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EFFECT OF MATERIAL REQUIREMENT PLANNING ON PERFORMANCE OF MANUFACTURING FIRMS IN KENYA

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Abstract: **Owing to the trend of globalization in recent decades, the importance of material requirements planning has been growing in various areas. For industries, material requirements planning system helps to optimize the existing production and distribution processes based on the same resources through management techniques for promoting the efficiency and competitiveness of firms. Material requirements planning system is 'part of the supply chain process that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements. The General objective of this research was to determine the role of material requirement planning on operational performance in the East African Manufacturing Industry. The specific objective of this research project was to establish the role of elementary scheduling system, inventory control system, capacity requirement planning and demand forecasting system on operational performance in selected manufacturing firms in East African. The study adopted descriptive research design. This study focused on carefully selected 10 Manufacturing firms in East Africa that have existed for more than ten years. The study collected and analyzed data from the 10 East African Manufacturing firms identified in East Africa. This study collected and analyzed both primary and secondary data. Questionnaires was the primary data collection instrument, while secondary data was collected from institutional records, reports, journals, and past research. Secondary data was used to identify East African Manufacturing firms, while primary data was collected from respondents in East African Manufacturing firms. Data was collected using self-administered questionnaires, which was delivered to respondents and collected the following day to allow them adequate time to respond effectively. A pilot study was conducted to test the reliability and validity of the questionnaire. Descriptive statistics, including means, standard deviation, and frequency distribution were used in the study. Regarding elementary scheduling system, the study established that Elementary scheduling system had a significant and positive effect on the operational performance in the East African Manufacturing Industry. The study also established that inventory control system had a significant and positive effect on the operational performance in the East African Manufacturing Industry. The study further established that capacity requirement planning had significant and a positive effect on the operational performance in the East African Manufacturing Industry. The study final established that demand forecasting system had significant and a positive effect on the operational performance in the East African Manufacturing Industry. The study recommends that the management of the manufacturing firms should enhance on the utilization of the factory's resources by implementing an elementary scheduling system that can attribute to their competitive advantage to short product lifecycles and quick response to changes in market demand that will in turn enhance operational performance in the East African Manufacturing Industry. The study also recommends that the management of manufacturing firms should deploy inventory record accuracy practices that implement cycle counting to eliminate errors in recording, improvement of record accessibility, lower transactions cycles as well as reducing records errors in inventory operations which in turn will enhance operational performance in the East African Manufacturing Industry.**

Keywords: **elementary scheduling system, inventory control system, capacity requirement planning & demand forecastingsystem.**

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1. INTRODUCTION

Globally, material requirements planning (MRP) aims at efficient scheduling of production requirements so that raw materials, components, and subassemblies can be provided in the right amount and at the right time. An MRP system needs to adjust production plans to counter the adverse effects caused by various unexpected disturbances or production uncertainties such as unexpected demand increases, tool or machine breakdowns, new product introduction, non-arrival of raw materials, and excessive rejects (Chadwick, 2013). Extreme changes in production plans, a problem referred to as nervousness, can be obstacles to the effective execution of material requirements planning (MRP) systems. System nervousness leads to high rescheduling costs and fluctuation in capacity utilization (Murthy, 2014).

According to Johnson (2016), some of the approaches that predominate in the production planning and control field are evaluated, such as material requirements planning, hierarchical production planning, just-in-time (JIT), and optimized production technology (OPT), and their pros and cons are stressed. The need for new systems, which simultaneously consider the planning requirements of materials and capacities, enables the various uncertainty elements present in all the planning phases due to the complex and dynamic nature of the relations between different supply chain members. In such contexts, where planning decisions involve resources and information from various supply chain entities, there are aspects which the decision-maker must face; conflictive objectives, the uncertainty of production levels, or lack of knowledge of demand data in (Ben, 2013).

Statement of the problem

A practical material requirement planning MRP ensures that production planning, scheduling, and inventory control systems manage manufacturing processes. Most MRP systems are software-based, while it is possible to conduct MRP byhand (Johnson, 2016). Paul (2017) has stated that an effective MRP is a powerful tool for operational performance. According to Wayne (2017), the vital goal of MRP is to ensure that materials are available for production and products are available for delivery to customers, maintain the lowest possible material and product levels in the store, and plan

manufacturing activities, delivery schedules, and purchasing activities, and thus a long term operational performance. However, the lack of integration with the procurement department has led to considerable losses to firms, hence lowering firm's operational performance.

In the present day, manufacturing firms face greater risk and a greater degree of uncertainty due to global competition. To gain a competitive advantage, organizations need to restructure and establish integrated systems for easy management endlessly. Perceived trends during the last five years show that the significant influence of the strategic advantage for the companies worldwide is the integration of material requirement planning in its management system and further with other management functions.

Looking at the findings of Achieng (2017), the key challenges facing manufacturing industries in Kenya include the purchasing of insufficient quantities of an item used in manufacturing hence not meeting contractual obligations to supply products on time and also purchasing of excessive amounts of an item, therefore, the excess quantity ties up cash while it remains as stock and may never even be used at all. To control this, East African manufacturing firms have to integrate material requirement planning in their management system. With the development of modern management systems, the manufacturing sector has become a process industry that maximizes available resources. However, other manufacturing firms are recently embracing material requirement planning practices to enhance their operations. Therefore, there is a substantial need for firms to embrace the MRP system to enable them to address operational performance effectively.

Therefore, this has opened a research opportunity for a study on the material requirement planning on operational performance in the East African Manufacturing Industry. To fulfill this purpose, descriptive research will be undertaken at Selected manufacturing firms in East African headquarters, for which procurement officers and staff will be fully involved.

Objectives

i. To establish the role of elementary scheduling system on operational performance in Selected manufacturingfirms in East African.

ii. To find out the role of inventory control system on operational performance in Selected manufacturing firms inEast African.

iii. To establish the role of capacity requirement planning on operational performance in Selected manufacturingfirms in East African.

iv. To find out the role of demand forecasting system on operational performance in Selected manufacturing firms inEast African.

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2. THEORETICAL REVIEW

Systems theory

According to Collier & Evans (2016), a system is a related group of components that work together to accomplish the task. Ludwig von Bertalanffy in 1951 and Kenneth Boulding in 1956 wrote articles that have provided a modern foundation of general systems theory (Bertalanffy, 1951). Johnson, Kast, & Rozensweig (1964) applied the systems theory to management as a framework to manage operations and handle complex problems. The system theory can provide a rationale for the performance of the manufacturing industry. A system is an entity that is a coherent whole such that a boundary is perceived around it to distinguish internal and external elements and to identify input and output relating to and emerging from the entity (Maull and Yip, 2019). Stevenson (2013) states that the systems approach's central theme is that the whole system consists of different individual parts, but the main emphasis is on the interrelationship among its subsystems. Bellgran and Safsten (2015) also backed up these arguments, arguing that how different components relate and interplay in a system is called systems theory. Various methods are distinguished from the environment through what the system is used for and what comes from it (Yourdon, 1989). The argument for the Theory is that internal and external factors shape an organization's performance, and to understand it, a holistic perspective of systems theory has to be understood.

Theory of constraints

The Theory of constraints is a set of principles that maximizes all activities that would cause a bottleneck in the workstations by increasing total process throughput (collier & Evans. 2016). The Theory of constraint is a scheduling approach that focuses on bottleneck operations (Stevenson, 2013). According to Jacobs et al. (2017), bottlenecks are described as any resource with the same or lower required capacity. There is always at least one constraint, and the Theory of constraints uses a focusing process to identify the constraint and restructure the rest of the organization around it. The Theory of constraints was introduced by Eliyahu M. Goldratt in 1984 in his book titled "the goal," which was geared to help organizations continually achieve their goals. Goldratt (1997) adapted the concept to project management. The Theory is based on several assumptions that the organizations can be measured and controlled by variations on three measures that is throughput, operational expense, and inventory (Goldratt, 2014). Inventory is all money that the system has invested in purchasing things that it intends to sell. Operating expense is all the money the system spends to turn inventory into throughput, while throughput is the rate at which the system generates money through sales (Goldratt, 1998). This theory also assumes that necessary conditions must first be met before the goal itself can be reached. These include safety, quality, legal obligations, etc. Goldratt reason that the bottleneck operations limited the system's output. Therefore, organizing the non-bottleneck operations in a better schedule would reduce the period when the bottleneck operations were idle (Stevenson, 2013).

Conceptual framework

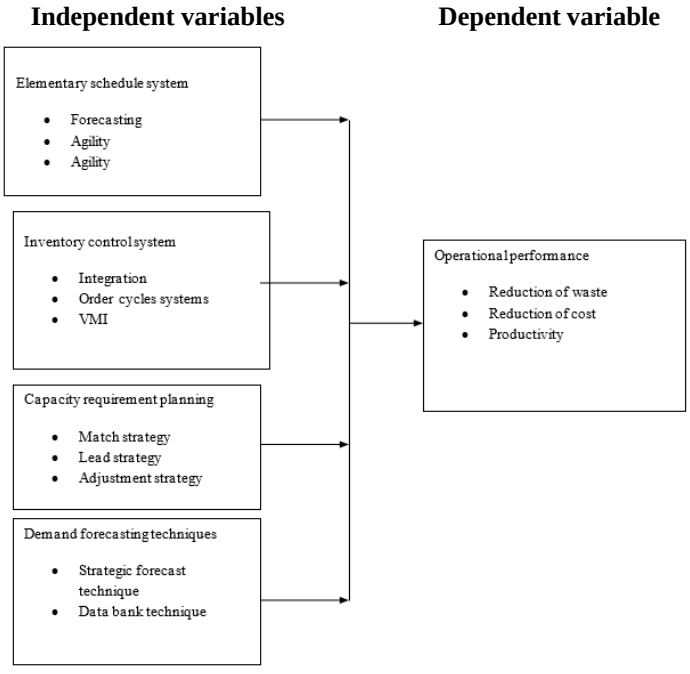

Figure 2.1: Conceptual framework

Critique of Existing Literature Relevant to the Study

According to Kotler (2019), demand forecasting systems efficiently oversee the constant flow of units into and out of an existing inventory. Inventory management control refers to all the activities involved in developing and managing the inventory levels of raw materials, semi-finished materials work-in-progress and finished good so that adequate supplies are available and the costs of over or under stocks are low. Having inventory has been justified on several grounds since ithelps provide a buffer stock against variations in supply and demand, which is often caused by poor forecasting, it promotes production efficiencies, to provide a hedge against price increases by suppliers to encourage purchasing and transportation discounts and to protect the firm against strikes and shortages. However, it affects customer satisfaction since with too little inventory, the firm risks not having products when customers want to buy. With too much of it, the firm incurs additional expenses in terms of storage expenses. This is still wanting and requires a lot of research to improveit.

According to Morrison (2013), Kenyan firms have employed inventory control systems in a wide variety of applications, but they all revolve around tracking the delivery of goods to customers. Inventory control is crucial in retail stores, especially those with a large number or variety of merchandise items for sale. Inventory control is also used in warehouses to track orders and shipments and for automated order processing. Other critical applications of inventory control systems are in manufacturing, shipping, and receiving. Inventory control is essential to ensure quality control in businesses that handle transactions revolving around consumer goods. Without proper inventory control, a large retail store may run out of stock on an essential item. A sound inventory control system will alert the retailer when it is time to reorder. Inventory control is also an important means of automatically tracking large shipments. However, a discrepancy may arise between effective monetary demand and the capacity to satisfy this demand. The development of production, the enlargement and renewal of the commodity selection, the increase in the standard of living, and the growing exactingness toward commodity quality alter demand hence increasing operational performance.

According to Jain (2019), an elementary scheduling system is characterized by high flexibility. It is generally conceived to manufacture a variety of products simultaneously. The quantities can be rapidly adjusted to answer customers' requests.For this reason, production systems need a stable, flexible and robust scheduling system ready to adapt to the changing nature of the request about quantity and variety. Thereby, the elementary scheduling system has received considerable attention in the literature. This is because it belongs to the most intractable combinatorial optimization problems considered, and only a few particular cases are efficiently solvable. For this purpose, completion time optimization in the elementary scheduling system has been addressed in the literature by many researchers. However, sometimes you have to spend money to make (or save) money. The elementary scheduling system is no different. Mistake proofing processes willcost money. Fixing problem areas permanently will usually cost money. Redesign of equipment to facilitate new line balancing will cost money. But over time, these improvements will pay for themselves through increased quality and reduced defects.

Studies have been conducted by various researchers such as Morrison, Jain and Kotler concerning the role of material requirement planning on operational performance in both public and private bodies to identify the causes of its underperformance. However, several researchers have embarked on limited funds and organization culture; however, they have not touched on elementary scheduling system, inventory control system, capacity requirement planning and demand forecasting system on operational performance.

Research Gaps

The literature review had dealt much with past studies on matters of the role of material requirement planning on operational performance. There are significant gaps in the scholarly area of material requirement planning on operational performance in the East African manufacturing industry, leading to excessive loss of organizational resources and increased operational performance. However, for years no decisive study had been carried out to compute the role of material requirement planning on operational performance in the East African manufacturing industry (Walter, 2015).

The findings of Lewis (2016) note that the demand forecasting system is critical in transforming firms. This comes with an integral demand forecasting system such as planning and optimization, JIT technique, and production planning, which ensures the firm's future viability and enhances the reduction of operational performance. Constricting down an elementary scheduling system is a critical activity in any public entity. Moreover, every organization requires efficient capacity requirement planning. He further asserts that purchasing and supply management professionals should universally apply the practice set out in this document and encourage their organizations to include effective capacity requirement planning and promote research and development of these elements of material requirement planning.

A previous study by Payne (2017) appears only to focus on gaps on insights of necessities and recompenses held by material requirement planning on operational performance in the areas of waste reduction, cost reduction and maximum exploitation of funds of a firm. The research gap of this study seeks to fill the gaps related to the role of material requirement planning on operational performance on elementary scheduling system, inventory control system, capacity requirement planning and demand forecasting system. Additionally, the study seeks to recommend the appropriate measures to ensure maximum reduction of operational performance occurs, as should be the case. According to Payne (2017) and Lewis (2016), it was evident that the research work that has been carried out before did not wholly deal with these four issues named above. The researcher intended to bridge these apparent research gaps.

3. RESEARCH METHODOLOGY

This study adopted descriptive research design. This study focuses on carefully selected 10 Manufacturing firms in East Africa that have existed for more than ten years. The study collected and analyzed data from the 10 East African Manufacturing firms identified in East Africa. This study collected and analyzed both primary and secondary data. Questionnaires was the primary data collection instrument, while secondary data was collected from institutional records, reports, journals, and past research. Data was collected using self-administered questionnaires, which was delivered to respondents and collected the following day to allow them adequate time to respond effectively. Research assistants are to hand-deliver and collect questionnaires, keeping in mind the respondent's schedule. Email and SMS questionnaire link sharing will also be considered to reach respondents who are in the field. A pilot study was conducted to test the reliability and validity of the questionnaire. The Statistical Package for Social Science (SPSS V 21.0) will be used for quantitative analysis. Descriptive statistics, including means, standard deviation, and frequency distribution

4. RESULTS

Correlation Analysis

Cooper & Schindler (2011) asserts that, correlation coefficients enable a researcher to quantify the strength of the linear relationship between two or more variables. Correlation is a measure of the degree of relatedness of variables (Bryman, 2012). Ken (2010) states that, Pearson product-moment correlation coefficient r, ranges from –1 to +1 with the sign at the front indicates whether there is a positive or a negative correlation. For this study Pearson Product Moment Correlation was used and the results obtained are summarized In Table 4.12.

The correlation on the factors influencing the implementation of special groups' procurement opportunities in public sector in Kenya was investigated using Pearson product-moment correlation coefficient. There was positive correlation between the dependent variable and all the four independent variables ($r>0.4$, $p<.001$). Rubin and Babbie (2010) opined that, the size of the absolute value provides information on the strength of the relationship where; (r=.1 to .29 Small; r=.30to .49 Medium; r=.5 to 1.0 Large).The strength of the relationship between the independent variables and the dependent variable (implementation of public procurement opportunities) was averagely large medium where; elementary scheduling system (r= 0.482, medium),inventory control system (r= 0.579, large),capacity requirement planning (r= 0.634, large), and demand forecasting system (r= 0.555, large).

Table 4.1: Correlations Analysis

		elementary scheduling system	Inventory control system	Capacity requirement planning	Demand forecasting system	Operational performance
Elementary scheduling system	Pearson Correlation	1	.616**	.418**	.623**	.482**
	Sig. (2-tailed)		.000	.000	.000	.000
	N	63	63	63	63	63
Inventory control system	Pearson Correlation	.616**	1	.454**	.553**	.579**
	Sig. (2-tailed)	.000		.000	.000	.000

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N		63	63	63	63	63
capacity	Pearson Correlation	.418**	.454**	1	.529**	.634**
requirement	Sig. (2-tailed)	.000	.000		.000	.000
planning	N	63	63	63	63	63
demand	Pearson Correlation	.623**	.553**	.529**	1	.555**
forecasting	Sig. (2-tailed)	.000	.000	.000		.000
system	N	63	63	63	63	63
operational	Pearson Correlation	.482**	.579**	.634**	.555**	1
performance	Sig. (2-tailed)	.000	.000	.000	.000	
N		63	63	63	63	63

**. Correlation is significant at the 0.01 level (2-tailed).

4.1 Regression Results

Regression analysis denotes collection of statistical methods that investigate the relationship between more than one independent variable and one dependent variable (Paul & Zhang, 2010). Regression is often used when the intent of the analysis is prediction. The goal of regression is to arrive at the set of regression coefficients (B values), for independent variables that put the Y values expected from the equation as close to the Y values extracted as far as possible from the measurement.The computed regression coefficients lessen the total of the square deviations between the Y values predicted and obtained as well as refine the correlation between the Y values predicted and obtained for the data set (Paul & Zhang, 2010).

4.2 Regression analysis model summary

Table 4.2: Model summary

Model	*R*	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*
1	.970[a]	.941	.937	.33379

a. Predictors: (Constant), elementary scheduling system, inventory control system, capacity requirement planning and demand forecasting system

A multiple linear regression analysis was performed to test the effect of the independent variables on the dependent variable. The average ratings for the four independent variables. The coefficient of determination and standard error of theregression model are shown in Table 4.2 above. Results indicate that R squared was 0.941 indicating that the independent variables explained 94.1% of the implementation of operational performance in the East African Manufacturing Industry. This indicates the model had good explanatory power. Further, the regression output in Table 4.3 presents the source of variance, mean of variances and the F value.The results indicate that the overall model was significant (f value = 230.691; $p < 0.05$) and could provide important results. This indicates that the model could provide some predictive significance and was a good fit.

Table 4.3: Analysis of Variance of the Regression (ANOVA)

Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	102.808	4	25.702	230.691	.000[b]
Residual		6.462	59	.111		
Total		109.270	63			

a. Dependent Variable: Operational performance

b. Predictors: (Constant): elementary scheduling system, inventory control system, capacityrequirement planning and demand forecasting system

Further, the regression output on significance of the independent variables is presented in Table 4.4.

Table 4.4: Significance of Independent Variables

Model		*Unstandardized Coefficients*		*Standardized Coefficients*	*T*	*Sig.*
		B	**Std. Error**	**Beta**		
1	(Constant)	.308	.114		2.707	.000
	elementary scheduling system	.885	.052	.909	17.087	.000
	inventory control system	.911	.040	.946	22.802	.002
	capacity requirement planning	.926	.034	.962	27.409	.003
	demand forecasting system	.923	.043	.939	21.269	.004

a. Dependent Variable: implementation of Public procurement opportunities

The optimal regression model was: $Y=0.308+0.885X_1+0.911X_2+0.926X_3+0.923X_4+\varepsilon$

The regression equation above has established that taking all factors into account (elementary scheduling system, inventory control system, capacity requirement planning and demand forecasting system) constant at zero, operational performance in the East African Manufacturing Industry will be 0.308.The findings presented also show that taking all other independent variables at zero, a unit increase in the elementary scheduling system would lead to a 0.885 increase in the scores of operational performance in selected manufacturing firms in East African and a unit increase in the scores of inventory control system would lead to a 0.911 increase of operational performance in selected manufacturing firms in East African. Furthermore, unit increase in the capacity requirement planning would lead to a 0.926 increase in the scores of operational performance in selected manufacturing firms in East African. Finally, the findings shows that a unit increases in the scores of demand forecasting system would lead to a 0.923 increase in operational performance in selected manufacturing firms in East African.

5. CONCLUSION

Regarding elementary scheduling system, the study established that Elementary scheduling system had a significant and positive effect on the operational performance in the East African Manufacturing Industry. The study established that inventory control system had a significant and positive effect on the operational performance in the East African Manufacturing Industry. The study established that capacity requirement planning had significant and a positive effect on the operational performance in the East African Manufacturing Industry. The study established that demand forecasting system had significant and a positive effect on the operational performance in the East African Manufacturing Industry

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