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Influence of Material Resource Planning on Operations Management among Manufacturing Firms in Nairobi, Kenya

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Abstract: Superior process operations management performance is achieved by an effective technology adopted by the organization. Manufacturing firms in Kenya have ignored the potential savings from Material Resource planning thus treating inventory as not necessary an asset requiring effective operations management performance. The practices adopted have a significant impact on returns, profitability and volume of sales. Manufacturing firms that efficiently apply these practices have an excellent performance. This paper examined the effect of Material Resource Planning on operations management of manufacturing firms in Kenya, by analyzing the extent to which lean control system, lead time reduction, quality management system and product specialization are being applied in these firms. A descriptive survey design was used. The study used structured self-administered questionnaire to collect data. The target population of the study was 455 manufacturing firms in Nairobi County. The study findings showed that the four variables had a significant effect on operations management. The study recommends that since lean control systems have a positive significant effect on operations management the manufacturing firms in Kenya should invest more in lean control systems like adoption of just in time strategy, proper communication systems with suppliers, lean inventory, materials requirements planning systems and Enterprise resource planning. The study also recommends that manufacturing firms should consider adopting lead time reduction practices for instance automation tools, integrated material resource planning tools, efficient information technology tools, flexible manufacturing systems as well as implementing high level of innovation.

Keywords: *Lean control systems, Lead time, Quality management systems, Product specialization*

Introduction

According to Muturi and Noor (2015), Material Resource Planning is not plainly software, but can be perceived as a marriage of people's skills, database accuracy, and dedication and computer resources. It is therefore more of the company's management concept for using human resources more effectively and productively. Material Resource Planning has in the past few years provided a platform where business functions are linked-up including capacity management, production planning, business planning, marketing, purchasing, accounting, finance and human resource management. According to Otto (2015) MRP systems are widely believed to contribute to the better performance of the supply chain. The most highly-rated perceived benefits for firms that have adopted MRP II applications and their impact on the supply chain performance are in technical areas such as standardization, transparency and globalization. The new manufacturing environment is characterized by intense global competition, rapid technological changes and product variety proliferation (Heim, 2012). Organizations are striving to maintain product leadership through provision of quality products, at minimum production cost at the right time to the customer. Again, the competitive pressures are forcing manufacturing companies to continuously seek new ways to manage their production capabilities more effectively in order to meet the demands of the market. Chase, Jacobs and Aquilano (2005) rightfully noted that designing new products and getting them to the market quickly is the challenge facing manufacturers in all diverse industries. For effective operations management an organization has to ensure improved performance. This involves the introduction and ongoing investment into advanced information systems that can assist management across the core production functions. This includes inventory control, order management, production scheduling and financial management and the cross-linking thereof. One such system that supports these activities is Material Resource Planning.

The emergence of the global market has forced organizations to realign their manufacturing processes to enable them compete effectively. In the recent past, manufacturing companies in most parts of the world have been faced by a new challenge of ensuring effective operations management which looks at customer satisfaction within the least time possible and effectively getting the ready products to the market in good time (Vorster, 2007).This challenge has threatened the prosperity of manufacturing companies of the world. However, this has been observed to be problems of the manufacturers since most world-class manufacturers have already found the solution to this menace-integration of the Material Resource Planning system (Johansson, 2007). First introduced by Oliver Wright in the early 1970s, Material Resource Planning has today grown beyond manufacturing and operations to providing a link-up of the various business functions including production planning, capacity management, business planning, finance, purchasing, accounting, marketing and even human resource management (Kumar, Chan, Poon, Chau & Chun 2010).

Statement of the Problem

The Vision 2030 stipulates that the manufacturing sector should account for 20 per cent of GDP by 2030. Achieving this ambitious goal largely depends on a competitive manufacturing sector (RoK, 2015). However the sector's contribution to the GDP has stagnated at an average of 10 per cent for more than ten years with a growth of 3.1 percent, significantly lower than the overall economic growth of 5.0 percent (WB, 2014). In the year 2014, the manufacturing sector recorded a growth of 3.4 per cent as compared to a growth of 5.6 percent in 2013 (RoK, 2015). Compared to the other sectors the manufacturing sector has lagged behind in output growth.

For instance, in 2014, while manufacturing output increased by only 4.8 percent, agriculture output grew by 15.8 percent, building and construction grew by 13.1 percent, information and technology 12.7 percent, transport and storage 13.7 percent among others (KNBS, 2015). On the other hand KAM (2014) reiterates that the declining performance is disturbing for business and indicates eroded competitiveness and compromises the government's aspirations of 20% growth that will enable Kenya to become prosperous. The application of technology in manufacturing has enhanced operations management in manufacturing firms (Hammer, 2016). Salonen (2010) argues that excellent adoption and implementation of Material Resource Planning can increase operations management performance by 38%-60% and can yield 25-50% reduction in total supply chain costs; 25-60% reduction in inventory holding; 25-80% increase in forecast accuracy and 30-50% improvement in order-fulfillment cycle time (Bourne *et.al*, 2005)

further stated that the costs associated with production material; raw materials, Work In Progress (WIP), and finished goods account for 50% to 60 % of the company's total production cost when there is adoption of Material Resource Planning in the manufacturing firms. Materials resource planning can therefore play a significant role in the operations management of the manufacturing firms in Kenya. This is what the study sought to establish. Furthermore, the study was motivated by the existing knowledge gaps on the topic. Even though studies for instance Monk (2006), Vorster (2007), Henry et.al (2012), Ambrose et.al (2010) and Macharia (2015) have observed varied effects resulting from implementation of various Material Resource Planning systems in the manufacturing sector, the influence of material resource planning on operations management performance in the manufacturing sector has not been well covered thus leading to conceptual knowledge gaps. This study therefore aimed at bridging this gap by examining the influence of Material Resource Planning on operations management among manufacturing firms in Nairobi, Kenya.

Objectives of the study

i. To determine the influence of lean control systems on operations management among manufacturing firms in Nairobi, Kenya.
ii. To assess the influence of lead time on operations management among manufacturing firms in Nairobi, Kenya.
iii. To find out the influence of quality management systems on operations management among manufacturing firms in Nairobi, Kenya.
iv. To determine the influence of product specialization on operations management among manufacturing firms in Nairobi, Kenya.

Literature Review

Lean Theory

Toyota practiced the principles of lean management as early as the 1950s forming the basis of strategic inventory management which today is envisaged as an essential core principle of almost any production system in all industries worldwide (Lysons, 2006).Lean production is 'lean' because it uses less of everything compared with mass production: half the human effort in the factory, half the factory space, half the investment in tools, half the engineering hours to develop a new product in half the time and it requires far less half of the needed inventory on site (Eroglu, 2011). The expected results are fewer defects while producing a greater and ever growing variety of products. These manufacturing firms should have an understanding of the implementation of technology in minimizing costs and utilizing resources optimally with no waste.

Porter's Theory of Competitive Advantage

Porter's Theory of Competitive Advantage analyzed competitiveness and its implications in various industries where principles of competitive advantage are applied Porter(2008). Thereafter Porter's Theory of Competitive Advantage, which focuses upon individual industries, argues that every nation influence the ability of its firm to succeed in a particular industry (Porter, 2008). The Porter's theory of Competitive Advantage contributes to understanding the competitive advantage. This theory encourages individual industries to build up to the economy as a whole, since the firms are the ones competing in the markets (Aiginger, 2006). These manufacturing firms should have an understanding of the way firms create and sustain competitive advantage. Porter's theory of Competitive Advantage distinguishes between; primary activities and support activities (Porter, 2008).

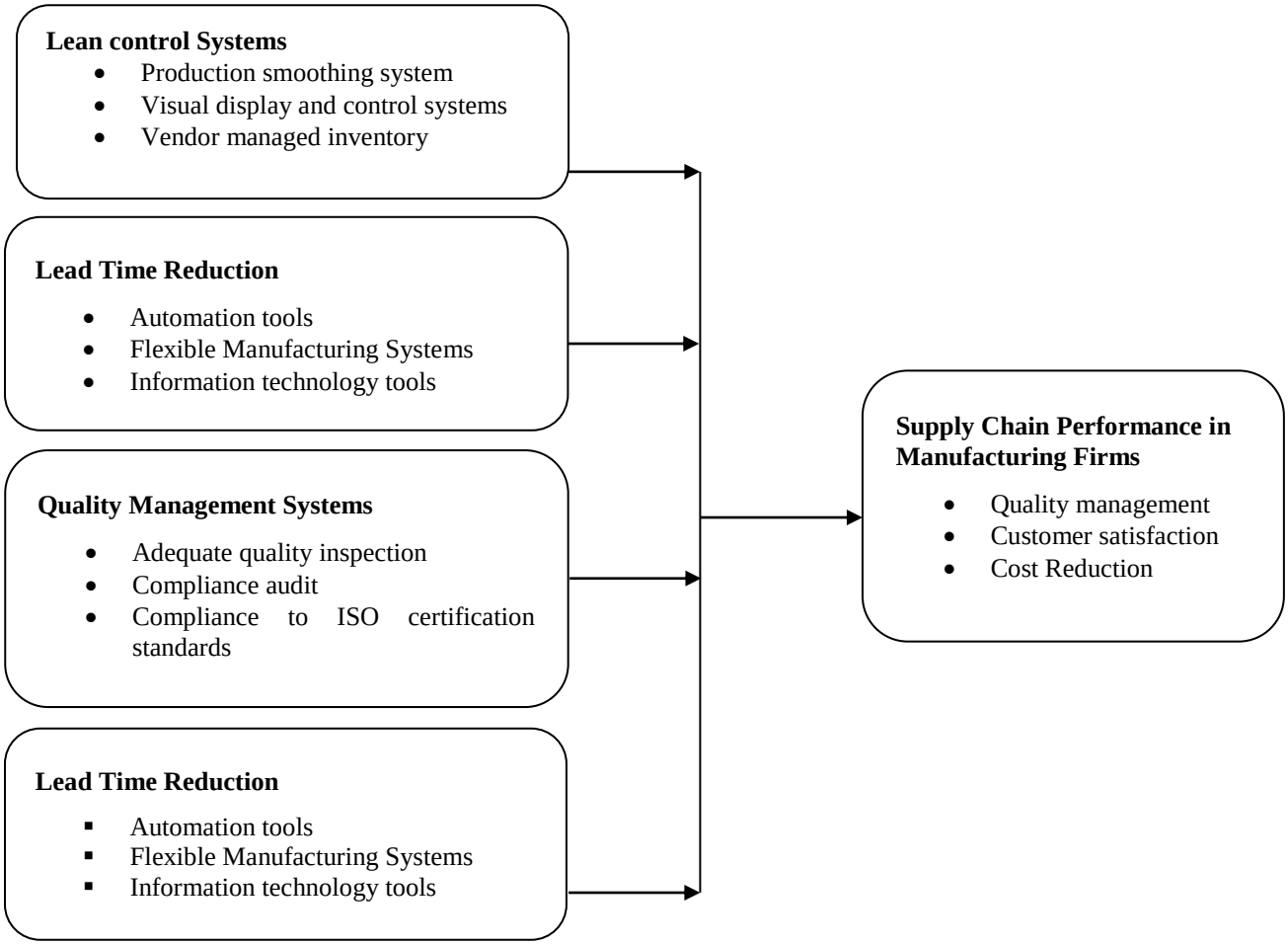
Resource Based Theory

The quest for effective green supply chain management practices has long been a central tenet of the field of supply chain management (Shi & Yu, 2013). Within this field, resource-based theory (RBT) has emerged as a promising new framework for analyzing the sources and sustainability of green supply chain management (Singhal & Mittal, 2011)). According to RBT, material resource planning - measured as procurement economic rent (Ramanathan, 2014) - derives from strategic resources. Such supply chain management is sustainable to the extent that the resources on which it is based are valuable, rare, inimitable, and non-substitutable (Tebarak, 2011). Given that organizational learning and resource-based theory both seek the objective of creating and sustaining competitive advantage as far as supply chain management is concerned, it seems logical for organizational learning to be identified as a strategic resource within the resource-based view (Marley & Hill, 2014).

Technology Acceptance Model

It has become necessary for companies to provide their customers with cost-effective total solution and better customer satisfaction with innovative ideas and methods. MRP (Material Requirements Planning) is a set of algorithms designed to establish material requirements based upon known sales orders (or forecast), bills of materials and material supplier lead times OSIRS (2008).There are several models existing that have been used to investigate adoption of technology. Several studies focusing on adoption of mobile services have their roots in Technology Acceptance Model (TAM) originally proposed by Davies in 1986.The model is originally designed to predict user's acceptance of Information Technology and usage in an organizational context. TAM focuses on the attitude explanations of intention to use a specific technology or service; it has become a widely applied model for user acceptance and usage. There are a number of meta-analyses on the TAM that have demonstrated that it is a valid, robust and powerful model for predicting user acceptance (Bertrand & Bouchard, 2008).

Conceptual Framework



Independent variables **Dependent variable**

Figure 2 Conceptual Framework

Lean Control Systems

Lean production principle was pioneered by Womack et al (1990). Lean manufacturing is a major constituent of supplier development programs (Jensen, & Jensen, 2007). This principle was linked with reduced inventories. In recent years, a number of systems have been developed in the field of operations management to deal with excess inventory problem. Management–oriented systems include the Just-In-Time (JIT), the materials Requirements Planning systems and Enterprise resource planning, ERP. Just-In-Time refers to a collection of practices that eliminate waste. These organization wide practices encompass the entire supply chain. The elements of JIT include shared product design with suppliers and customers, movement towards single sourcing proximate suppliers, reduced machine set-up times and total preventive maintenance.

It is an inventory strategy that is implemented to improve the return on investment of a business by reducing inventory and its associated carrying costs. In order to achieve JIT, the process must have signals of what is going on everywhere within the process JIT can lead to dramatic improvements in a manufacturing organization's return on investments, quality and efficiency. It emphasizes that production should create items that arrive when needed, neither earlier nor later.

Lead Time Reduction

According to Rajaniemi (2012), by reducing lead times, productivity can increase or more value can be added for the end-users. This could lead to a preferable market position. Risks can be reduced and trust can be increased (Fawcett et al., 2013). Short lead times in the order fulfilment process make it easier for the salesman to make reliable promises to the customer. Reduction of lead times will eventually contribute to the reliability of product delivery (Rajaniemi, 2012). Proper management of lead time can be a competitive advantage to a manufacturing firm. Managing time may be the mirror image of managing quality, cost, innovation, and productivity (Fawcett et al., 2013). For reducing lead time it is essential to adopt Just in Time philosophy and need for continuous improvement focus on issues. In this case, integration of Material Resource Planning tools, flexible manufacturing cells (FMC) or flexible manufacturing systems (FMS), automation tools and efficient information technology tools is vital (Ding, 2014).

Quality Management System

Quality system can be defined as a process that combines with manufacturing or service provision to ensure quality perfect products and services. ISO refers to international organization for standards. ISO 9000 series is an international family of generic quality standards, originally published by ISO in 1987, and updated in 1994 and again in 2000 and 2008. This international standard has been adopted by over 100 countries worldwide including Kenya. The idea behind the standards is defects can be prevented through the planning and application of best practices at every stage of business from design through manufacturing and then installation and servicing. ISO 9000 defines quality management system as "Management system to direct and Control an organization with regard to quality".

Product Specialization

According to Porter (1980), product specialization is an important strategy adopted by firms to enhance performance and beat competition. It emphasizes specialty products, charging relatively higher prices and targeting narrow market segments. Product specialization is producing a particular product to target a specific consumer niche. Niche markets places more emphasis on the products rather than exclusivity. Product specialization is focused on serving buyers in a niche market through product specialization than rival competitors. It is more focused on addressing customer's distinctive product preferences, special requirements and unique needs. Product specialization is achieved through lower costs than competitors in the market segment by adopting a low cost production strategy targeted at the segment only.

Research Methodology

The study adopted a descriptive design. This research is descriptive in nature and employs empirical survey method in establishing the influence of material resource planning on operations management performance among manufacturing firms in Nairobi, Kenya. In this study the population was all the manufacturing firms in Nairobi County that are registered by the Kenya Association of Manufacturers (KAM).

The population and target population of this study comprised of all the 455 manufacturing firms registered under the Kenya Association of Manufacturers by the year 2016. The manufacturing companies were indentified for this study because as Awino (2011) indicated, these firms are likely to exhibit elaborate SCM philosophy. The unit of analysis was manufacturing firms while the unit of observation was supply chain managers. Stratified random sampling method was applied to come up with the sample size, since the population was from heterogeneous sectors. This according to Cooper and Schindler (2011) ensures that each manufacturing subsector is represented. The study used the Yamane (1967) formula to determine the sample size.

n = (N/ (1+N (e) ^2) Where: n = sample size, N = Population size, e = margin of error set at 5%, For this study: N= 455, (Total number of manufacturing firms in Nairobi City County), e =5%. Therefore replacing the values in the formula gives a sample size of

n = (455/ (1+455 (0.05) ^ 2

= 213

A questionnaire was used for data collection. Both descriptive and inferential analysis was used for the study. Descriptive statistics was applied in analyzing the data in frequency distributions and percentages which was presented in tables and figures. Inferential analysis was used to establish the correlation and regression analysis. A multivariate regression analysis was used to test relationships between the variables. A multivariate regression model was used to establish the effect of the d=independent on the dependent variable.

$$\mathbf{Y= \beta_0+\beta_1X_1+\beta_2X_2+\beta_3X_3+\beta_4X_4+e}$$

Where **Y** is the dependent variable (Operations Management among Manufacturing Firms), $\mathbf{X_1}$– Lean control Systems, $\mathbf{X_2}$– Lead time reduction, $\mathbf{X_3}$– quality management Systems, $\mathbf{X_4}$– Product specialization, $\boldsymbol{\beta_{i\ (i=1,2,3,4)}}$ are the parameters associated with the corresponding independent variable that are to be estimated (partial regression coefficients), $\boldsymbol{\beta_0}$ is the intercept and $\boldsymbol{\mathcal{E}}$ is the error variability (error term).

Results

Response Rate

Out of 213 questionnaires administered, a total of 134 filled questionnaires were returned giving a response rate of 63% which is within what Mugenda and Mugenda (2008) as well as Baruch and Holtom (2008) prescribed as a significant response rate for statistical analysis and established at a minimal value of 50%. Bailey (2008) argued that a response rate of 50% is adequate, while a response rate greater than 70% is very good. Baruch and Holtom (2008) argued that the use of reminders as well as electronic data collection efforts (email, phone and web) resulted in response rates as high as or higher than traditional mail methodology. This high response rate was achieved through the use of reminders as well as electronic data collection efforts.

Table 1 Response rate

	Frequency	Percentage
Administered Questionnaires	213	100
Filled Questionnaires	134	63
Unfilled Questionnaires	79	37

Demographic Information of Respondents

Respondents Gender

The study put into account the gender of respondents. The findings indicated that a total of 134 managers responded to the questionnaires of the study. The majority of the respondents, 70%, were male; indicating that the manufacturing sector is male dominated. The female were 30% of the respondents. The results imply that the manufacturing firms that are registered members of KAM are male dominated. In addition, the gender distribution met the Constitution of Kenya (2010) threshold of not more than two thirds of one gender in employment; however this did not affect the results of the study. The results agree with the findings of a study by Kihara (2016) which indicated that the manufacturing sector is male dominated. Mugenda and Mugenda, (2009) argue that equal representation of both genders helps in eliminating cases of data biasness that could arise as a result of gender imbalance in the response rate. However, they also argue that gender representation doesn't affect the findings of the study.

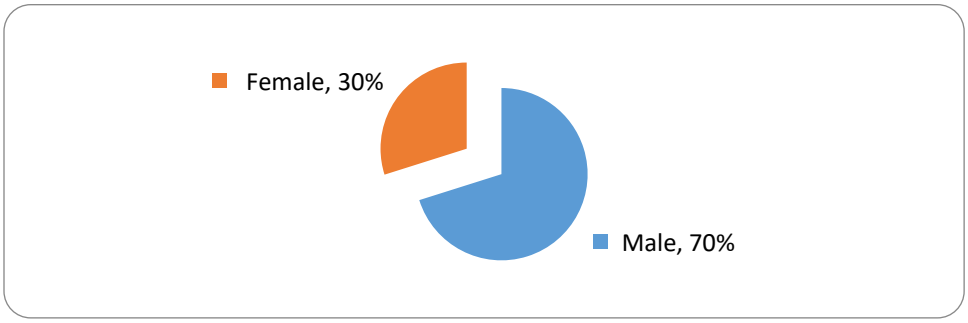


Figure 2 Respondent's Gender

Respondent's Level of education

In determining the employee's skill qualifications the respondents were asked to indicate their education level. It is evidenced from Table 2 that the supply chain managers in the manufacturing industry hold a range of educational qualifications. Of the total respondents who participated, 62.3% had a bachelor's degree education, 15.6% had below a bachelor's degree and 22.1% had a Master's education level. No respondent had a PHD. This implies that supply chain managers of the manufacturing firms that are registered members of KAM have intellectual capacity. The respondents could easily understand the contents of the questionnaire and the concept of Material Resource Planning and operations management. Similar findings were also recorded by Kiarie (2016) who established that senior management employees in KAM registered firms are literate.

Table 2: Respondent's Education Level

Education Level	Frequency	Percent
Below Bachelor	21	15.6
Bachelor	83	62.3
Masters	30	22.1
Total	**134**	**100**

Respondent's Period in their Current position

Again the researcher sought to determine the employee's period in their current position at the time of responding to the questionnaire. In reference to period of stay as an employee in their respective firms, it was evident that 29.5% of the respondents had worked for less than 5 years, 47.5% between 5-10 years and 23% more than 11 years. These results indicate that the manufacturing industry has good employee retention systems. This implies low turnover rate among the employees in management positions in the manufacturing sector. The results also imply that the firms surveyed had a high rate of specialization since employees stay on the same working environment for a long period of time. Additionally data collected can be more accurate since the employees are deemed more conversant with their environment as managers. The findings are similar to the findings of a study by Kihara (2016) who also established a long working period among the top management employees in the manufacturing registered by KAM.

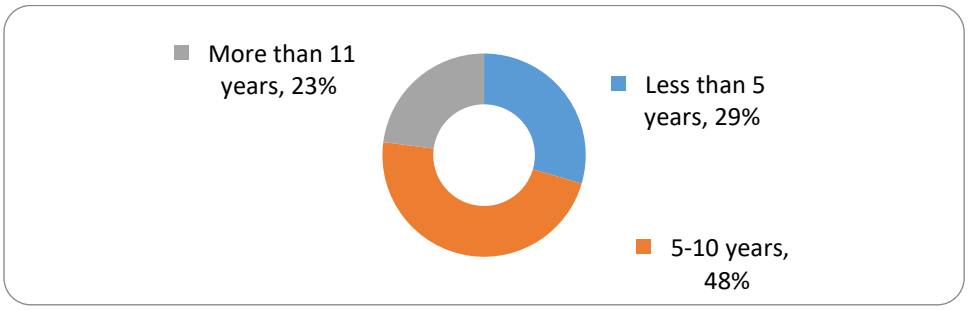


Figure 3 Respondent's Period in their Current position

Age of Respondents

Finally the respondents were asked to state their age and the results in Figure 4.3 revealed the age brackets of respondents. The findings reveal that 40.3% of the respondents were aged between 35 to 45 years, 55.8% were aged above 45 years while 3.9% respondents were below 35 years. This implies that majority of the employees at the position of supply chain management in manufacturing firms in Kenya are aged above 45 years.

The findings agree with the findings of a study by Kihara (2016) who indicated that majority of the workers in management positions at manufacturing firms that are registered members of KAM are aged above 40 years.

The findings are also consistent with Bowen & Staudinger (2012) who linked promotion and placement into management positions to age over 35 years.

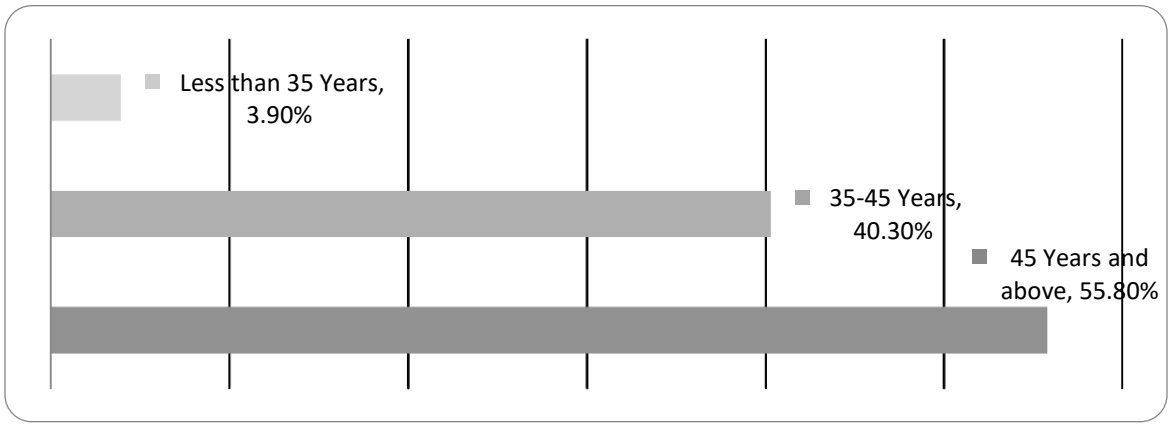


Figure 4 Respondent's Age

Descriptive analysis of Lean Control System

The study findings indicated that to a moderate extent, majority of the respondents indicated that the firm has adopted production smoothing systems (Mean = 2.85), the firm has adopted proper communication systems with its suppliers (Mean = 2.55), there is the use of visual display and control systems (Mean = 2.55) and to a small extent the respondents agreed that materials requirements planning systems are being used (Mean = 2.02). The results also showed that to a large extent, the respondents agreed that the firm uses vendor managed inventory system (Mean = 3.99). Generally, the respondents indicated that there is moderate adoption of production smoothing systems, proper communication systems with its suppliers, visual display and control systems, materials requirements planning systems and high adoption of vendor managed inventory systems. These findings are consistent with the argument by Lysons and Gillingham (2013) that among the important lean control systems in manufacturing is production smoothing systems, proper communication systems with its suppliers, visual display and control systems, materials requirements planning systems and adoption of vendor managed inventory systems.

Table 3: Descriptive analysis of Lean Control System

Statement	1	2	3	4	5	Mean	Std Dev
The firm has adopted production smoothing systems	27.50%	20.80%	14.10%	14.10%	23.50%	2.85	1.54
The firm has adopted proper communication systems with its suppliers	35.90%	13.70%	23.40%	13.70%	13.30%	2.55	1.43
There is the use of visual display and control systems	29.70%	19.90%	25.40%	15.20%	9.80%	2.55	1.32
	48.40%	21.50%	16.80%	6.60%	6.60%	2.02	1.23

Statement	1	2	3	4	5	Mean	Std Dev
Materials requirements planning systems are being used							
The firm uses vendor managed inventory system	12.50%	5.10%	6.20%	23.40%	52.70%	3.99	1.39
Average						**2.792**	**1.382**

Descriptive analysis of Lead Time Reduction

The results showed that to a moderate extent, the respondents agreed that the firm has adopted automation tools (Mean = 3.03), the firm has integrated material resource planning tools (Mean = 2.75) and that the firm has adopted efficient information technology tools (Mean = 3.23). On the other hand, the respondents agreed to a large extent that the firm has adopted flexible manufacturing systems (Mean= 4.06) and that there is high level of innovation (Mean= 4.09). Generally the results indicated moderate adoption of automation tools, integrated material resource planning tools and efficient information technology tools and high adoption rate of flexible manufacturing systems as well as implementing high level of innovation. The findings are consistent with Ding (2014) that for reducing lead time it is essential to adopt integration of Material Resource Planning tools, flexible manufacturing cells (FMC) or flexible manufacturing systems (FMS), automation tools and efficient information technology tools is vital.

Table 4: Descriptive analysis of Lead time reduction

Statement	1	2	3	4	5	Mean	Std Dev
The firm has adopted automation tools.	16.50%	20.40%	23.90%	22.40%	16.90%	3.03	1.33
The firm has adopted flexible m anufacturing systems.	4.70%	11.30%	11.30%	18.40%	54.30%	4.06	1.24
There is high level of innovation	1.60%	7.80%	12.50%	35.90%	42.20%	4.09	1
The firm has integrated material resource planning tools	27.70%	12.10%	25.00%	27.70%	7.40%	2.75	1.32
The firm has adopted efficient information technology tools	15.60%	11.30%	32.80%	15.20%	25.00%	3.23	1.36
Average						**3.591**	**1.252**

Descriptive analysis of Quality Management Systems

The study findings showed that there is adoption of compliance audit to a small extent (Mean = 1.94) and that the firm moderately performs adequate quality inspection (Mean = 3.12), compliance to ISO certification

standards is to a large extent (Mean = 3.53) and continuous updating of the quality inspection systems is to a large extent (Mean = 3.81). Furthermore, continuous process improvement is conducted to a large extent (Mean = 4.17). The findings are consistent with Bozarth (2009); Agus (2011) that quality in manufacturing can be termed as production of superior goods. In order to produce value and optimize profitability, it is fundamental to establish successful partnerships with the supply chain organizations that can be achieved by new models of cooperation, improved communication and integration among all the supply chain partners.

Table 5: Descriptive analysis of Quality Management Systems

Statement	1	2	3	4	5	Mean	Std Dev
The firm performs adequate quality inspection	18.40%	10.90%	26.60%	28.50%	15.60%	3.12	1.32
The firm has adopted compliance audit.	59.00%	10.50%	14.10%	10.50%	5.90%	1.94	1.3
There is compliance to ISO certification standards	17.20%	6.60%	16.00%	26.20%	34.00%	3.53	1.45
There is continuous updating of the quality inspection systems	9.40%	14.50%	9.40%	19.10%	47.70%	3.81	1.4
There is continuous process improvement	3.50%	8.60%	8.60%	26.20%	53.10%	4.17	1.12
Average						**3.314**	**1.318**

Descriptive analysis of Product specialization

From the results in the Table, the study indicated that implementation of specialty products strategy is to a moderate extent (Mean = 3.3), production according to the consumer preference, practice of diversification, negotiation with suppliers for products at cost-effective prices and practicing of low cost production strategy at the segment only is conducted to a large extent (Mean = 3.62, 4.07, 3.5 and 3.53) respectively.

Table 6: Descriptive analysis of Product Specialization

Statement	1	2	3	4	5	Mean	Std Dev
The firm has implemented specialty products strategy	12.10%	16.40%	19.10%	34.00%	18.40%	3.3	1.28
The firm produces according to the consumer preference.	6.60%	17.60%	13.70%	31.60%	30.50%	3.62	1.27
Diversification is practiced in the firm.	1.60%	5.90%	14.80%	39.50%	38.30%	4.07	0.95
The firm negotiates with suppliers for products at cost-effective prices	18.00%	14.10%	5.90%	23.80%	38.30%	3.5	1.54

Statement	1	2	3	4	5	Mean	Std Dev
The firm practices low cost production strategy at the segment only	17.20%	6.60%	16.00%	26.20%	34.00%	3.53	1.45
Average						**3.622**	**1.26**

Descriptive analysis of Operations Management Performance

The findings showed that majority of the respondents indicated that customer satisfaction and customer retention rate has improved to a moderate extent (Mean = 3.3 and 3.23) respectively while the firm revenue, reduction of operation costs, decrease in percentage of product defects as well as the overall sales growth had improved to a large extent (Mean = 3.62, 4.07, 3.5 and 3.81) respectively.

Table 7: Descriptive analysis of Operations Management Performance

Statement	1	2	3	4	5	Mean	Std Dev
The firm revenue has improved	6.60%	17.60%	13.70%	31.60%	30.50%	3.62	1.27
Operation costs have reduced	1.60%	5.90%	14.80%	39.50%	38.30%	4.07	0.95
The percentage of product defects has decreased	18.00%	14.10%	5.90%	23.80%	38.30%	3.50	1.54
Customer retention rate has improved	15.60%	11.30%	32.80%	15.20%	25.00%	3.23	1.36
The overall sales growth has improved	9.40%	14.50%	9.40%	19.10%	47.70%	3.81	1.4
Average						**3.622**	**1.26**

Pearson Moments Correlation Analysis

The study conducted a Pearson Moment Correlation analysis which is represented by r. The correlation factor ranged from $-1 \leq 0 \geq 1$. The acceptance confidence level was 95% or significance level of 0.05.

Table 8: Pearson Moments Correlation Analysis

	Lean control systems	Lead time reduction	Quality management systems	Product specialization

		Lean control systems	Lead time reduction	Quality management systems	Product specialization
Lean control systems	Pearson Correlation	1			
	Sig. (2-tailed)				
Lead time reduction	Pearson Correlation	.538**	1		
	Sig. (2-tailed)	0.000			
Quality management systems	Pearson Correlation	.535**	.613**	1	
	Sig. (2-tailed)	0.000	0.000		
Product specialization	Pearson Correlation	.154*	.373**	.477**	1
	Sig. (2-tailed)	0.014	0.000	0.000	
Operations management performance	Pearson Correlation	.493**	.575**	.679**	.576**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000

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

* Correlation is significant at the 0.05 level (2-tailed).

The correlation results indicated a positive significant correlation between lean control systems and operations management (r = 0.493, Sig = 0.000). This shows that an increase in adoption of production smoothing systems, proper communication systems with its suppliers, visual display and control systems, materials requirements planning systems and vendor managed inventory systems leads to high operations management performance. The findings are consistent with Eroglu and Hofer (2011) who indicated a positive relationship between inventory control systems and performance. The correlation results also indicated a positive significant correlation between lead time reduction and operations management (r = 0.575, Sig = 0.000). The results show that an increase in adoption of lead time reduction practices like automation tools, integrated material resource planning tools, efficient information technology tools, flexible manufacturing systems as well as implementing high level of innovation leads to an increase in operations management. The findings are consistent with Sushma (2007) who established a positive relationship between lean reduction and performance.

Furthermore, quality management systems had a positive significant correlation with operations management (r = 0.679, Sig = 0.000). These findings imply that an increase in quality management practices for instance compliance to quality audit , adequate quality inspection, compliance to ISO certification standards , continuous updating of the quality inspection systems and continuous process improvement lead to an increase in operations management. The study findings are consistent with Lin & (Gibson, 2011) who concluded that key QM practices result in improved operations performance. The results also showed that product specialization had a positive significant correlation with operations management (r = 0.576, Sig = 0.000). This shows that an

increase in implementation of specialty products strategy, production according to the consumer preference, practice of diversification, negotiation with suppliers for products at cost-effective prices and practicing of low cost production strategy at the segment leads to an increase in operations management performance. The findings agree with Chang (2008) who examined the effects of MRP applications for instance product specialization and established a positive effect on performance.

Regression analysis

Model Summary (Coefficient of determination analysis)

The R-square or coefficient of determination shows the percentage explained by variables under study towards variability on the main variable which is operations management performance (Gujarati, 2004). The R-square therefore measures the portion of variation of operations management performance being explained by the independent variables in this study which happen to be derived from MRP. The study had a coefficient of determination value of 0.41 which indicates that 41% of operations management is explained by the four factors that is lean control system, lead time reduction, quality management systems and product specialization. The remaining 59% can be accounted to other factors captured by the standard error.

Table 9: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.640a	0.41	0.401	0.54908

ANOVA (Model Fitness)

The ANOVA model measures the significance of the independent variables jointly using F-statistics. The F-statistics ought to be significant if the predictors are to be jointly significant. Table 4.11 reveals that the F-value of 43.602 with a probability value of 0.000 is significant at 5% level of significance since the probability value of 0.000 is less than 5% level of significance. This indicates that the overall regression model is significant hence the joint contribution of the independent variables was significant in predicting firms' operations management performance.

The study also compared the F calculated value of 43.602 to the F critical value of 2.44 and since (F calculated, 43.602 > F critical, 2.44), similar conclusions were arrived. This indicates that the overall regression model is significant hence the joint contribution of the independent variables was significant in predicting firms' operations management performance.

Table 10: Model Fitness (ANOVA)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	52.583	4	13.146	43.602	.000
	Residual	75.674	129	0.301		
	Total	128.257	133			

Model Coefficients

The model coefficients of the study were used to answer the research questions of the study. According to the multiple regression model results in Table 4.13, taking all the predictor variables to be constant, operations management performance will be at 2.331 which is the value of β_0 in the model. Meaning other variables other than those considered in this study have an impact on manufacturing firms' operations management performance. This finding is significant with the p-value of 0.000 ($p < 0.005\%$) significance level. Objective one of the study sought to determine the relationship between lean control systems and operations management performance. Lean inventory technique was measured using indicators such as just in time strategy, proper communication, green procurement and utilization of store space. The results revealed that lean inventory technique has a positive significant effect on operations management performance with a beta value of (B= 0.196, P-value = 0.000) which is less than 0.05 significance level). This means 1% change in lean control systems will lead to a positive change of 0.196% on operations management performance. In conformity with the findings, Brigham & Gapenski (2013), Jensen & Jensen (2007) and Lysons & Gillingham (2013) are of the opinion that firms in manufacturing industry in utilizing lean inventory techniques end up boosting operations management in the same direction.

The second objective sought to determine the relationship between lead time reduction and operations management performance. Lead time was measured using indicators such as use of automation tools, flexible manufacturing systems, level of innovation and quality improvement. The results showed that the effect of lead time reduction on operations management was positive and significant with (B = 0.260, p-value = 0.000 < 0.05). This implies that with a change of 1% of lead time reduction there will be 0.260% positive change in the operations management performance.In line with the results Rajaniemi (2012), Rajaniemi (2012) and Fawcett et al. (2013) inferred that lead time reduction can cause increase in productivity, increase value addition to the end-users and consequently rise to reliability of product delivery. They also added that such a measure ensures better management of quality, cost and innovation hence positive effect on operations management.

The third objective of the study sought to determine the effect quality management on operations management. Quality management system was measured by indicators such as adequate audit, compliance audit and product quality in the firm. The findings indicated that quality management system has a positive significant effect on operations management (B = 0.217, Sig = 0.000). The findings indicate that for each unit percent increase of quality management system, there is 0.217% increase in operations management performance. The findings are consistent with Bozarth (2009), Agus (2011) and Lin et.al (2005) Gibson (2011). They argued that proper quality management techniques such as TQM and SCM synergies could trigger much needed collaboration between firms and suppliers and finally lead to a customer satisfaction end-result.

The fourth objective of the study sought to determine the relationship between product specialization and operations management performance. Product specialization was measured in terms of specialty products, consumer preference and diversification in the firms. Regression analysis results revealed that product specification has a positive and significant effect on operations management performance with (B= 0.198, Sig = 0.000). The findings imply that a 1% change in product specialization leads to a 0.198% increase in operations management performance. Cognate to the results Porter (1980) Wang (2008) Bharadwaj and Varadajaran (1993) noted that product specialization if well strategized can lead higher performance and beat competition. They suggest however smart strategies such as niche marketing and marketing in general together with steady focus.

Table 11: Model Coefficients

Independent variables	Beta	Std. Error	**t**	**Sig.**
(Constant)	2.331	0.173	13.446	0.000
Lean control systems	0.196	0.042	4.016	0.000
Lead time reduction	0.260	0.065	4.716	0.000
Quality management systems	0.217	0.052	4.003	0.000
Product specialization	0.198	0.06	3.631	0.000

The optimal multiple regression model used is as follow

Y=2.331+0.260+0.217+0.198+0.196

Where y = operations management

X1= Lead Time Reduction

X2= Quality Management System

X3= Product Specialisation

X4= Lean Control System

Conclusion

The section presents the conclusion of the study made from the study findings and which guided the study recommendations. The conclusions have been presented per objective. The study concluded that lean control systems have a positive significant effect on operations management implying that an increase in adoption of production smoothing systems, proper communication systems with its suppliers, visual display and control systems, materials requirements planning systems and vendor managed inventory systems leads to high operations management performance. The study also concluded that lead time reduction has a positive significant effect on operations management implying that an increase in adoption of lead time reduction practices like automation tools, integrated material resource planning tools, efficient information technology tools, flexible manufacturing systems as well as implementing high level of innovation leads to an increase in operations management. The study also concluded that quality management systems have a positive significant effect on operations management which implies that an increase in quality management practices for instance compliance to quality audit , adequate quality inspection, compliance to ISO certification standards , continuous updating of the quality inspection systems and continuous process improvement lead to an increase in operations management. The findings led to the conclusion that product specialization has a positive significant effect on operations management implying that an increase in implementation of specialty products strategy, production according to the consumer preference, practice of diversification, negotiation with suppliers for products at cost-effective prices and practicing of low cost production strategy at the segment leads to an increase in operations management performance.

Recommendations

The study findings showed that the four variables had a significant effect on operations management. The section presents the recommendations of the study. This section presents the recommendations of the study based on the findings.The section presents the recommendations of the study. The study recommends that since

lean control systems have a positive significant effect on operations management the manufacturing firms in Kenya should invest more in lean control systems like adoption of production smoothing systems, proper communication systems with its suppliers, visual display and control systems, materials requirements planning systems and vendor managed inventory systems. The study also recommends that manufacturing firms should consider adopting lead time reduction practices for instance automation tools, integrated material resource planning tools, efficient information technology tools, flexible manufacturing systems as well as implementing high level of innovation. Furthermore, the study recommends that since quality management systems have a positive significant effect on operations management, the manufacturing firms operating in Kenya should implement various quality management practices like compliance to quality audit , adequate quality inspection, compliance to ISO certification standards , continuous updating of the quality inspection systems and continuous process improvement.

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Conflict of Interest

No potential conflict of interest was reported by the authors.

References

Amemba, C. S. (2013). Green supply chain best practices in hospitality industry in Kenya. *Global Journal of Commerce & Management Perspective*,*2*(3), 7-18.

Buckley, P., Pass, C., and Prescott, K. (1988). Measures of international competitiveness: a critical survey. *Journal of Marketing Management*, 4, 175- 200

Carter, B., Danford, A., Howcroft, D., Richardson, H., Smith, A., & Taylor, P. (2011). 'All they lack is a chain': lean and the new performance management in the British civil service. *New Technology, Work and Employment*, *26*(2), 83-97.

Chao, C. W., Ma, H. W., & Heijungs, R. (2013). The Green Economy Mirage?.*Journal of Industrial Ecology*, *17*(6), 835-845.

Chau, C.K., Tse, M.S., Chung, K.Y. (2010), A choice experiment to estimate the effect of green experience on preferences and willingness-to-pay for green building attributes, *Building and Environment*, 45 (11), 2553-61.

Duarte, S., Cabrita, R., & Machado, V. C. (2011, January). Exploring lean and green supply chain performance using balanced scorecard perspective. In*Proceedings of the 2011 International Conference on Industrial Engineering and Operations Management* 4 (2) 520-525.

Elliot, S. (2011), Transdisciplinary perspectives on environmental sustainability: a resource base and framework for IT-enabled business transformation, *MIS Quarterly*, 35 (1) 197-236.

Guide Jr, V. D., & Pentico, D. (2003). A hierarchical decision model for re-manufacturing and re-use. *International Journal of Logistics*, *6*(1-2), 29-35.

Hansmann, K.W., Claudia, K. (2001), "Environmental management policies", J. (Eds), *Green Manufacturing and Operations: from Design to Delivery and Back*, Greenleaf Publishing, Sheffield, 3 (5) 192-204.

Hanim Mohamad Zailani, S., Eltayeb, T. K., Hsu, C. C., & Choon Tan, K. (2012). The impact of external institutional drivers and internal strategy on environmental performance. *International Journal of Operations & Production Management*, *32*(6), 721-745.

Hofer, C., Jin, H., Swanson, R. D., Waller, M. A., & Williams, B. D. (2012). The impact of key retail accounts on supplier performance: A collaborative perspective of resource dependency theory. *Journal of Retailing*, *88*(3), 412-420.

Hult G.T.M., Ketchen D.J.Jr and Slate,r S.F. (2005) Information processing, Knowledge development, and strategic supply chain performance, *Academy of management Journal 47(2) 241-253*

Hwa, T. J. (2001, May). Green productivity and supply chain management. In *Conference on Enhancing Competitiveness Through Green Productivity, China 11* (3) 25-27.

Kannan, G., Noorul Haq, A., & Devika, M. (2009). Analysis of closed loop supply chain using genetic algorithm and particle swarm optimisation. *International Journal of Production Research*, *47*(5), 1175-1200.

Kerlinger, F. N. (2003). *Foundations of Behavioral Research.*(2ndEdition). New York: Holt Rinehart and Wilson, Inc.

Lakshmimeera, B.L. & Palanisamy, C., (2013) 'A Conceptual Framework on Green Supply Chani Management Practices' *Industrial Engineering Letters, 4* (3) 10

Lambert, D. M., García-Dastugue, S. J., & Croxton, K. L. (2005). An evaluation of

Mose, J. M. Njihia, J. M. & Peterson, O. M. (2013). The critical success factors and challenges in e-procurement adoption among large scale manufacturing firms in Nairobi, Kenya. *European Scientific Journal*, 9(13).

Murage J.M (2011) Green supply chain initiatives and challenges by manufacturing firms in Kenya. Unpublished MBA Project, University of Nairobi.

Murray, J. (2000). Effects of a green purchasing strategy: the case of Belfast City Council. *Supply Chain Management: An International Journal*, *5*(1), 37-44.

Orodho, A. J. (2003). Essentials of educational and social science research methods. *Nairobi: Mazola Publishers*.

Ramanathan, U. (2014). Performance of supply chain collaboration–A simulation study. *Expert Systems with Applications*, *41*(1), 210-220.

Robinson, J. (2004). Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological Economics, 48,* 369–384.

Stock, J. R., & Lambert, D. M. (2001). *Strategic logistics management* (Vol. 4). Boston, MA: McGraw-Hill/Irwin.

Vojnovic, I., (1995), Intergenerational and Intergenerational Equity Requirements for Sustainability' *Environmental Conservation,* 22 (3) 223-228.

Wells, P. & Seitz, M. (2005), Business models and closed-loop supply chains: a typology, Supply Chain Management: *An International Journal*, 10 (4), 336-356

Wilson, S. B., & Mecca, L. K. (2003). Seed production and germination of eight cultivars and the wild type of Ruellia tweediana: A potentially invasive ornamental. *Journal of Environmental Horticulture*, *21*(3), 137-143.

Zeng, W., Cao, Y., Bai, Y., Wang, Y., Shi, Y., Zhang, M... & Wang, P. (2010). Efficient dye-sensitized solar cells with an organic photosensitizer featuring orderly conjugated ethylenedioxythiophene and dithienosilole blocks. *Chemistry of Materials*, *22*(5), 1915-1925.