The Effect of Material Handling Procedures on the Supply Chain Performance of Mount Kenya Dairies

Kimathi, Winfred Makena & Dr. Wachiuri Elizabeth (PhD).

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*[1]Kimathi, Winfred Makena & [2]Dr. Wachiuri Elizabeth (PhD).

[1]MSc. Procurement & Logistics Student, Jomo Kenyatta University of Agriculture and Technology

[2]Lecturer, Jomo Kenyatta University of Agriculture and Technology

E-mail Address: winmak07@gmail.com

Abstract

Achieving the best performance in distribution companies remain key objective for the management globally. To achieve the expected performance objectives, management of firms has strong concern to adjust the logistics in a company to achieve a higher service level internally and profitability. Materials handling management has been sought as a critical determinant of performance is among many green logistics practices that contribute to improve a company's performance. Milk products distribution companies such as Mount Kenya Dairies deploy material handling operations in distribution of various products that include Pasteurized milk, yoghurt, Long life milk, butter, Mala and Ghee. The objective of this study was to find out the effects of material handling on the performance of Mount Kenya Dairies. The study used a descriptive survey research design. The target population was 572 employees. A sample of 58 employees who were selected randomly from various departments using purposive sampling method. The collected data was analysed using descriptive statistics, correlation and regression statistical techniques. The results revealed that material handling had a significant influence on the performance of Mount Kenya Dairies as evidenced by $r=0.641$ ($r>0.5$) and $p=0.000$ ($p< 0.05$). The regression analysis results indicated that the predictor sustainable material handling had a significant and positive relationship with organizational performance of Mount Kenya dairies as $\beta_{1=} 0.699$, $P=0.000$ and $t=5.793$. The study concluded that material handling has a significant positive impact on the performance of dairies distribution firms in Kenya. It was recommended that the management of Mount Kenya Dairies give more attention to material handling procedures and strategies in order to establish and maintain a desirable level of company performance.

Key words: *Mount Kenya Dairies, Material Handling, and Organisational Performance.*

1.1 Introduction

The continued advancement of eco-centrism philosophy has elicited widespread concern for the environment worldwide. This has compelled organizations to develop ways of minimizing their impact on the environment as part of the sustainability endeavours (Lin & Ho, 2011). However, extant literature does not satisfactorily explore the relationship between environmental protection and economic prospects especially in the contexts of developing countries. Green logistics is one of the new techniques that firms are adopting to enhance their profitability. The primary role of green logistics practices is to ensure that food processing and manufacturing companies pay attention to present eco situations in their economic pursuits. According to Martinez, Stapleton and Van Wassenhove (2011), this requires manufacturing companies to exhibit perfectionism in the measure of material or item at the right time and at the expected place. Customarily, cost were the solitary factor in planning logistician's exercises to accomplish firm performance. Nonetheless, expanded accentuation on green logistic practices makes considering the environmental impact made by their sourcing and distribution activities (Koh, Gunasekaran & Tseng 2012). Therefore, different green logistic practices have been utilized in an effort to achieve performance objectives. Regardless of this, developing countries such as Kenya has remained behind in complying with the requirements of green logistics.

Zhang and Zhao (2012) argue that sustainable logistics also has to consider economic and social factors in addition to environmental factors. A combination of these factors makes the triple bottom line, which conveys a three-way trade-off or balance between people, planet and profit (Zhang & Zhao, 2012). Green logistics therefore takes into consideration both the quantifiable and non-quantifiable costs involved in the movement of materials and sharing of information in the supply chain. Given the aforementioned importance, governments in the region are also promoting green logistics and sustainable supply chain in general. For example, the Africa Agenda 2063 is a roadmap that aims at achieving growth and sustainable development in the continent (NEMA Strategic Plan, 2019). One of the objectives of Agenda 2063 is to ensure that the environment of each country is sustainable for current and future generations. The agenda promotes environmental management practices that will help achieve this goal, which NEMA is in charge of managing in Kenya. During the eighth Climate Change Summit organized by the African Union in 2019, the participants reiterated the need to develop local strategies that will help in achieving the goal to reduce greenhouse gas emissions by 45% within the next decade and to zero by 2050 (NEMA Strategic Plan, 2019).

Distributing companies such as DHL embrace green logistics in an effort to achieve set firm performance objectives (DHL, 2018). The firm optimizes packaging by selecting unique boxes for each parcel that the firm transports; these boxes eliminate empty spaces in each parcel that is shipped. Material handling as a green logistic practice with is essential hubs in a supply chain network as it perform important functions that help the development of materials, handling items, deamassing vehicle loads, making stock keeping unit combinations and gathering materials for shipments purposes (Hassan, 2014). The effective material dealing in the stores ensures optimal production and dissemination complete products with main objective of cost decrease and firm performance improvement. Kenyan manufacturing firms have understood the advantages of embracing great materials administration and are taking keen interest regarding materials administration since survival of any firm relies upon how well their expenses are overseen (Gitahi & Ogollah, 2014). Nevertheless, most Kenyan firms are not applying refined methods of materials administration in comparison to resources spent on acquisition and maintenance of materials in various firms.

In UK, Bibby Distribution Company deploy significant steps towards adopting sustainable material handling and made various achievements. The firm uses high cube vehicles that have a capacity of 16% higher than that of standard HGVs (Bibby Distribution, 2014). The organization has also developed an efficient system of optimizing inbound and outbound journeys resulting into saving time and cost efficiency in the firms. The South African Government is forcing firms to adopt green logistics strategies with its carbon tax law. That means saving on material handling and developing waste management strategies that help them to minimize their emissions to the environment. Although the law is being implemented in phases, firms including those that are not being scrutinized in the first phase will start finding ways to minimize their emissions to the environment so that they can remain profitable (IEA, 2019).

Distribution companies in Kenya have taken the initiative to promote green logistics. Unilever, which is a multinational company that operates in Kenya, is one of the distribution firms that have taken the initiative to implement sustainable material handling practice. In 2017, the firm developed an initiative to package and handling of its products using 100% recyclable packaging materials and transportation equipment. Siginon Groups also embraces green logistics while providing services (Siginon Group, 2019). Onyango (2016) opined that crude materials conveyance frameworks in the agrochemical firms in Kenya improve operational performance of agrochemical firms in Kenya.

1.2 Problem Statement

Mount Kenya Dairies has been attempting to adopt green logistics particularly eco-friendly material handling procedures in a bid to improve their performance. However, there have been growing concerns both globally and locally about the environmental impact of supply chains. These concerns arise from the negative impact of firm's activities on the environment, for example, freight transportation has been found to be the cause of at least 8% of the CO_2 that is in the atmosphere worldwide. According to Mckinnon, Cullinane, Brown, and Whiteing (2010), if no action is taken, the amount of carbon dioxide emitted through transport alone may be between 15% and 30% by 20150. To avoid this, consumers and lobby groups are calling for firms to adopt sustainability measures so as to minimize their negative impact on the environment. In Kenya, the quest for sustainability begun in 1999 when the Environment Management and Co-ordination Act No.8 that established the National Environment Management Authority came into effect (NEMA, 2019).

According to Onyango (2016), green logistics is one of the sustainable strategies that firms may adopt to increase their competitiveness and performance. If more firms adopt green logistics strategies, they can save resources by a large percent while increasing customer satisfaction, which is a win-win for the organizations and their customers. However, locally, firms have not shown much commitment to green logistics despite it being successful internationally. As Cullinane (2014) argues that local firms are afraid that they will increase their cost of operations once they implement green logistics strategies. Researchers have also not paid much attention to this area despite the urgency of the matter that needs to be addressed before organizations cause more damage to the environment. Mwirigi (2016) studied the factors that drive manufacturing companies to adopt green supply chain strategies. Namagembe, Ryan and Ramaswami (2018), on the other hand, sought to determine the influence of green supply chain management on Ugandan SMEs. Based on this analysis, it is evident that most of the studies have researched supply chain in general. Material handling as part of green logistic has not been given much attention. The studies have also ignored the distribution sector, which has significant impact on the performance of a country as a whole.

Therefore, these gaps prompted this research to assess how material handling influences the performance of distribution firms in Kenya with a particular attention to Mount Kenya Dairies, which processes and distributes milk products around the country.

1.3 Aim of the Study

The aim of this study was to assess the influence of material handling on the performance of Mount Kenya Dairies.

Significance

Findings from the study will be beneficial to the distribution firms in Kenya, academicians and research institutions, policymakers, and the community. Distribution firms in Kenya will implement eco-friendly material handling procedures, hence, enhance their performance. Findings from the study will contribute to literature that academicians and research institutions can refer to. Policymakers will use the results from the study results to support their policy formulations. Having been informed about the centrality of green material handling, distribution firms will reduce the amount of pollution to the environment, which will significantly create a habitable environment for the community

2.1 Literature Review

2.2 Theoretical Review

Systems theory posits that an organization is a process that is made up of numerous variables that interact with one another. The interaction between the variables that make up the system is critical because it influences the outcome of the organization (Cole & Kelly, 2015). Thomas and Stephens (2014) argues that organizations are open systems because they interact with the external world, which influences their decision-making process. Xia and Wang (2013) argue that green logistics is a system that is made up of subsystems that include waste management, green transportation, green packaging, green warehousing, material handling, and green data collection and management. The system is influenced by environmental factors such as customer expectations, government laws and lobby groups that aim at ensuring that firms are responsible to the external environment.

According to systems theory, it is important for organizations to ensure that their green logistics system is working efficiently by undertaking strategies that ensure that each subsystem is geared towards being sustainable in the long term. It is also important for an organization to ensure that there is communication between the individuals in charge of handling of materials to ensure that they are working towards achieving the performance goal (Xia & Wang, 2013). The resources-based view argues that a firm's resources must be valuable, rare, inimitable and non-substitutable in addition to being heterogeneous and immobile in order for them to lead to sustainable competitive advantage. In order for an organization to implement material handling resources. Sustainable material handling equipment and tools are resources that foster execution of material handling to improve organization performance.

2.3 Empirical Review

Material handling is a critical function in a warehouse because it supports operations; managing material handling efficiently may improve the operational performance of an organization. Efficient material handling leads to benefits such as reduced delays, reduced cost of movement and eliminates contamination and damage of goods (Swinderman, 2018). The design of material handling systems determines whether an organization enjoys these benefits or not. Material handling refers to the movement and storage of goods in the warehouse through the manufacturing process and to the final consumer using tools and techniques that sustain the environment. Material handling may use manual, automated or semi-automated tools to move or keep goods in safe storage (Cullinane, 2014). With minimal and safe handling, an organization may be able to save on the cost of moving goods through the supply chain. Sustainable material handling may be achieved through the use of energy efficient tools. For example, when using forklifts, an organization should minimize the consumption of fuel by operating the machine only when there is a substantial amount of goods to be moved. Another technique of achieving sustainable material handling is that of managing waste (Trivellas, Malindretos & Rekliti, 2020). An organization should be able to separate hazardous materials from the non-hazardous ones and then dispose each of them appropriately. For example, a firm may develop an incinerator for disposing off chemicals and other waste products that may pollute the environment (Bank & Murphy, 2013).

Basically, organization performance is influenced by various factors that may be internal or external. Internally, organization performance may be influenced by available resources, human resources, costs of operations, and capabilities. Externally, the performance of a firm is determined by how satisfied customers are with the time it takes to receive the final product, the ability to sustain the environment, and economic factors. The performance of a firm depends on various factors as measured by a company. These factors may be financial or non-financial (Gavrean, Ilies & Stegerean, 2011). Mohsen and Hassan (2010) carried out a study to find out the best design for an efficient material handling system. The research also aimed at identifying the factors that firms should consider when developing their material handling systems. The research aimed at designing a material handling system that sustains the environment, increase safety and equipment utilization, and have sufficient equipment classes. The study suggested that an efficient material handling system should consider the following factors: complexity of the system, life cycle, purpose, environment of the system, characteristics of equipment and nature of transactions (Mohsen & Hassan, 2014). The study then proposed a material handling system that consists of the design phases that involved conceptual design dealing with specifying and prioritizing requirement, setting and decomposing objectives, establishing performance measures, determining leaner's equipment and designing of the system. Preliminary design which deal with selection of equipment type from classes and determining number of units of the equipment type while detail design involve determining the specifications of the selected equipment and evaluation of design (Mohsen & Hassan, 2010)

Carl and Lars (2008) conducted a study to find out the impact of material feeding design on the performance of assembly process in automotive firms. The study argues that the performance of material feeding at substation in these firms may be measured in terms of flexibility, volume and expansion. Flexibility refers to the ease with which components being handle may change. The research used a case study of two Swedish automotive firms; the research selected three work stations in each organization using random sampling. The study collected data through videotaping the work cycles in each work station under study. The research concluded that component racks with small packaging improve efficiency and effectiveness compared to those with large packaging. This is because it decreases handling

hence reducing time wastage by at least fifty percent. This also increases flexibility because it provides free time for displaying components in the work stations. The results of the research agree with Khan and Biligiri (2018) who found out that the use of containers of small sizes increases adaptation to change and it also decreases inventory costs that are normally hidden.

A study conducted by Oyebamiji (2018) also showed that material management is vital for the performance of manufacturing firms. The research aimed at assessing how material handling influences organization performance in the Nigerian cement industry. According to the research, material management involved handling, procuring, receiving and storing of materials in the warehouse. The study used purposive sampling to select three cement firms in Nigeria; ten respondents were selected from each organization to fill in structured surveys and take part in personal interviews. The research found out that efficient material handling enhances organization performance in that it minimizes interruptions; material management factors that do not deal with actual material handling such as procurement and storage did not have a significant impact on organization performance. The findings of the research agree with those of (Ogbadu, 2009) who also found out that efficient material handling enhances performance by reducing the cost of operations.

2.4 Conceptual Framework

Due to development of new markets, distribution demands for a large variety of products and handling efficiency demand increases. This material handling demand led to speed increases and changes in how materials and tools were being handled and transported in order to monitor distribution requirements. With these changes and demands for distribution companies to attain the company's goals, motivated acquisition of tools such as forklifts run quickly and with quality. The relationship between material handling and performance of distributions firms in exhibited the model Figure 1.
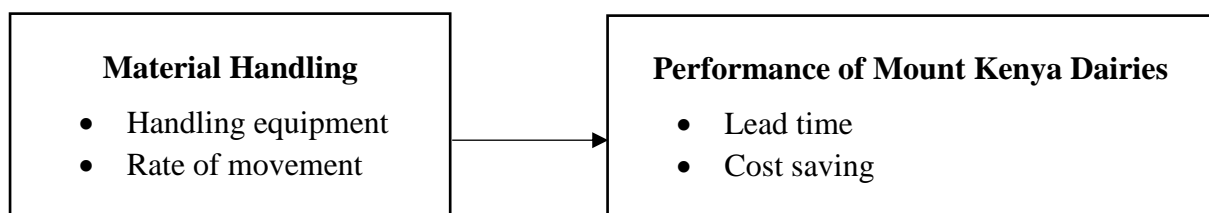

Figure 1. Conceptual Framework

3.1 Methodology

Research Design

Based on the nature of research questions developed for this study, a descriptive survey research design was adopted. Mitchell and Jolie (2013) argued that descriptive survey design aims at describing phenomena through answering of research questions. This approach is considered suitable for answering the what and the how questions about a phenomenon, similar to those raised in this study. Descriptive research design is a class of descriptive design that answers research questions using statistical figures. Descriptive design was used because of its ability to show relationships between variables. This design was also used because it presents

the relationship between variables using visuals such as tables and graphs; visuals are easy to understand as they summarize large sets of data into one table or graph (Blankenship, 2010). The design was able to show whether the adoption of green logistics increases or decreases the performance of distribution firms in Kenya. The target population was 572 employees working in Mount Kenya Dairies as at the year 2019 (Mount Kenya Dairies, 2019).

Sampling Procedures

A sampling frame refers to the total number of elements in the population that consist of characteristics required for the research (Saunders, Lewis &Thornhill, 2016). This is because although the population may be large, not all elements may consist of the desired characteristics for research. Having selected Mount Kenya Dairies as the case study, the sampling frame included the staff members of the company who are based in Meru County. The sampling frame of the study included employees from procurement, logistics, operations and quality control departments. These are 284 members from the organization (Mount Kenya Dairies, 2019). These departments were selected because they deal with distribution activities in the organization, hence they were able to help in providing answers to the questionnaire. A sample of 20% was drawn from population using purposive sampling .where 58 officers were selected. The sample constituted Quality control officers 12, operations 4, logistics 34 and procurement 8 totalling to 58 officers.

Data Collection and Analysis

Data was collected using a closed-ended questionnaire that was administered to 58 officers working with Mount Kenya Dairies. Data collected was processed using the Statistical Package for Social Sciences. Descriptive statistical techniques involving mean, frequencies and standard deviation was done. Further inferential regression statistical techniques involved correlation and regression analysis were utilized to determine the relationship between the material handling and performance of distribution Mount Kenya Dairies.

Ethical Considerations

The study complied with the ethical requirements of confidentiality, informed consent and safety. Approvals were sought from both NACOSTI and the Jomo Kenyatta University of Science and Technology prior to involving the participants in the study.

4.1 Findings

Response rate and Reliability

All the questionnaires that were administered to 58 participants and all of them successfully participants successfully participated in the study, translating to 100% response rate. The alpha value for the variable, 'material handling', was 0.754 (a>0.7). This implies that the data collection instrument was reliable (Creswell, 2018).

4.2 Demographic Characteristics

The findings show that the majority (68%) of the respondents in the organization had attained at least diploma and degree level of education. On working experience, 55.1% of the participants have worked in the firm for more than two years. This shows that most of the respondents were proving information required by the study through know how and experience.

4.3 Descriptive Analysis

Material Handling and Performance of Mount Kenya Dairies

The objective of was assess the effect of sustainable material handling on the performance of Mount Kenya Dairies. The results were presented in Table 1.

Table 1: Descriptive Analysis's on Material Handling and Performance of Mount Kenya Dairies

	Mean	Std. Deviation
I believe that there is minimal handling of materials in the company	3.95	1.176
I believe that minimal material handling promotes the safety of goods	3.76	1.288
Our company's handling equipment significantly reduces the need for handling materials by hand	3.66	1.207
Our company's material handling equipment ensures the safety of goods	3.90	1.119
Handling materials using equipment helps to save time in the company	3.62	1.349
I am completely satisfied with the way our company handles their goods	3.55	1.340
There is minimal double handling of materials in our company	3.60	1.107

The findings in Table 1 indicated that the respondents agree that there is minimal handling of materials in the company (3.95), and that they believe that the minimal handling leads to safety of goods in the company (3.76). The respondents also agree that the handling equipment that the company has reduces the need for handling goods by hand (3.66). Participants strongly agree that the handling equipment that the firm has promotes the safety of goods (3.9). They also agree that handling equipment enables the organization to save time (3.62).The respondents agree that they are satisfied with how goods are handled in the company (3.55). However, there is need for improvement as the level of agreement with the statement was not so strong. They also believe that double handling is at a minimal level in the organization (3.6). The level of agreement with the statement also shows that the organization can do better. These findings are in agreement with those of Swinderman (2018) who argues that efficient handling of materials reduces delays and also saves on the cost of operations. The savings on cost are achieved through the use of equipment that then minimizes the number of times goods are handled in a company's warehouse.

The use of equipment also saves time because of the high productivity of machines compared to humans. The results also tally with Carl and Lars (2008) who believe that the creation of an optimal material handling design in automotive firms promotes their positive performance. Such a design should be one that prioritizes requirements, sets objects, selects equipment for use, and determines the number of units that equipment can handle. When an organization creates such an optimal design, it is then possible to achieve the firm's performance targets. Participants believed that material handling saves the firm funds and time resources. Due to

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minimal handling, the firm saves on the time it takes to deliver goods to the point of sale. This is followed by saving of the cost of labour because few workers are needed to conduct handling.

Organization Performance of Mount Kenya Dairies

The study endeavored to measure the performance of Mount Kenya Dairies. The results from the analysis were presented in table 2 below.

Table 2: Organization Performance of Mount Kenya Dairies

	Mean	Std. Deviation
Lead time affects the overall performance of the organization	3.62	1.182
The cost of operations has a huge impact on the performance of an organization.	3.47	1.341
The company may experience loss of market share if it increases lead time	3.57	1.230
Training of employees to respond to customer requests affects lead time, which in turn affects organization performance.	3.60	1.227
Increased cost saving and decreased lead time may help the organization to perform even better in the future	3.55	1.287

From results in Table 2, lead time affects the overall performance of the organization (Mean=3.62) because it reduces delays in the system and leads to high customer satisfaction. Participants also agreed that the costs the organization spends on operations has a huge impact on the performance of the company (Mean=3.47) probably because it translates into more profits. The results also show that the company may lose market share if it increases lead time (Mean=3.57) because the organization would lose customers due to dissatisfaction. The training of employees in the company affects lead time which in turn has an impact on the performance of the organization (Mean=3.60). Finally, the respondents agree that an increase in cost savings coupled by a decrease in lead time may help the organization to perform even better in the future (Mean=3.55) because it would translate to increased customer satisfaction and loyalty, which would then lead to higher profits in the firm.

These findings are similar to those of Akandere (2016) who argue that various factors influence organization performance and they include financial and non-financial gains. Financial gains such as cost savings lead to higher profits. Non-financial gains such as training of employees and satisfaction of customers also lead to increased productivity and positive company image. These factors influence performance indirectly meaning that organizations should not ignore them. The respondents argued that the organization should engage in other practices such as planting of trees as a way of giving back to the community and sustaining the environment for future generations. They also mentioned that the firm needs to engage in waste management as it will help them to become more efficient. Some of the participants also believed that the firm uses a lot of water, hence they pointed out that the organization should engage in the conservation of water if it wants to become more sustainable in the future.

4.4 Correlation Analysis

Correlation analysis was conducted and the results showed that there is a strong, positive and significant correlation between material handling and performance of Mount Kenya Dairies as shown in table 3 below.

Table 3: Correlation Analysis of Variables

	Organization performance
Material handling	0.641*
Sig (2-Tailed)	0.000

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

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

Correlation analysis was conducted to determine whether there existed a relationship between material handlings and organizational performance in Mount Kenya milk distribution dairies. From the correlation results in Table 3, there was a significant, strong and positive association between material handling and organizational performance of Mount Milk processing dairies in Meru County, Kenya as r=0.641, PV=0.000< 0.05.

4.5 Regression Analysis

A linear regression analysis was carried out to establish the relationship between the material handling and performance of Mount Kenya dairies in Meru County, Kenya.

Table 4: Model Summary for Material Handling

Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.641[a]	.411	.399	.83040

The model summary results indicated that adjusted R^2 was 0. 411 indicating that there was a significant variation of 41.1.5% between performance of Mount Kenya dairies in Meru County, Kenya and material handling at confidence level of 95%.

Analysis of variance was conducted to identify the significant of the model in predicting the relationship between dependent and independent variables. Table 5 below details the results.

Table 5: ANOVA Analysis

ANOVA[a]						
Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	23.141	1	23.141	33.559	.000[b]
	Residual	33.099	56	.690		
	Total	56.240	57			

b. Predictors: (Constant), Material Handling

The ANOVA results indicate that the model had an F-ratio of 33.559, P=0.000<0.05. This result ascertains the regression model adopted by the study had a significant goodness of fit. It also means that the model was significant in explaining relationship between material handling and performance in Mount Kenya milk distribution dairies.

Calculation of beta coefficients confirmed that material handling has a significant effect on the performance of Mount Kenya Dairies as detailed in table 5 below.

Table 6: Beta-Co-efficient Results

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.909	.479		1.896	.004
	Material Handling	.699	.121	.641	5.793	.000

   a. Organizational Performance

The resultant regression model took the form:

Y=0.909+ 0.699X+ẹ.

From the regression analysis, the predictor sustainable material handling had a significant and positive relationship with organizational performance of Mount Kenya dairies as $\beta_1= 0.699$, P=0.000 and t=5.793. This implied that an increase in sustainable material handling would result into increase in performance of Mount Kenya dairies by 0.772. This implied that a unit increase in material handling would lead to an increase on organizational performance of Mount Kenya dairies by 0.699. The findings were supported by Gitahi and Ogolla (2014) and Mohsen and Hassan (2014) that revealed that material handling has a positive effect on performance of distribution organizations.

5.1 Summary

The study assessed the effect of material handling on the performance of Mount Kenya Dairies. The correlation analysis showed that there was a strong, significant and positive correlation between material handling and performance. The overall regression analysis showed that material handling predicts performance positively. This means that as the firm acquires machines for handling goods, it is able to reduce cost. Machines also enable the organization to increase efficiency in handling; hence it contributes to the minimization of lead time. The model showed that material handling was the only significant factor; hence there is need for the organization to pay more attention to material handling.

6.1 Conclusion and Recommendations

Material handling, on the other hand, has a significant positive impact on the performance of distribution firms. First, when organizations embrace sustainable material handling, they are able to get rid of double handling. This saves the firms from incurring huge costs on labour that was not necessary in the first place. Secondly, the organizations acquire machines that are more productive than people. With the machines, they are able to save time and cost. Lifts, forks, cranes and other machines can handle numerous goods at a go, hence saving the firm from spending on the cost of using labour that would take even more time, hence affecting performance negatively. Distribution firms should, therefore, continue adopting technology that enables them in handling materials better so that they can improve their performance even further. Distribution firms should also continue the practice of acquiring huge trucks for transporting goods to the final consumers. These trucks may help them to transport huge quantities of goods per trip. Firms that distribute perishable products should consider acquiring trucks that are loaded with coolers. These may help in minimizing losses that the firms acquire from goods that spoil before reaching the end consumer.

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