow of materials increases productivity</td>
<td>4.85</td>
<td>0.86</td>
</tr>
<tr>
<td>Managing flow of materials improves customer satisfaction</td>
<td>4.79</td>
<td>0.79</td>
</tr>
<tr>
<td>Managing flow of materials reduces manufacturing costs</td>
<td>4.89</td>
<td>0.94</td>
</tr>
</tbody>
</table>

4.4.3 Integrating Records and Information
The study sought on the extent to which respondents agreed on the given statements that relate to the influence of integrating records & information on performance of manufacturing firms and results presented on Table 4.19. From the findings, majority of the respondents strongly agreed that integration of records and information reduces manufacturing costs, increases productivity and improves customer satisfaction as indicated by mean of 4.72, 4.70 and 4.66 with standard deviation of 0.69, 0.65 and 0.56. This implies that distribution requirements planning enable the firms to integrate records and information hence influencing manufacturing firm’s productivity. The finding agreed with Feigin, Katircioglu & Yao (2013), who stated that DRP greatest payoff is from integrating records and information of products in a warehouse.

4.5 Performance of Manufacturing Firms
The study sought the extent to which indicators of level of performance experienced by manufacturing organizations in the last five years in terms of productivity, customer satisfaction, total manufacturing costs, market share, and profitability, that is related to RFID, Barcode technology, MRP-II and DRP by taking year 2011 as the base year. The implementation of warehousing management systems was found to contribute to performance of manufacturing companies as productivity level increase attributed to implementation of warehousing management systems from 15% in year 2011 to 21.1% in the year 2015. The performance in productivity level was on upward trends as the productivity increased steadily from 15%, to 16% to 19% then to 20% to 21.1% from 2011 to 2015 respectively.

**Table 11: Performance Level of Manufacturing Firms**

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Performance levels %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
<td>2011</td>
</tr>
<tr>
<td>Productivity level</td>
<td>15</td>
</tr>
<tr>
<td>Customer satisfaction level</td>
<td>2.6</td>
</tr>
<tr>
<td>Market share</td>
<td>6.9</td>
</tr>
<tr>
<td>Profitability level</td>
<td>10.34</td>
</tr>
</tbody>
</table>

**4.5 Inferential Analysis**

**4.5.1 Correlation analysis**

**Table 12: Correlation Matrix Analysis on influences of warehouse management systems and productivity of manufacturing firms**

<table>
<thead>
<tr>
<th>Effects of Warehouse management systems</th>
<th>Productivity of manufacturing firms</th>
<th>Radio frequency identification</th>
<th>Barcode technology</th>
<th>Manufacturing resources planning</th>
<th>Distribution requirements planning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio frequency identification Pearson Correlation</td>
<td>0.786(*)</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.5.2 Regression Analysis

Table 13: Model Summary

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.869a</td>
<td>.755</td>
<td>.743</td>
<td>.534</td>
<td>.001</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), radio frequency identification, barcode technology, manufacturing resources planning and distribution requirements planning.

b. Productivity (Mmanufacturing firms in Kenya)

Table 14: ANOVA

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>Degree of Freedom (Df)</th>
<th>Mean Square</th>
<th>F-ratio</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>14.719</td>
<td>4</td>
<td>3.103</td>
<td>9.621</td>
<td>.000a</td>
</tr>
<tr>
<td>Residual</td>
<td>33.134</td>
<td>105</td>
<td>.652</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>47.853</td>
<td>109</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
a. Predictors: (Constant), radio frequency identification, barcode technology, manufacturing resources planning and distribution requirements planning

b. Productivity (Manufacturing firms in Kenya)

4.5.3 Coefficient Analysis

Table 15: Coefficient Analysis

<table>
<thead>
<tr>
<th>Coefficientsa</th>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>B</td>
<td>Std. Error</td>
</tr>
<tr>
<td>1 (Constant)</td>
<td></td>
<td>3.127</td>
<td>.867</td>
</tr>
<tr>
<td>Radio Identification Frequency</td>
<td>.549X4</td>
<td>.205</td>
<td>.212</td>
</tr>
<tr>
<td>Barcode Technology</td>
<td>.673X3</td>
<td>.291</td>
<td>.313</td>
</tr>
<tr>
<td>Manufacturing Planning Resources</td>
<td>.738X2</td>
<td>.336</td>
<td>.374</td>
</tr>
<tr>
<td>Distribution Planning Requirements</td>
<td>.881X1</td>
<td>.372</td>
<td>.452</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), radio frequency identification, barcode technology, manufacturing resources planning and distribution requirements planning

b. Productivity (Manufacturing firms in Kenya)

The established regression equation was:

\[ Y = 3.127 + 0.881X_1 + 0.738X_2 + 0.673X_3 + 0.549X_4 + e \]

From regression results in Table 4.24, the 3.127 represented the constant which predicted value of productivity (manufacturing firms in Kenya) when all warehouse management systems effects remain constant at zero (0). This implied that manufacturing firms in Kenya productivity would be at 3.127 holding RFID, barcode technology, manufacturing resources planning and distribution requirements planning at zero (0).
Regression results revealed that radio frequency identification has significance influence in productivity in manufacturing firms in Kenya as indicated by $\beta_1=0.549$, $p=0.001<0.05$, $t=3.324$. The implication is that as increase in radio frequency identification lead to increase in manufacturing firm’s performance by $\beta_1=0.549$. This implied that an increase in radio frequency identification would lead increase in firm’s performance. The finding concurred with Wamba, Coltman & Michael (2011), who stated that RFID implementation can bring about additional benefits such as reduction losses due to shop lifting and increased use of point of sale applications.

Regression results revealed that barcode technology has a significance influence on productivity in manufacturing firms in Kenya as indicated by $\beta_2=0.673$, $p=0.004<0.05$, $t=4.584$. This implied that an increase in barcode technology would lead to an increase in project performance by $\beta_2=0.673$. This implied that barcode technology was effective in improving the performance of the manufacturing firms. From the regression findings, the study revealed that there existed a significant positive relationship between manufacturing resources planning and firm performance as indicated by $\beta_3=.738$, $p=0.003<0.05$, $t=5.522$. The implication is that an increase in manufacturing resources planning would lead to increase in productivity in manufacturing firms by $\beta_3=.738$.

CONCLUSION

The study concluded that barcode technology data collection solutions for warehouse management systems provide powerful and flexible automatic identification system that connects the shop floor to the enterprise software. Adaptation of barcodes greatly improved the speed and accuracy of the identification process and facilitated better management of inventory and pricing when coupled with information systems. Barcodes provide benefits like operational efficiency, better customer service, improved visibility of key business information to management, data integrity, ease of implementation, and cost effectiveness.

The study concluded that manufacturing resources planning is the effective method of operational or financial planning of a manufacturing firm’s resources. MRP-II leads to efficient procuring of materials hence influencing productivity of manufacturing firms. Efficient procuring of materials
enables management to make decisions such as whether to build up inventory or use overtime, or a combination of the two to meet increased demand for a product. In a practical manufacturing environment, the production line must deliver the right quantities of components while maintaining a timely delivery.

The study concludes that distribution requirements planning is a method used in business administration for planning orders within a supply chain hence influencing firm’s productivity. DRP is a time-based approach that determines when inventory is likely to be depleted and plans replenishment to avoid shortages. DRP provides the basis for integrating supply chain inventory information and physical distribution activities with the Manufacturing Planning and Control System. The study concluded that DRP enable the firms to integrate records and information hence influencing manufacturing firm’s productivity. DRP efficiently carry out the whole process of completing customer orders by minimizing shortages and reducing the overall costs comprising of ordering, transporting and inventory holding. This in turn influences the success of firm’s productivity. The study proved that WMS are enabling factors for performance and productivity improvement. The productivity of warehouse management systems is way higher than when the operations are manually performed.

**RECOMMENDATION**

The study concluded that warehouse management systems have a positive impact on performance of manufacturing firms. Investments in warehouse management systems enable the distribution centre to compete successfully against other rivals in the market. The study recommends that the manufacturing firms in Kenya should employ warehouse management systems in order to streamline the operations of the firms and maximize the performance. The adoption of the radio frequency identification, barcode technology, manufacturing resources planning and distribution requirements planning allows firms to track every unit down to the lowest level of detail for improved order fulfillment and inventory accuracy. The study recommends that management should ensure RFID implementation to bring about additional benefits such as reduction losses due to shop lifting. The study recommends that management should ensure wireless barcode in warehouse management systems as it is necessary in supporting the complex operational activities and ensure accuracy of each order by establishing the right quantity to pack for shipping.
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