EFFECTS OF MATERIALS HANDLING SYSTEMS ON PERFORMANCE OF CEMENT MANUFACTURING FIRMS IN MACHAKOS COUNTY

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Received: 20th May 2016

Accepted: 27th May 2016

Full Length Research

Available Online at: http://www.iajournals.org/articles/iajpscm_v2_i1_21_36.pdf

Citation: Kathurima, R. I., Ombul, K. & Iravo, M. A. (2016). Effects of materials handling systems on performance of cement manufacturing firms in Machakos County. *International Academic Journal of Procurement and Supply Chain Management, 2* (1), 21-36

ABSTRACT

This research project focuses on the effects of materials handling systems on the performance of cement manufacturing firms in Machakos County. The aim of this research was to establish the effects of materials handling systems in order to achieve better performance and generate available efficiency and cost reduction benefits. This study was guided by the following specific objectives; To determine the effect of automating material handling systems on performance, to assess the extent to which information directed systems affect the performance, to establish the influence of mechanized materials handling systems on performance, to examine the extent to which semi -automated systems affect the performance. A descriptive correlational research design was incorporated in the study where a respondent was drawn from selected departments and targeted production, marketing, administration, human resource departments and supply chain. The target population was 60 employees. The researcher conducted a census on the target population. Data was collected primarily by the use of questionnaires. Collected data was edited, coded, entered into SPSS version 21 for analysis. Regression analysis model was used to show the relationship between the independent and the dependent variable. The study found out that there was a positive and significant effect of automating material handling systems on performance in that 32.8 percent of the performance of cement manufacturing firms in Machakos County can be explained by automating material handling systems (R squared = 0.328). The study also results revealed that information directed systems had an effect on performance and the effect was positive and statistically significant (overall p-value = 0.008) while semi automated systems had overall significant positive relationship with the performance (β = 0.464, p-value = 0.004). Mechanized materials handling systems was found to accounted for 18.6 percent of performance of cement manufacturing firms. The study recommends that the cement manufacturing firms in Machakos should stiff to improve on their automating material handling systems, information directed systems, semi automated systems and mechanized materials handling systems in an effort to improve on their performance.

Key Words: *materials handling systems, performance, cement manufacturing firms, Machakos County*

INTRODUCTION

Gypsum plaster, common lime, hydraulic limes, natural pozzolana, and Portland cements are the more common hydraulic cements, with Portland cement being the most important in construction. The cement industry has some distinctive characteristics. It is capital intensive, where the typical investment cost of a cement plant with an annual capacity of one million ton is estimated to be about US Dollars 200million. The industry is also energy intensive, where the production of one ton of cement requires about 130kg of fuel oil or its equivalent, and

about105kWh of electricity (Faisal et al., 2009). The cement industry in China is the largest in the world, producing 2.18 MT in 2012. The Chinese cement industry has been the largest in the world for at least the past 20 years and remains the largest cement industry by far in 2013. Since 2010 it has added even more dry process lines China cement still faces many challenges, e.g. unreasonable structures, too many small companies, and backward production capacity. China accounts for 60% of all cement production in the world (International Cement Review, 2011).

The cement industry in Nigeria has experienced immense growth over the past few years. With a population of over 140 million people and a growth rate of approximately 3% per annum, the demand for and consumption of cement is expected to increase. Despite its associated energy costs and the availability of cheap imports from China and Pakistan, demand for cement in East Africa has continued to rise. The need to increase cement production to feed the region's booming construction industry dominated discussions at a workshop meeting of East African cement producers and German cement-equipment manufacturers in Nairobi, Kenya, on November 2012. According to (Aketch 2014) Overall, in East Africa, capacity additions by 2018 are expected to increase the region’s cement capacity to 13.45 million [metric tons] per year. Despite increased capacity, the cost of cement production in the region remains high because of the high cost of energy, says Pradeep Paunrana, managing director of Athi River Mining Cement Ltd., one of East Africa's leading cement makers.

In Kenya, there are six cement manufacturing firms namely: Bamburi Cement Limited, East African Portland Cement Company, Athi River Mining Cement Manufacturing Company, Mombasa Cement Company, Savannah Cement and National cement company Ltd. Apparently, more than 90% of all cement manufacturers in Kenya today are located within Machakos County and mainly in Athi River. The establishment of these firms in Athi River area is due to several reasons among them being; with a ready market, cement ready market in Nairobi and Machakos among many other adjacent towns in Kenya, infrastructure in form of roads running from Mombasa all the way to the hinterland, including Rwanda and Southern Sudan, there is also the railway line, relatively cheaper land in Athi River and the black cotton soil not suitable for agriculture. In addition there is abundance of pozzollana, the blue stone used for building which is an ingredient in the final stage in grinding cement. Gypsum, also an ingredient for the final mix, is also readily available from Kajiado, Isinya and Konza nearby, and the improvement of the roads in the area has helped to ensure easy transport, there is really no doubt that cement companies in this part of Kenya will always continue to flourish (KAM, 2013).

In 1951, Bamburi Cement Ltd was founded and Lafarge a company from France is the principal shareholder of Bamburi Cement Ltd. East Africa Portland Cement (EAPC) began as a trading company importing cement. Blue Circle Industries of United Kingdom formed the company. The plant’s initial capacity was 60,000 tons a year, but presently it stands at 700,000 tons a year (East African Portland Cement Company, 2015). Athi River Mining Limited in Kenya (ARM), Athi River Mining Limited is the most popular cement manufacturer in Kenya. ARM (Kenya) was

established in 1974 and its principle shareholder is the Paunrama family. Initially it was a mineral extraction and processing company and later in 1996, the cement division began operation. As a demonstration of its commitment to corporate social responsibility, Rhino Cement Company runs Rhino Cement Foundation (RCF) that caters for education, health and environment that caters for improvement of the livelihood of community members.

Mombasa Cement Limited (MCL) was founded in the year 2007 to cater for the building construction with an annual capacity of 1.6 million metric tons. MCL is the most technologically advanced and environmentally friendly cement producers in East Africa. As part of its corporate social responsibility, Mombasa Cement Ltd is committed to carrying out her production, service, and delivery activities and processes while ensuring conservation of the environment for the future generations. Devki Steel Mills Ltd, the owners of National Cement Company plays a very important role in terms of growth and support of the local community. With a growth of net income of 101.5m in 2013 to 112m in 2014 they have been running on a positive footing (Bloomberg Business, 2015). Savannah Cement Company is a state of the art, eco-friendly cement grinding plant with a capacity of 1.5 million tons a year. Savannah Cement Company is located in Athi-River which is 30km from Nairobi City in Kenya.

STATEMENT OF THE PROBLEM

Material handling is an indispensable element in most production and distribution systems and has adverse effects on performance of organisations (Biles, 2006). Due to the amounts of movements, problems can arise in a wide range of contexts, for example longer lead times, high amount of time spent on material handling and unnecessary movements can occur. This directly impacts on financial performance and competitiveness of the cement manufacturing firms. In the year 2010, Kenya had a capacity to produce 5.1 million tons of cement annually. However, 3.7 million tons was actually produced, translating to a capacity utilization of 72.5%, compared to the global capacity utilization of 80% in the same year (Joachim, 2008). Cost of sales in the cement industry escalated by 43% on average over the last 4 years. EAPCC□s cost of sales went up by 6% from Kes 7.4 billion in 2010 to Ksh. 7.8 billion in 2011. This directly impacts on financial performance and competitiveness of the firms. According to WBCSD (2002) cement manufacturing is energy intensive and modern cement plants are highly automated in an effort to improve on their usage of material handling. Cement manufacturers in Machakos County have made improvements and redesign of material transport systems and the development of procedures for effective material handling. Some of these improvements include automation of handling systems, training of staff and introduction of information systems. However even with these improvements the manufacturers are still facing rising cost of sales of which most is associated with materials handling. This directly impacts on financial performance and competitiveness of the firms thus encouraging customers to turn to alternatives from Pakistan and China which tend to be cheaper. Therefore this study was used to identify the effects of

materials handling systems on the performance of cement manufacturers in Machakos County so as to encounter such issues.

GENERAL OBJECTIVE

To establish the effects of materials handling systems on the performance of Cement manufacturing firms in Machakos County.

SPECIFIC OBJECTIVES

1. To determine the effect of automating material handling systems on the performance of cement manufacturing firms in Machakos County.
2. To assess the extent to which information directed systems affect the performance of cement manufacturing firms in Machakos County.
3. To examine the extent to which semi automated systems affect the performance of cement manufacturing firms in Machakos County.
4. To establish the influence of mechanized materials handling systems on the performance of cement manufacturing firms in Machakos County.

THEORETICAL REVIEW

Control Theory

This is an interdisciplinary branch of engineering and mathematics that deals with the behavior of dynamical systems with inputs, and how their behavior is modified by feedback. The usual objective of control theory is to control a system, often called the plant, so its output follows a desired control signal, called the reference, which may be a fixed or changing value. To do this a controller is designed, which monitors the output and compares it with the reference. The difference between actual and desired output, called the error signal, is applied as feedback to the input of the system, to bring the actual output closer to the reference. Some topics studied in control theory are stability (whether the output will converge to the reference value or oscillate about it), controllability and observability.

Queuing Theory

This theory will guide the study in investigating the relationship between material handling equipment and effective inventory management. Queuing theory is a mathematical study of waiting lines or queues (Shingo, 2005). The theory enables mathematical analysis of several related processes, including arriving at the back of the queue, waiting in queue (a storage process) and being served in front of the queue. The theory permits the derivation and calculation of several performance measures including the average waiting time in the queue or the system, the expected number waiting or receiving service, and the probability of encountering the system

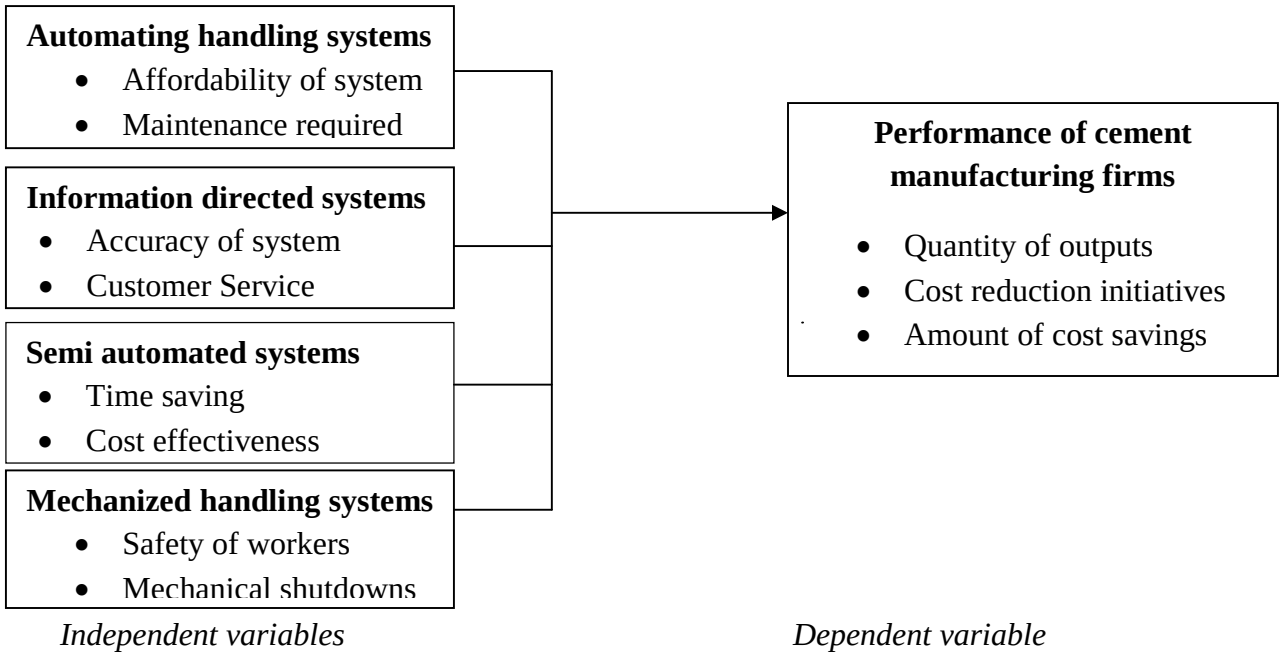
in certain states such as empty, full having an available server or having to wait a certain time to be served (Houtzeel,1999).

The Theory of Constraints (TOC)

This 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. There is always at least one constraint, and TOC uses a focusing process to identify the constraint and restructure the rest of the organization around it. Constraints can be internal or external to the system. An internal constraint is in evidence when the market demands more from the system than it can deliver. If this is the case, then the focus of the organization should be on discovering that constraint and following the five focusing steps to open it up (and potentially remove it). Scheinkopf (1999) defined these as prerequisite steps so the Process of On-Going Improvement is an amalgamation of the Five Focusing Steps and the two prerequisites of its for implementation (Watson et. al., 2007).

CONCEPTUAL FRAMEWORK

The study suggests that firms' performance is a function of Material handling system. Material handling system is the independent variable of the study while performance is the dependent variable. The study presumes that material handling systems significantly and positively affects the performance of cement manufacturing firms in Machakos County as illustrated in the framework.



Automating Materials Handling Systems

Automated materials handling (AMH) refers to any automation that reduces or eliminates the need for humans to check-in, check-out, sort material, or to move totes and bins containing library material. Manzini et al (2005) explain that there is an increasing new trend towards automation of logistical activities. There exist automated systems with the purpose to facilitate the material handling activities. The appeal of automation is that it substitutes capital equipment for labor. In addition to requiring less direct labor, an automated system has the potential to operate faster and more accurately with less product damage than its mechanized counterpart. The level of automation varies depending on the handling requirements. Fully automated handling systems ensure that the materials/components/assemblies are delivered to the production line when required without significant manual intervention.

Manzini et al (2005) explain that there is an increasing new trend towards automation of logistical activities. Ondiek (2009) assess materials management in the Kenyan Manufacturing firms with the aim of determining whether long term success and survival of any organization depended entirely on how well organization are managing their material(cost). The study was a survey of medium and large manufacturing firms in Nairobi. The result confirms that Kenyan firms were not practicing professionalism in material management.

According to Grant et al (2006) automated systems provide benefits as well, for example automated materials handling operations eliminates labour and non-value-adding processes. However, advantages and disadvantages with automated systems can be held against each other. Grant et al(2006) has listed some of the advantages as cost reduction in labour, increase of output rate, reliability and time of service will be improved, the amount of materials handling will be reduced etc. Disadvantages of automating the systems include initial capital cost, risk of downtime and unreliability of equipment, software related problems, lack of flexibility to respond to changing environments, user interface and training etc. With regard to the attributes to be considered in a material handling system, according to Kulak (2005), effective use of labor, providing system flexibility, increasing productivity, decreasing lead times and costs are some of the most important factors influencing selection of automated material handling systems.

Information Directed Systems

Information and Software Baudin (2004) defines information flow as transaction processing associated with the material flow, analysis of past activities, forecasting, planning, and scheduling of future activities An information directed system applies computerization to sequence mechanical handling equipment and direct work effort. According to Coyle et al. (2008) information is the lifeline of every system, and also one of the important pillars in making decisions and actions effectively. All material handling movements are directed and monitored by the command of microprocessors. To begin with all required handling movements are fed into the computer for analysis and equipment assignment. Analysis of handling requirements and

equipment assignment is done in such a way that direct movements are emphasized and deadhead movements are minimized.

Information-directed systems can increase productivity by tracking material handler performance and allowing compensation to be based on activity level. Single handling equipment may be involved in loading or unloading several vehicles, selecting many orders, and completing several handling assignments, thus increasing the complexity of work direction. For this purpose, electronic information technology, for example, in forms of wireless barcode scanners and RFID technologies can be very handy. By implementing RFID technologies not only financial gains, but also efficiency gains can be achieved through improved productivity and visibility, higher speeds, greater accuracy and better customer service (Drum, 2009).

Semi Automated Systems

Semi automated systems supplement a mechanized system by automating a specific handling requirement. Semi automated system is a mixture of mechanized and automated handling. The automated transfer devices will reduce the usage of human energy for a lifting task. The automated transfer device might need to operate under the guidance of human but without wasting human energy as manual handling system did. Mulcahy (1998) presents Automated Guided Vehicles (AGVs) as an alternative above floor powered horizontal in-house pallet transportation concept. When handling high pallet volume with frequent, regular deliveries to predetermined locations; AGVs can be a good alternative to forklift and milkrun.

Baudin (2004) argues that using most traditional methods on the shop floor such as dispatching the materials by forklifts are contradicting with lean manufacturing principles, since they are costly, contain safety hazard and can be operated only by specially trained drivers.

Mechanized Materials Handling Systems

Mechanical devices and machines are necessary for many material handling operations. Mechanical alternatives to manual handling of materials should also be used whenever possible to minimize lifting and bending requirements. A combination of labour and handling equipment is utilized in mechanical handling systems to facilitate receiving, processing and shipping. Generally, labour constitutes a high percentage of overall costs in mechanized handling. This is the most commonly used system in cement manufacturing firms in Machakos County.

According to Grant et al (2006) the level of mechanization in manufacturing companies has greatly increased over the past decades. Good workforces are expensive and increasingly hard to find. That is why warehouses are opting more and more for mechanization in the form of conveyor belts, rollers and cranes. Towlines consist of either in floor or overhead-mounted cable or drag devices. The main advantage of towlines is continuous movement. Conveyors are used

when material is to be moved frequently between specific points over a fixed path and when there is a sufficient flow volume to justify the fixed conveyor investment.

Baudin (2004) argues that using most traditional methods on the shop floor such as dispatching the materials by forklifts are contradicting with lean manufacturing principles, since they are costly, contain safety hazard and can be operated only by specially trained drivers, and also by restricting forklifts manufacturing density can be increased by 70%. Forklift accidents occur indiscriminately across all industry sectors; however a significant fatality 'black spot' exists for plant and machine operators within the Manufacturing industry (NOHSC, 1998).

Findings of a previous forklift related study conducted by Larsson and Rechnitzer, states that many forklift related hazards stem from not treating forklift trucks as 'vehicles' requiring systematic traffic management in the working environment. Certain risk factors were found to be inherent, due to the design and functional requirements of the forklift. The narrow track coupled to a variable centre of gravity makes stability a primary concern whilst operating.

RESEARCH METHODOLOGY

The study adopted a descriptive correlational research design. The target population consisted of two respondents selected from five departments. They were selected to take part in the study as key informants as they were perceived to be knowledgeable on the issues under study and for which they are either responsible for the execution or they personally execute them hence making it a census study. There are six (6) cement manufacturing firms in Machakos County according to Machakos County Government (2015). The study targeted twelve respondents from each department hence having a total number of 60 respondents. Judgmental sampling technique was used in this study. Both primary and secondary data was used in this study. The primary data was collected through a self-administered semi-structured questionnaire. Secondary data was obtained from the already written literature on the cement firms which will be used to cross-validate and check the consistency of the questionnaire responses. Documentary analysis was also used to gather background information by reviewing literature relevant to the study. After the data was collected, the researcher edited them to ensure their completeness and consistency, Coding and classification then followed to ensure sufficient analysis. The data was entered and analyzed by descriptive analysis using statistical package for social scientists version 21 (SPSS) computer software to generate cumulative frequencies and percentages. The software package was chosen because it is the most used package for analyzing survey data. Descriptive statistics was used to deduce any patterns, averages and dispersions in the variables. They include measure of locations (mean) and measure of dispersions (standard error mean). The study expected that the relationship between the study variables would follow a correlation model of the nature:

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4\ \varepsilon}$$

Where: Y = dependent variable (performance).
β_0 = Constant or intercept which is the value of dependent variable when all the independent variables are zero.
β_{1-4} = Regression coefficient for independent variables.
X_1 = Mechanized handling systems
X_2 = Automating handling systems
X_3 = Information directed systems
X_4 = Semi automated systems
ε = Stochastic or disturbance term or error term

RESEARCH RESULTS

The study managed to collected data from 60 respondents which represent a response rate of 100% of the target population; the data was coded and cleaned through extensive checks and consistency. The study reveals that 33.3 percent of the respondents were over 40 years, 22.2 percent were aged between 35 and 45 years while 44.5 were aged between 25 and 35 years. On the work experience of the managers, 33.3 percent of the respondents had worked in the cement firm for more than 10 years while 22.2 percent had worked between 5 and10 years and majority of the respondent had worked for less than 5 years (44.4%). On the level of education, 22.2 percent of the respondents had acquired degree level of education, 22.2 percent had diploma level and 55.6 percent had other lower levels of education.

Automated Material Handling System

To assess the role of automated material handling system on the performance of cement manufacturing firms in Machakos County, the top management and their assistants were asked to fill in questionnaires indicating their view on how automated material handling system affects performance of cement manufacturing firms in Machakos County. The findings were as shown on table Table.4.4. (Where 5= the greatest extent and 1 is the lowest extent).

Table 1: Automated Material Handling System

Organizational Structure Measures	Mean	t-value	Sig. (p-value)
Automating the systems allowed your organisation to eliminate non-value-adding processes?	2.423	52.654	0.000
Downtime and Unreliability of equipment	2.024	49.814	0.000
lack of flexibility to respond to changing environments	2.084	43.452	0.000
user interface and training	2.391	36.291	0.000
Staff turnover	2.029	34.891	0.000
Overall mean score=2.190			

Overall, the intensity of automated material handling system on the performance of cement manufacturing firms in Machakos County is considerably low with the mean of 2.190. This is because the overall score is less than 2.5 which is the half of the maximum score of 5.Automation in materials handling is yet to be fully realized in this industry due to financial constraints and logistical issues. Also this is so as the other handling systems, that is, mechanized and semi automated are widely used.

Information Directed Material Handling System

The managers were asked to fill in questionnaires indicating their view on how information material handling system affects the performance of cement manufacturing firms in Machakos County.

Table 2: Information Material Handling System

Information Material Handling System Measures	Mean	t-value	Sig. (p-value)
Level of information flow regarding to materials management at your organisation?	2.1325	42.354	0.000
implementation of soft ware's such as ERP and AS/RS will benefit the organization	2.0640	39.834	0.000
Need for more learning on part of staff	2.0847	33.452	0.000
Unwillingness to change long established processes	3.3012	36.291	0.000
Poor technology awareness	3.0294	34.891	0.000
Disruption of Productivity	2.341		

From the study results in table 4.5, Overall, the relevant result shows that on the scale of 1 to 5 (where 5= the greatest extent and 1is the lowest extent), the information material handling system had a mean score of 2.492. This means that the intensity of the effect on performance of cement manufacturing firms in Machakos County was moderate. As observed above it is seen most orders are unwilling to adopt this new system. This is due to their poor technology awareness and the need for more training resulting to extra work hours. From the above findings it's also noted that this system is underutilized even though it can offer benefits to these companies.

Semi Automated Material Handling System

The managers were asked to fill in questionnaires indicating their view on how semi automated material handling system affects the performance of cement manufacturing firms in Machakos County.

Table 3: Semi Automated Material Handling System

Semi Automated Material Handling System Measures	Mean	t-value	Sig. (p-value)
Increased quantity of outputs	2.39	51.514	0.000
Commitment to Quality	2.48	48.582	0.000
Elimination of possible damages to facilities and products	2.68	42.462	0.000
flexibility on the shop floor	2.31	36.261	0.000
Automatic systems will bring better performance and quality to the organization	3.201	28.345	0.000
Improved safety and time saving is directly related to use of semi automated systems	2.982	29.305	0.000

The relevant result shows that on the scale of 1 to 5 (where 5= the greatest extent and 1 is the lowest extent). Overall, the intensity of semi automated material handling system on the performance of cement manufacturing firms in Machakos County was moderate (mean 2.673). This shows that this system is moderately used. In the attempt to modernize the industry, most firms chose to adopt semi automated systems instead of fully automated ones due to their ease of

Mechanized Material Handling System

Overall, the Level of mechanized material handling system was considerably high (mean 3.625).

Table 4: Mechanized Material Handling System

Mechanized Material Handling System Measures	Mean	Std. Deviation	t-value	Significance (P-value)
Gauge the current materials handling system in your firm	4.452	1.0712	32.184	0.0000
Worker Compensation claims due to injuries	2.950	1.6575	29.814	0.0000
Stoppages in work due to machinery breakdown	3.050	1.6874	30.252	0.0000
Stoppages in work due to worker injury	4.050	1.2031	28.280	0.0000

Mechanized materials handling is the most utilized and the one that has the most impact on performance according to the findings. This is due to the kind of equipments used i.e simple equipments which are frequently used, very mobile, easy to use and easily installed. Some of this include forklifts. This system is also mostly used due to how the human element is required in the operations. Even though human injuries are mostly brought about with this system, it is still popular with the workers.

Performance of Cement Manufacturing Firms

Table 5: Performances

Performance Measures	Mean	t-value	Sig. (p-value)
our institution offer quality services to its customers	3.423	52.654	0.000
Our firm performs better than others	3.024	49.814	0.000
Our customers are happy with your services & products	3.084	43.452	0.000
Firm has provided a method to receive customers feedback	3.391	36.291	0.000
Customer feedback is usual worked upon	3.929	34.891	0.000
You are satisfied in working for the cement firm	3.770	27.372	0.000

The relevant result shows that on the scale of 1 to 5 (where 5= the greatest extent and 1 is the lowest extent) Overall, the intensity of performance of cement manufacturing firms was moderately high with a mean of 3.436 as indicated in table 4.8. This can be supported by looking at the industry and comparing it with others in East Africa. Most of these firms have invested heavily on materials handling which equates to improved performance. Customer satisfaction is seen to be very high as quality products and services leads to happy customers.

REGRESSION ANALYSIS

Table 6: Regression Results for Automating Material Handling Systems and Performance Goodness of fit analysis

R	R Square	Adjusted R Square	Std. Error of the Estimate
0.552	0.328	0.768	0.382

The regression results on the other hand shows that 32.8 percent of the performance of cement manufacturing firms in Machakos County can be explained by automating material handling systems (R squared = 0.328) table 4.9. The study therefore found out that there was an effect of automating material handling systems on the performance of cement manufacturing firms in Machakos County. The study result is in agreement with Ondiek (2009) study which found out that there is a relationship between automating material handling systems and performance.

Table 7: Regression Results for Automating Material Handling Systems and Performance: Overall significance: ANOVA (F-test)

	Sum of Squares	Degree of Freedom	Mean Square	F	Sign. (p-value)
Regression	2.018	1	2.218	39.018	0.006
Residual	1.640	59	0.124		
Total	3.368	60			

The effect of automating material handling systems on performance of cement manufacturing firms in Machakos County was positive and significant in that its R was 0.552 (table 4.9). The regression results on the other hand shows that 32.8 percent of the performance of cement manufacturing firms in Machakos County can be explained by organizational structure (R squared = 0.328). From the above regression analysis, the study found out that there is a relationship between automating material handling systems and performance of cement manufacturing firms in Machakos County. The study results answers the research question in that it has found out that automated material handling systems had an effect on the performance of cement manufacturers in Machakos County

Table 8: Regression Results for Automating Material Handling Systems and Performance: Individual significance (T-test)

	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta (β)	T	Significance (p-value)
(Constant)	1.634	2.482		1.432	0.083
automating material handling systems	0.342	0.402	0.328	1.162	0.024

The regression results also shows that at individual significance, there was a statistically significant positive linear relationship between automating material handling systems and performance of cement manufacturing firms in Machakos County (β= 0.342, p-value 0.001) in that the p-value is less than α (0.024 < 0.05).

Table 9: Regression Results for Information Directed Systems on Performance

R (Beta)	R Square	Adjusted R Square	Std. Error of the Estimate
0.482	0.268	0.586	0.236

The study results revealed that information directed systems effect on performance was statistically significant. Performance depended on the information directed systems with 26.8 percent of performance being explained by information directed systems (R squared = 0.268). The study findings go hand in hand with (Jones et al., 2004) who found out that information directed systems effect on performance.

Table 10: Regression Results of Semi Automated Systems and Performance

R	R- squared	Adjusted R^2	Estimate std error
0.464	0.264	0.104	0.736

The regression results also shows that 26.4 percent of the performance of cement manufacturing firms in Machakos County can be explained by semi automated systems (R square = 0.264). The effect of semi automated systems on performance of cement manufacturing firms in Machakos County was positive and significant in that its R was 0.464 (table 4.11a).

Table 11: Goodness of fit analysis Performance against ROI of Mechanized Materials Handling Systems

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.294(a)	.186	.343	.572

The goodness of fit results show that 18.6 percent of the performance of cement manufacturing firms in Machakos County can be explained by mechanized materials handling systems (R square = 0.264). The effect of mechanized materials handling systems on performance of cement manufacturing firms in Machakos County was positive and significant in that its R was 0.294

CONCLUSIONS

Based on the study findings, the study can conclude that automating material handling systems helps in improving the performance of cement manufacturing firms in Machakos County. Cement manufacturing firms in Machakos should therefore stiff to improve on their automating material handling systems because it has been found by this study to have a positive effect on the organizational performance. The study found out that info-directed systems were under utilized as most firms didn't have them or some have implemented them to a little extent. Therefore, the study can conclude that Cement manufacturing firms in Machakos County should make efforts towards information directed systems of material handling. It is seen that semi automated systems are commonly used in this industry. The study therefore concludes that semi automated systems of material handling in cement manufacturing firms in Machakos County need to be encouraged because it has a positive and significant effect on their performance. Finally, the study found out that mechanized materials handling systems had explanatory power on performance of cement manufacturing firms in Machakos County in that mechanized materials handling systems accounted for 18.6 percent of performance of cement manufacturing firms. The study therefore concludes that cement manufacturing firms in Machakos County should fully utilize the available mechanized materials handling systems.

RECOMMENDATIONS

The study recommends that the cement manufacturing firms in Machakos should stiff to improve on their automating material handling systems in an effort to improve on their performance. Since the study found out that performance depended on the information directed systems, the study recommends that cement manufacturing firms in Machakos County should work towards enhancing information directed systems in their firms. Based on the findings, the study recommends that semi automated systems of material handling in cement manufacturing firms in Machakos County need to be encouraged because it has a positive and significant effect on their performance and finally, mechanized materials handling systems by cement manufacturing firms in Machakos County need to be encouraged because it has been found to have a positive and significant effect on their performance.

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