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The Strategic JOURNAL of Business & Change MANAGEMENT
ISSN: 2312-9492 www.strategicjournals.com
Vol. 10, Iss.2, pp 198 – 207. April 21, 2023. www.strategicjournals.com, ©Strategic Journals

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Accepted: April 3, 2023

ABSTRACT

Material handling is an essential component of the manufacturing process. Manufacturing companies are working to improve their production and operating efficiency while also assuring the safety of their employees. Manufacturing organizations are working on building systems that will see the material go through several phases of manufacturing in a seamless manner to ensure customer satisfaction and increased profitability. Despite these notable investments in material handling, manufacturing firms in Mombasa County have experienced poor growth and high production costs. The goal of this research was to see how material handling methods affected the performance of formal manufacturing companies in Mombasa, Kenya. The study used a descriptive survey design, with the population of interest being 25 formal manufacturing enterprises in Mombasa. The study's 175 participants were recruited from various levels of management in various manufacturing companies (strata). To compute the sample size of each strata or industry of selected manufacturing enterprises, a proportionate stratified sampling technique was used on the target sample of 150 participants. Structured questionnaires with a Likert scale were used to collect primary data. Data was collected by managers, engineers, truck drivers, and operators from each manufacturing organization. The surveys were double-checked for accuracy before being coded and entered into SPSS. The data was analyzed using both descriptive and inferential statistics. The analytical findings were given in tables with footnotes. Most of the indications for the material handling operations were determined to be helpful to the company's success. As a secondary method, a regression analysis was performed at a 5% level of significance to explore the bond between the variables. The research shows that there is a strong link between material flow and the performance of manufacturing companies. A manufacturing company's material handling systems should be prioritized if it wishes to reduce costs, increase profits, and improve quality.

Key Words: *Material handling system, Material flow, Automatic Material Handling System*

CITATION: Munga, P. M., Kitheka, S., & Monari, D. (2023). Influence of material handling practices on the performance of formal manufacturing firms in Mombasa County. *The Strategic Journal of Business & Change Management,* 10 (2), 198 –207.

INTRODUCTION

The materials used in a manufacturing process are crucial to the success of the business. The term "material handling" covers a wide range of activities, including the organization of procurement, reception, movement, storage, and distribution. That's why it's so important for manufacturers today to have an efficient and reliable material handling system if they want to stay competitive. Because of this, factories now consider material handling essential to their goals (Hariharan, Suresh, & Sagunthala, 2019). Kenya's industrial sector is showing only modest development, thus boosting its performance is high on the government's agenda. Kenya's manufacturing industry accounts for 10% of GDP, according the Kenya Association of Manufacturers (KAM) (2018). As a result, retail, wholesale, and other service sectors are the fifth most important contributors to GDP, placing this industry in fifth place (KAM, 2018). In depth, the manufacturing sector output volume declined by 1.1% in 2017 while it's a real value-added rose by 0.2% in 2017, which is lower compared to the economic growth of 2.7% in 2016 (Newman, Page, Rand, Shimeles, Soderborn, & Tarp, 2016).

The quality of the products in a manufacturing concern depends on how materials are handled and sourcing quality raw materials. This research did not dwell on policy issues that are external to an organization but on internal aspects of manufacturing like material handling that pose a significant impact on performance. This makes material handling an important element in quality control and it has an impact on customer satisfaction and prevention of loss of resources (Umair, 2019). In this regard, material handling is a significant element of the production process and it enhances the competitiveness of manufacturing firms. Material handling influences quality, efficiency, production cost, and customer experience of manufacturing firms.

On the global front, various studies were conducted to determine how MH impact the performance of manufacturing firms (Nasution, Budiman, & Salim, 2018; Vieira, Pasa, Borsa, Milan, & Pandolfo, 2016). The global manufacturing activities are expanding and the world logistics and transportation industries are also expanding. The global demand for Agility of Material Handling Systemsis being driven by China and there is a projection that sales of material handling equipment and systems will stand at $176 billion by 2020. Manufacturing firms in the developed world are seeking to satisfy the growing demand for their products and thus has sought to enhance the efficiency of their operations. They have invested in upgrading their warehousing facilities, installation of automated storage and retrieval systems, and automated vehicles because of their efficiency, productivity gains, and reduce labor costs (MH &L, 2016). Most importantly, a great proportion of the studies on material handling practices and organizational performance was carried out in the Western regions and Southern regions of Africa. For instance, Albert, Shakantu, and Ibrahim, (2018) study focused on investigating the influence of material handling practices in the building construction sector in Nigeria. Their underlying argument was that poor material handling practices attributed to a great proportion of the poor performance experienced in this sector.

The performance of manufacturing companies in Kenya is wanting. The manufacturing sector, which entails of both formal and informal companies has in the recent past exhibited some promising performance. For instance, in 2014 the sector grew at 3.2%, then at 3.5% in the following year, 2015, resulted in 10.3% contribution to the country's gross domestic product (KNBS, 2016). Nonetheless, when comparing this performance with the country's economy, it becomes evident that the sectors average growth rate is much slower as the economy, in 2015, expanded by 5.6%. Such statistics imply that the manufacturing sector's share in the gross domestic product has been falling over time. The aforementioned, poor performance of the Kenya's manufacturing sector can partially be

credited for leading to the various studies that was carried out to examine factors that influence performance among manufacturers (Nyongesa & Shale, 2019; Kathurima, Ombul, & Iravo, 2016; Odero &Ayub, 2017). In particular, material handling practices have in the recent past received increasing attention by researchers on their contribution towards the performance of manufacturing firms. Nyongesa and Shale (2019), focused on examining the influence that material management had on the performance of manufacturing companies within Nairobi in Kenya.

Statement of the Problem

There is need for growth of the Kenyan manufacturing sector in order to compete at the global level. As a benchmark for this needed improvement, Kenya's vision 2030 stipulates that the manufacturing sector needs to account for 20% of the gross domestic product by 2030. Nonetheless, this has yet to be attained by the country's manufacturing sector as its contribution has revealed a 10% average stagnation for over a decade with a 3.1% growth rate, which is below the overall economic growth rate (5%) of the country (Were, 2016). Various studies have also stressed on the significance of material handing in the organization (Kaur, Kumar & Kumar, 2017; Kathurima, Ombul, & Iravo, 2016; Asaolu, Agorrzie, & Unam, 2016). For instance, Kaur et al. (2017) research showed that manufacturing companies in Northern India benefited from practices of material control management in terms of performance. In Nigeria, Asaolu et al. (2016) found that study material management was a critical tool for enhancing the profitability of food and beverage manufacturers. From the few studies conducted, it is apparent that little attention has been focused on the manufacturing companies in the coastal region of Kenya, which accounts for a significant proportion of Kenya's manufacturing sector.

Hypotheses Testing

H_{01}: Material flow does not significantly affect the performance of formal manufacturing firms in Mombasa County.

LITERATURE REVIEW

Theoretical Review

Theory of Constraints

By zeroing in on specific restrictions that prevented systems from reaching higher performance levels, Dr. Goldratt's 1984 management philosophy sought to initiate and execute breakthrough innovations. Undeniably, there have been several reports on the successful empirical application of TOC elements as an effective strategy for the attainment of anticipated degrees of operational performance (Naor & Coman, 2017; Gundor et al., 2016; de Jesus Pacheco, Junior & de Matos, 2021). Most notably the influence of these TOC elements has been presented from various angles, for instance, in mathematical modelling, in health care systems, in flow shops environment, and in supply chain performance. For instance, Naor and Coman (2017) recommended approaches for the streamlining of operations through applying TOC methods particularly in a services call center's stressful environment. Taking the health care angle, Tiwari and Sandberg (2016), investigated approaches of improving perioperative bed capacity planning under the guidance of TOC. Conversely, Gundor et al., (2016) investigation into flow shops environment joined TOC and a simulation-based heuristic technique to identify hindrances in production lines to stabilize the partially complete material flow.

Still, studies on TOC are seemingly, to a certain extent, sporadic in comparison to other key areas in operations. de Jesus Pacheco, Junior and de Matos (2021) note that even though the probable consideration of TOC as an example of an effective Operations Supply Chain Management's managerial philosophy in practice, it is yet to be fully accepted as a scientific discipline. De Jesus Pacheco, Junior, and de Matos (2021) performed research to fill this gap by investigating the relationship between TOC components and market-defined priorities such on-time delivery, low cost, high speed, high quality, and high flexibility within the framework of operations strategy. Based on their research, they

determined that many of the TOC practices that have an effect on several critical competitive aspects have common ground. The research concluded that the theory may be seen as an approach in the operations planning process, similar to a system-oriented paradigm (de Jesus Pacheco et al., 2021).

In the context of this study, TOC's influences on the competitive dimensions such as on-time delivery, high flexibility, and high speed closely relates to the agility of the material handling systems. According to de Jesus Pacheco et al. (2021) the integration of all supply chain partners in that they act as a homogenous unit would result in the improvement in performance and profit throughout the supply chain, as supply and demand combination (Chawla & Kant, 2017). Benotmane, belalem and Neki (2017) confirmed that, with the growing market requirements, the logistics process became increasingly intricate and with heightened demand levels, particularly in relation to attaining competitive advantage.

Conceptual Framework

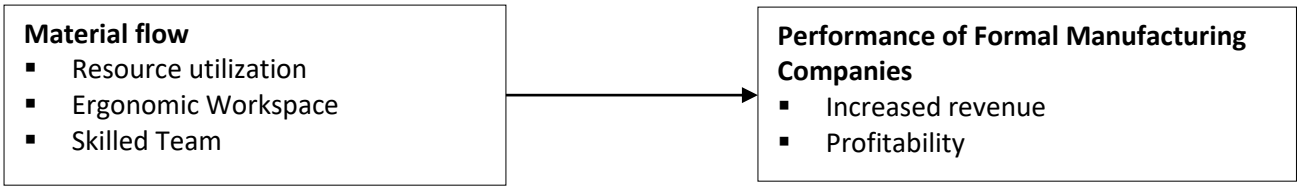

Figure 1: Conceptual Framework

Review of Variables

Material Flow and Organizational Performance

A coordinated role that holds the responsibility of controlling an organization's material flow is referred to as material management. Material management can be approached through two approaches. The first approach emphasizes on maximal utilization of company resources whereas the second approach emphasizes on the importance of offering the required quality of service (Jusoh & Kasim, 2017).

Material flow within the production floor has an impact on cost and time. Conventionally, the production facility layout has determined the efficiency of material flow and handling. According to Nilsson (2018), a facility layout decision is determined by constraints of the facility and the necessity to support and ease material movement. Additionally, the ideal layout that ensures cost and time saving is one that is most efficient in as far as the interaction between production units and material handling system is concerned.

Ergonomics is the study of how humans interact with machines and other people in the workplace, as well as the use of scientific knowledge in the form of theory, data, methodologies, and principles to design for maximum human comfort and efficiency (Alves, Ferreira, Maia, Leao & Carneiro, 2019). Ergonomic workplace and work design has been shown to improve worker productivity in a variety of studies. Nonetheless, there is as well a commercial perspective linked to ergonomic workspaces. Information mainly linked to such a perspective is often not given much attention as in the scientific investigation. Arnita et al. (2020) point out that ergonomics influences businesses in terms of disturbance, quality, and productivity. Nevertheless, various authors have suggested that there exists an intersection between productivity, quality and ergonomics (Olabode & Adesanya, 2017; Alveset al., 2019; Rizki, Ushada & Pamungkas, 2019).

Resource utilization refers to the extent to which a company uses its available resources and demonstrate if these resources are employed properly. Besides, resource utilization can be understood as a ratio between employed resources and the overall available resources. Azizi, Yazdi, and Humairi (2018) state that it is important for each

flow to be adapted to the other to achieve a high resource utilization. One common challenge that could arise is related to the carrier not being fully adjusted to the goods, which is required all through the process. An organization can easily focus more on the flow of products than ensuring that the overall flow of its resources is specifically meant to meet the needs. Such focusing results in a disproportion in the flow that in turn causes low resource utilization. Other factors that can result in disproportion in the flow include chain imbalances, structural imbalances, safety imbalances, technical imbalances, and operational imbalances

In the operational context, transports system's resource utilization is typically concerned with how individual resources are employed. Therefore, resource utilization is directly related to operations such as loading of cargo carriers. Two factors should be considered when measuring the filling degree. They include, weight-based fill rate (this is the ratio between the real weight that can be stored, or loaded onto a transport and its maximum carrying capacity) and volume based fill rate (this the percentage of the total volume taken by cargo)

METHODOLOGY

Research Design: Miller, Smith, and Pugatch (2020) state that a research design is the strategy used to investigate the research topic. Descriptive research methods were used to determine whether or not there was a correlation between material handling and the performance of manufacturing organizations.

Target Population: The study's complete population of interest which included all the formal manufacturing firms located within Mombasa County, Kenya. There were approximately 25 formal manufacturing companies within Mombasa County (Kenya Association of Manufacturers, 2020).

Table 1: Target Population

Employee Role	Total Population
Production manager	25
Logistics manager	25
Production Planner	25
Production engineer	25
Operators (Truck driver/machine operators/Maintenance technicians per company)	75
Total	**175**

Sampling Techniques and Sampling Size

The sample size for this investigation was calculated using a stratified sampling method. For this method of sampling, the population of interest was first stratified. This method allowed the researcher to divide the sample population into subsets depending on job functions, as shown in Table 2 A total of 150 people were selected at random from the population of interest for the research. Therefore, to obtain the sample size for each stratum, this formulae was applied: = (Strata size / Total Target Population) X Total sample size

Table 2: Sample Size

Employee Role (Strata)	Calculation	Strata Sample Size
Production Manager	=25/175*150	21
Logistics Manager	=25/175*150	21
Production Planner	=25/175*150	21
Production Engineer	=25/175*150	21
Operators (Truck driver/machine operators/Maintenance technicians per company)	=75/175*150	64
Total		148

Data Collection Instrument

The questionnaire was used as the primary method of information gathering in this research. The study's participants, in instance, were given questionnaires to fill out at their own leisure that only allowed for closed-ended responses. In light of continuing health worries due to the Covid-19 outbreak, self-administered questionnaires were a suitable research method for this study. In order to maintain the necessary social distance, these surveys permitted respondents to fill them out independently, without the researcher's presence.

Data Analysis

The collected data was fed to SPSS software for data analysis purposes. The descriptive statistics of these data presented using tables and charts.

$$Y = \beta 0 + \beta_1 x_1 + \varepsilon$$

Where:

Y; denotes the manufacturing firms' performance

β_0; Is the constant

β_1 = Regression coefficients to be estimated

X_1; denotes the material flow sub-variable

Ɛ; denotes the stochastic term

DATA FINDINGS AND DISCUSSIONS

Table 3: Response Rate

No. of questionnaires Returned	Target No. of respondents	Response Rate (%)
120	148	81.1%

The response rate was 81.1%, based on 120 completed surveys out of 148 sent out. In order to draw meaningful inferences from the data, such a response rate is deemed adequate by Fincham (2008).

Reliability

Cronbach's alpha, which ranges from 0 (indicating no consistency) to 1 (denotes perfect consistency), was used to assess the internal consistency of the scales used to measure the research variables. According to Bell, Bryman and Harley (2019), a scale that registers a Crobach's coefficient of 0.7 and above is internally consistent to a satisfactory degree. This guideline was adopted for this study and the scales were reliable. The Cronbach's alpha values varied from 0.86 to 0.92 as indicated in Table 4 below and Bell et al. (2019), which states that a reliability coefficient over 0.7 indicates adequate internal consistency.

Table 4: Reliability Test Results

Variable	No. of Scale Items	Cronbach's alpha	Remark
Material flow	6	0.92	Reliable
Performance	5	0.86	Reliable

Correlation Analysis

The linear association between material flow and firms' performance was explored through a Pearson correlation analysis.

Table 5: Pearson Correlation Matrix

	Material flow	Performance
Material flow	1	
Performance	0.66*	1

Correlation is significant at the 0.05 level"

The results show a strong and positive correlation between performance and material flow (r = 0.66, p < 0.05)

Regression Analysis

The coefficient of determination describes how much one variable affects another when the other is changed.

Table 6: Regression Coefficients

	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.77	0.451		8.3592	0.004
Material flow	0.782	0.121	0.146	6.46281	0.003

a. Dependent Variable: Manufacturing firms Performance

Manufacturing firms Performance= 3.77 + 0.782*Material flow

$$Y = \beta 0 + \beta_1 x_1 + Ɛ$$

ANOVA Results

Table 7: ANOVA Results

	Sum of Squares	df	Mean Square	F	Sig.
Regression	12.22	4	48.89	9.45	0.001
Residual	460.49	89	5.17		
Total	472.71	93			

Dependent Variable: Manufacturing firms Performance

Predictor: (Constant), Material flow

The regression model was shown to be statistically significant according to the analysis of variance (F (4, 89) = 9.45, p 0.05). This meant that the model statistically improved our ability to forecast the success of industrial companies in Mombasa County. In this case, material flow was shown to have a statistically significant impact on output (= 0.78, t =8.36, p 0.05).

Hypotheses Test Results

H_{01}: Material flow does not significantly affect the performance of formal manufacturing firms in Mombasa County.

Performance was shown to be significantly affected by the material flow (= 0.78, t =8.36, p 0.05). The results showed that material flow did affect manufacturing enterprises' performance in Mombasa County, thereby rejecting the null hypothesis. The results are collaborated by literature by Dube (2020) who arrived at the conclusion that resource management serves to improve performance in attaining client service demands while simultaneously ensuring profitability of the company by minimizing costs and ensuring that available resources are put to proper use. Additionally, Tezera and Yadesta (2017) concluded that material resource management is crucial for any type of an organization; as it is common practice and no organization can survive or function without it.

Table 8: Results of the Hypothesis Tests

Null Hypothesis	Hypothesis Statement	Results	Outcome Interpretation
H_{01}:β_1=0	Material flow does not significantly affect the performance of manufacturing firms in Mombasa County.	β_1=0.78, p <.05	Reject

Discussion of Key Findings

The Influence of Material Flow on the Performance of Formal Manufacturing Firms in Mombasa County

There was a clear split amongst respondents as to whether or not their company's loading and unloading system preserved material quality and minimized damage, and whether or not the design of their facility increased manufacturing efficiency by enhancing material quality, shortening cycle times, and minimizing the need for extraneous movements. This data points to a potential need for more manpower in material handling activities. The material handling system layout is crucial. To put it another way, it knew the difference between a tidy warehouse and one that was a mess. As a result of poor warehouse layout, bottlenecks formed, workers wasted time wandering aimlessly, and accidents while moving goods became more likely. Good warehouse design increased efficiency, reduced the need for workers to move about, and benefited their health.

The results also revealed that material flow had a significant influence on the performance of manufacturing firms in Mombasa County. This finding ties well with Asaolu et al. (2016) and Pyza et al. (2017). These studies established that material management optimized the organizational performance of manufacturing firms.

CONCLUSIONS AND RECOMMENDATION

The study demonstrated that there is a close connection between the Material flow which accounts for the Performance of Manufacturing enterprises. Continuous improvement meant looking for many ways to improve the production process that was already in place. Even though each change doesn't seem to have a big effect on its own, the total effect shows that the whole production process has changed and gotten better. By making small, controlled changes a normal part of their business, manufacturers were able to improve their processes without taking a single big step to achieve the same result. The ultimate goal of manufacturing is to have efficient production that is free of waste, unplanned interruptions, and actions that don't need to be done. As a result, the best level of standardization and automation reached.

The study concluded that to reduce money and boost productivity, a company must optimize production material flow. Maximizing material flow entails maximize dock usage, space utilization, tool consolidation, and congestion reduction. Space can improve material flow, safety, and prices. To maximize space, separate raw materials and finished goods. Beyond that, determine what kind of storage they will need and how to get it while lowering costs. Supply chain management involves the transfer of physical products and commodities, as well as the necessary communication. Material, data, and money flow in supply chain management. Without material flow, the other flows wouldn't exist. Managers should design systems in production engineering and material flow analysis, that enables firms optimize material flow processes

Assisting operations, decreasing costs, and enhancing the flow and handling of materials may all be achieved with the help of a well-designed Material Handling system, which manufacturers should use. Better ergonomics and decreased injury risks are two of the benefits of lowering the amount of lifting. Repetitive lifting and operating multiple equipment at once can be physically and mentally exhausting. It is imperative that manufacturing organizations have a culture of continuous improvement that permeates across the organization. This means that operators should be rewarded for coming up with innovative ideas about how to improve the system. Operators are typically the ones with the most in-depth understanding of the processes and methods used to move the materials.

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