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COLD CHAIN LOGISTICS AND THE PERFORMANCE OF FRESH PRODUCE FIRMS IN NAIROBI CITY COUNTY, KENYA

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ABSTRACT

The study sought to establish the influence of cold chain logistics on the performance of fresh produce firms in Nairobi City County, Kenya. Specifically, the study intended to determine the influence of cold transportation mode, cold material handling, cold storage and cold information management systems on the performance of fresh produce firms. The study adopted a descriptive research design and a census survey was done on 103 fresh produce firms. The unit of analysis for this study was the fresh produce firms in Nairobi County while the unit of observation was the heads of Supply Chain Management (SCM). A structured questionnaire was used to collect primary data from the respondents. Descriptive statistics were used to describe and summarize data with the help of SPSS. Further, Pearson Correlation was used to test the assumptions of the regression model and multiple regression was used to test the study hypothesized model. The study concludes that cold transportation mode has a positive and significant effect on the performance of fresh produce firms and cold material handling has a positive and significant effect on the performance of fresh produce firms. It also concluded that cold storage facility has a positive and significant effect on the performance of fresh produce firms and that information management system has a positive and significant effect on the performance of fresh produce firms. The study recommends that the management of the fresh produce firms should minimize paper work and maximize usage of information management systems to facilitate supply chain management and to increase their customer service and profitability levels. Also, Adoption of technology in managing information will help the firms improve their efficiency and improve product quality; this will help companies improve their performance.

Key Words: *Cold transportation mode, Cold material handling, Performance*

INTRODUCTION

The production and consumption of fresh produce have increased significantly in recent years to meet the ever-growing market demands (Xing & Chang, 2015). However, mechanical injury to

fruits and vegetables after harvesting can generate a series of detrimental physiological and biochemical changes, such as enzymatic browning, nutrient content deterioration and microbial contamination (Tao, Shi, & Wen, 2017). In particular, browning discoloration is a serious factor in reducing the quality of fresh produce in the supply chain (Supapvanich & Chollawit, 2020). Therefore, optimal logistics are needed to maintain the quality of fresh produce and to enable sufficient storage time (Supapvanich & Chollawit, 2020). While globalization has made the relative distance between regions of the world much smaller, the physical separation of these same regions is still a very important reality (Ashok, Brison & LeTallec, 2017). The greater the physical separation, the more likely freight can be damaged in one of the complex transport operations involved (Schbley, & Rosenau, 2017). Some fresh produce can be damaged by shocks while others can be damaged by undue temperature variations. For a range of goods labeled as perishables, particularly food (produces), their quality degrades with time since they maintain chemical reactions whose rate are mostly mitigated with lower temperatures.

According to Food and Agricultural Organization of United Nations (FAO, 2015), approximately 1.3 billion tons of food materials were lost or wasted globally in 2018 which was equivalent to one-third of production of that year. One of the most reasons for this extent of loss is due to the lack of proper temperature management during food transport (Aung et al., 2014). The loss of food during transportation can be significantly reduced if the temperature of the transported product is measured and supplied without delay (Jedermann et al., 2016; Tan & Zhang, 2016). White (2018) states that it takes time and coordination to efficiently move a shipment under required temperature, notably if the cargo is perishable. Therefore, this study proposes the use of cold chain logistics as a way of providing the right temperature to perishable cargo on transit (Tan & Zhang, 2016).

In Australia, cold chain logistics has been factored in environmental protection principles so as to reduce waste in the perishable goods industry (Holt & Ghobadian, 2018). This has helped in protecting the environment through reduction of waste and it start from receiving the goods to the final disposal of those goods (Holt & Ghobadian, 2018). It has resulted in minimal damage of the acquired goods on the environment and the appropriate technologies required achieving this goal like recycling techniques. It also considers the available infrastructure and facilities (Holt & Ghobadian, 2018).

According to Salin and Nayga (2015) multinational restaurant companies like McDonalds, KFC and Burger King have adopted cold chain logistics as a necessary means to ensure food safety and quality. According to The Global Cold Chain Logistics Report (2017), markets in Asia and Latin America have experienced an increase in demand for temperature controlled food and nonfood items. One main factor is the movement of manufacturers and retailers to emerging markets in Asia and Latin America, as well as the changing taste of consumers in more the mature markets. This has led to high levels of investments by logistics companies and their associate suppliers as they have acquired or partnered local players in order to access these markets and to open temperature controlled operations in these regions to serve the growth in prosperity of local populations (Yahia 2016).

Cold chain in sub- Saharan Africa is currently very poorly developed or inexistent, this is with the exception of some export-oriented chains targeting markets that are considered profit-able (FAO, 2017). The International Institute of Refrigeration (IIR, 2019b) estimates that in developed countries cold storage capacity in urban areas is about 200 litres per capita, while in developing countries it is about 19 litres per capita. This situation has been attributed to factors such as limited access to energy, shortage of qualified staff, poor logistics arrangements, weak organization and implementation of controls for compliance with standards, relatively low traded volumes and weak organizational arrangements for value chain activities (FAO, 2016).

A report by the Global Climate Change Alliance (2015) noted that the cold chain system in Kenya emerged in responsive to the needs and demands that are driving it, such drivers include Kenya being one of the largest exporters of cut flowers, accounting for 38% of imports into the, this report further stated that the key drivers of cold chains include; investment in strategic exports, growing local consumer demand that is influenced by growing purchasing power and middle class and the growth of multinational quick service restaurants (QSRs). For many years in Kenya, most fresh produce exporters maintained comparatively basic storage facilities that consisted of a warehouse with concrete floors and aluminum roofing and facilities to load and offload produce onto trucks (Sonesson, 2017).

Billiard (2015) noted that in Kenya, basic cold stores are used to hold fresh produce, which is then was packed each day before evening departure on charter or commercial airlines, while appreciating that a couple of firms had somewhat more sophisticated systems, he noted that the above account represents the norm in the industry up through the early 1990s. According to Rosenbusch (2015), the existing cold chains in Kenya are vertically integrated to meet specific business needs and do not have a wider economic impact, she also noted that there is a lack of awareness in the domestic market of the benefits of cold chain and therefore lack of widespread consumer demand for safe, quality food that is backed by government enforcement of food safety regulations.

The slow adoption of cold chain practices can be attributed to poor infrastructure as old roads, obsolete transportations and inefficient production points increase both the delivery and the manufacturing lead time (Shabani et al., 2015). Shortage of capital has been cited as a constraint to why most fresh produce firms in Kenya are not in a position to provide a modern cold chain. The cost of financing is expensive ranging from 13% to 18% annually, hence making it difficult to profit from the cold chain. This has created shortcuts in best practices and deviations from standard operating procedures leading to lower quality products (Private Equity & Venture Capital in SMEs in Developing Countries, 2016).

Demand arising from the Kenyan consumer for quality products is increasing, which has put pressure on key stakeholders to develop a modern cold chain. It has become a necessity in developing markets, investment in infrastructure and an increase in the quantity of products being produced should encourage higher standards. With a growing middle class in Kenya, greater attention on supply chains and productivity of products, as well as public investment in development of cold chains and logistics for fresh produce is required. The export market required that fresh produce firms meet general best practice standards for exporting such as

HACCP, Global Gap and BRC, these standards require that proper temperature monitoring and consistent quality of product is maintained. This implies that for the fresh produce firms to exist in the market, they will need to infrastructure and management of their cold chains (USAID, 2016).

Statement of the Problem

Kenya's Vision 2030 highlighted agriculture as one of the key sectors to deliver the 10% annual economic growth rate as envisaged under the economic pillar, fresh produce sub-sector was identified as being a leading contributor to the agricultural GDP. To achieve the growth of this sub-sector, the vison emphasized the need for transforming the industry from subsistence to an innovative, commercially oriented and modern agricultural sector (Global Cold Chain Alliance, 2015). Nevertheless, the fresh produce subsector has experienced a depression in the prices of commodities and low local production hence contribution to the GDP had been declining standing at 3.2% in 2016 and 3.5% in 2015 hence its contribution to the realization of the Vision 2030 and the government Big 4 agenda is in doubt (Research Solutions Africa, 2018). FAO (2015) approximates that over 60 % of fresh produce in Kenya perishes before it reaches a consumer. According to Jaco (2020), despite the fact that the fresh produce is a fast-growing sector in Kenya, bearing local and international market potential, the post-harvest losses of fresh produce are far higher than those of cereal crops and this can be attributed to storage conditions.

Gustavsson (2016) found out that a large share of the produce is lost between leaving the farm and arriving at the retailer, the post-harvest losses in supply chains vary from 13% in Europe to 38% in Sub-Saharan Africa. According to IIR (2015) up to 20% of all fresh foods may be lost due to lack of appropriate refrigeration infrastructure. The report further stated, that the failure of horticulture in the Kenyan economy was due to poor implementation strategy as the firms were not adequately sensitized, trained and properly involved on the use of modern facilities including cold chain logistics. Lütjen (2017) investigated the role of cold chain logistics on fresh farm produce in Kenya. The findings showed that for fresh products to maintain quality and reduce waste it is necessary to improve the cold chain infrastructure. It is therefore worth noting that cold chain logistics adoption is of high strategic economic value to the industry in supporting livelihoods and contributing to food security.

Kenya' Vision 2030 emphasized food security with the fresh produce industry expected to help realize this (FAO 2017). While Kenya's food deficit has decreased, it remains higher that the sub- Saharan averages (ASTGS 2019). According to Lutukai (2019) the most commonly used cooling solutions are out dated thus limiting obtaining certifications and resulting in high post-harvest losses that are on average of 30-60%. Therefore, the study targets to establish the significance of cold chain logistics on performance of fresh produce firms taking Nairobi City County as a representative sample.

Objectives of the Study

i. To determine the influence of cold transportation mode on performance of fresh produce firms.
ii. To examine the extent to which cold material handling affects the performance of fresh produce firms.

LITERATURE REVIEW

Theoretical Review

Resource-based Theory

Resource-based theory that a firm derives competencies, and consequently competitive advantage, and success by using its tangible and intangible resources to improve its performance (Chirchir, Ngeno, & Chepkwony, 2015) further categories these resources into: Physical resources (such as buildings, land); Human capital resources (such as training, experience, intelligence, relationships and workers); and Organizational capital resources. Organizations can thus be seen, according to RBV, be seen to derive competitive advantage out of certain capabilities, competencies, and efficiencies from adoption of cold chain logistics, technology, such as cold chain transportation, which can be viewed as part of physical resources (Seshadri, 2010).

The RBVT holds that theory a firm's outcome is based on the resources and capabilities it holds in control which may become a source of competitive advantage (Boermans & Roelfsema 2012). Hoffman (2012) observed that for many product types, refrigerated transportation is an absolute necessity and a source of advantage as many firm have not implemented it, he further noted that the benefits of refrigerated transportation are centered on safety, compliance and basic supply and demand. Shabani (2018) noted that refrigerated transportation allows products in need of temperature-controlled transportation to be moved from point A to point B more quickly and efficiently than alternative modes of transportation. Because of this, items in high-demand, such as fresh meat and seafood, rely on refrigerated transportation. According to Ashok (2017) businesses need to gain a competitive edge, and choosing the proper cold logistics system can be a huge advantage.

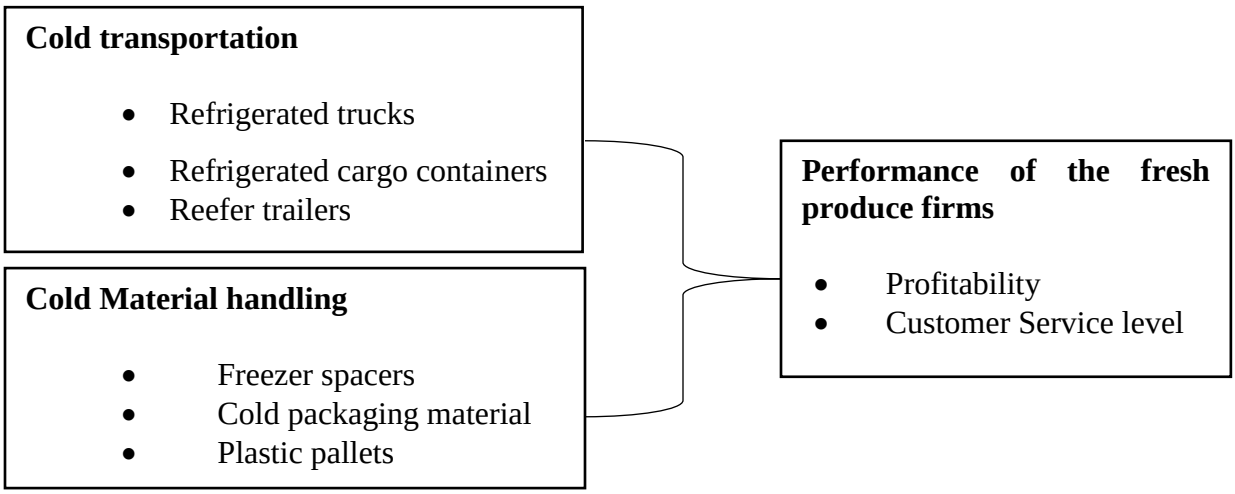
Systems Theory

Persson *et, al.* (2006) explores the historical background of application of systems theory in supply chain management and specifically in the context of logistics. They observed that that the neoclassical economic theories were dominant during period of 1950s-1970s where the focus was on "total cost" and "trade-offs". However, since the 1970s systems theory has developed to become the dominant theory for explaining efficiencies and the role of processes functioning of organizational supply chain.

Saen (2015) defined a system as is a collection of part unified to accomplish an overall goal and if one part of the system is removed, the nature of the system is changed as well, he further noted that a system has inputs such as raw materials, processes like planning, controlling and organizing. Movahedi (2010) noted that the systems theory can be used to simplify the relations among the components of a material handling systems, in order to gain better understanding and analysis of values generated. Systems theory, which views organizations as living organisms, acknowledges the complexity of these relationships. System theory challenges the static view of organizations and following an open system view, suggests that organizations at individual,

group and organizational level are affected by the time factors. The theory is therefore relevant in this study as it will help material managers to look at the firms more broadly and also enables them to interpret patterns and events in the workplace.

Conceptual Framework



Cold Transportation

According Yu and Yan (2015) Cold chain transportation is a unique kind of transportation that requires specific temperature to be maintained throughout the whole transportation process which includes loading or unloading and changing the mode of transportation. This could be road transport, water transport, rail transport, air transport, and can also be comprehensive of these above. The choice of carrier selection with satisfactory performance is key. These carriers need to have the ability to deliver on time with no delay. They should also be monitored by a third party firm to have a reliable report of products (Russo, 2011).

Cold Material Handling

Cold material handling as a part of material management that is concerned with the safety perishable materials in transit (Aromi, 2014). Tesha (2015) defined cold material handling as the art and science involving the moving, packaging and storing of perishable products. The aspects of cold material handling that this study will look at are freezer spacers, cold packaging material, plastic pallets and cold conditioned fork lifts (Tesha, 2015).

Laporte (2015) noted that material handling operation of perishable goods is challenging and opportunity for catastrophic product loss can occur easily hence this need to be handled with keenness. He further noted that temperature variations can compromise product quality if proper cold handling is not put in place.

Empirical Review

Cold Transportation and Performance

Shoki et al., (2016) conducted a study on cold transportation management; a review and research direction in Malaysia. The study used descriptive research design and the primary data was collected by use of self-administered questionnaires to all the respondents. The review focused on development of cold transportation in a developed and developing countries including all those researches which are relevant to cold chain transportation. It concluded that among other variables, cold transportation was the most important variable in implementation of cold chain logistics practices especially in developing countries such as Malaysia.

Gwynne (2015) conducted a study on the role of cold reefer trucks on supply chain performance in Chile, questionnaires were developed for the study. Analysis of data was done using both descriptive and inferential statistics and the target population was 27 firms. The study found out that large majority of the products have a better tolerance to temporary variations of transport temperatures. As a result, small errors can be compounded without the concern of irreversible damage. His study observed that the usage of refrigerated containers (reefers) has particularly helped, since they account for more than 50% of all the refrigerated cargo transported in the world.

Lütjen et al. (2017) conducted a study on effect of the use of a cold intelligent container in China. The study adopted questionnaire. The study used a sample of 60 respondents and utilized purposive sampling technique. The study analyzed the data using both descriptive and inferential statistics. The study concluded that cold containers provides necessary information about the product location and the quality conditions of its loaded goods to improve a firm's traceability, the study established that countries such as Chile have benefited from cold transportation and subsequently developed an active agricultural and food transformation industry that services the North American market during the winter.

Greis (2017) conducted a study on the response of fresh produce suppliers to use of cold transportation. The study used descriptive research design. The study used census method and 96 respondents were considered. The study employed the use of questionnaires as the principle data collection tool to collect views from the respondents. The collected data was analyzed using both qualitative and quantitative techniques. Qualitative data was analyzed using thematic data analysis there is significant influence between performance of the fresh produce firms and cold transportation and that low performance is a result of poor selection of appropriate cold transportation systems.

Tefera (2015) conducted a study to assess the cold transportation supply chain practice in Ethiopia's vegetable industry. A descriptive approach was employed to assess the cold transportation supply chain management. Census method was used to collect data from key respondents. Interview guides and observation check list was used to collect data for quantitative and qualitative analysis. The study found out that cold transportation was unsatisfactory and recommended the use cold transportation means to improve performance.

Cold Material Handling and Performance

Pauline, Wanyoike and Richu (2018) conducted a study on the assessment of the role of material handling on the performance of new Kenya Cooperative Creameries limited, Eldoret Kenya. A cross sectional survey design was used in the study. Primary data was collected using interview schedules and secondary data was generated from records, books, journals, published and unpublished research materials. Data was analysed using SPSS. The study findings indicated that it would be necessary to improve material handling management in the production process. This was motivated by the observed delay in forklifts service and their high maintenance cost. Forklifts were used both for parts handling and transportation and to assist in tooling changes, which many times resulted in excessive setup time leading to production delays. Changes were made in the materials handling process to address these concerns.

Chonhenchob and Singh (2016) conducted a study on the impact of cold material handling on performance agro- business firms in India. The study aimed at finding out influence of cold material handling practices of the performance of agro firms. The study adopted questionnaire and interview schedules. The study used a sample of 50 respondents. The study utilized purposive sampling technique. The study analysed the data using both descriptive and inferential statistics to analyses the data. The study found out that in line with cold material handling practices; businesses have shifted to handling more produce. The study concluded that proper cold material handling leads to better service delivery.

Saltveit, (2017) studied the effect of cold material handing on firm's performance of fresh produce sector in the US manufacturing sector. Questionnaires were developed for the study. Analysis of data was done using both descriptive and inferential statistics. Data was presented in form of frequency tables; averages were determined and tests of hypothesis like ANOVA and correlation analysis were done. The study concluded that material handling in the fresh produce cold chain plays a crucial role in the performance of the organizations.

Lisa (2016) conducted a study on cold material handling and avocado firms in South Africa. The study utilized agency theory and Kaizen theory. Data was collected by use of primary sources. The questionnaire for the study was semi structured containing open and closed ended questions. The study used descriptive research design and used purposive sampling technique in establishing the sample size. The study used descriptive statistics i.e. the mean and standard deviation in analysing the results. The study found out that cold material operational systems as operated by avocado processing firms are either centralized, decentralized and the hybrid. It is utilized as a tool of achieving benefits in the procurement process.

METHODOLOGY

The study adopted a descriptive research design. Kothari (2019) defined research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy procedure. In this study the unit of analysis was the 103 fresh produce firms in Nairobi County while the unit of observation was the heads of Supply Chain Management (SCM).The sampling frame of this study the entire list of 103 heads

of SCM in the registered fresh produce firms in Nairobi City County, Kenya (FPEAK, 2020). The study hence targeted 103 respondents.

The study used primary data that was gathered by use of structured questionnaires. The questionnaires were self-administered through email. The directors of the firms were contacted through a letter from the university requesting for permission to obtain information from their firms through emails due to Covid-19 pandemic. The email addresses were obtained from FPEAK directory and the Nairobi Business Directory and personalized email was sent to all the respondents requesting them to respond within seven working days. The purpose of the study was explained and consent to participate in the study was sought. Data was then coded and classified in terms of similarities then tabulated. Descriptive statistics such as percentages, means and standard deviations were used to analyze quantitative data. SPSS version 26 program was also used to analyze quantitative data and results presented in form of charts, graphs and frequency tables for easier interpretation.

FINDINGS AND DISCUSSIONS

Response rate

The study targeted 103 heads of supply chain management in the respective firms. From the 103 questionnaires distributed, 99 were completely filled and returned while 4 questionnaires were never returned hence a response rate of 96.1%. Kodhari (2016) indicated that a response rate of above 70% is considered suitable and excellent for data analysis and making inferences from the findings.

Descriptive Analysis of the Variables of the Study

Cold Transportation Mode and Firm performance

The statements regarding green recruitment and selection were established and summarized into mean and standard deviation as shown in Table 1. The results indicated that a majority of the respondents agreed that delivery by refrigerated cargo containers has helped in lengthening product life cycle with a mean of 3.655, the use of isothermal carriers has helped to maximize cold chain performance and had a mean of 3.655, implementation of the use of reefer trailers are included in cold transportation practices attracted a mean of 3.662.The respondents disagreed with the statement indicating that the firm has adequate refrigerated trucks to handle cold chain transport capacity with a mean of 2.069.

The results generally imply that majority of the respondents with overall mean score of 3.77 agreed with the statements and has started recognizing the role of cold transpotation mode on enhancing performance of the cold chain in fresh produce sector. However the answers were varied as shown by a standard deviation of 0.94.

The results were in agreement with those of by Chau & Chung, 2010) who states that cold transportation mode strategies are essential as they contribute to minimization of waste in the cold chain hence enhancing performance.

Table 1: Cold Transportation Mode and Firm Performance

Statement	Mean	Std. Dev
The firm has adequate refrigerated trucks to handle cold chain transport capacity.	2.069	0.222
Deliveries by refrigerated cargo containers has helped in lengthening product life cycle	3.855	0.316
The firm has formally implemented the use of reefer trailers	3.662	1.092
The use of isothermal carriers has helped to maximize cold chain performance	3.655	0.421

Cold Material Handling and Firm Performance

The Likert scale responses on cold material handling and firm performance were established and summarized in table 2. The results indicated that the firm has advanced cold conditioned fork lift with a mean of 3.793, the use of freezer spacers contribute to saving time and ensures product freshness had a mean of 3.655, the difference in packaging materials for different cold chain items had a mean of 3.621 and the use of plastic pallets prevents bacteria and fungi from contaminating the fresh produce in the cold chain had a mean of 3.620.The findings of the study are in agreement with literature review by Sangeeta (2012), who indicated that cold material handling involves use of specialized cold conditioned equipment aimed at eliminating wastes and improving productivity.

Table 2: Cold Material Handling and Firm Performance

Statement	Mean	Std. Dev
The use of freezer spacers contributes to saving time and ensures product freshness	3.655	0.470
There are different packaging materials for different cold chain items	3.621	0.293
The use of plastic pallets prevents bacteria and fungi from contaminating the fresh produce in the cold chain	3.620	0.424
The firm has advanced cold conditioned fork lifts	3.793	0.114

Inferential Analysis

Correlation Analysis

The study found that there was a positive and significant association between Cold Transportation Mode and Firm performance (r=.664, p=0.000). This implies that an increase in cold transportation results in an increase in the firm performance. The results further indicated that there is a positive and significant relationship between Cold Material Handling and Firm Performance (r=.664, p=0.000). This signify that an increase in Cold Material Handling and Firm Performance.

Regression Analysis

Table 5 Model Summary for cold Transportation and Firm Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.815[a]	.664	.653	.25966

Table 6 Analysis of Variance for cold Transportation and Firm Performance

Model	Sum of Squares	d.f	Mean Square	F	Sig.
Regression	4.129	1	4.129	192.047	.000[b]
Residual	2.090	97	.0215		
Total	**6.219**	**98**			

Table 7 Regression of Beta Coefficient and Significance for Cold Transportation and Firm performance

	Unstandardized Coefficients		Standardized Coefficients		
	β	Std. Error	Beta	t	Sig.
(Constant)	.155	0.518		.298	.769
Cold Transportation and firm handling	.941	.120	.815	7.826	.000

Table 8 Model summary for Cold Material Handling and Firms Performance

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.779[a]	.664	.607	.28072

Table 9 Analysis of Variance Cold Material Handling and Firms Performance

Model	Sum of Squares	d.f	Mean Square	F	Sig.
Regression	3.777	1	4.129	192.047	.000[b]
Residual	2.443	97	.0215		
Total	**6.219**	**98**			

Table 10 Regression of Beta Coefficient and Significance for Cold material handling and Firm performance

	Unstandardized Coefficients		Standardized Coefficients		
	β	Std. Error	Beta	t	Sig.
(Constant)	1.522	0.389		3.913	.000
Cold Material handling	.659	.095	.779	6.923	.000

Cold transport mode was regressed against firm performance and the results are presented on Table 5 to 7. Table 5 shows an R-Square (R2) of 0.664. The results established that 66.4 percent of performance of fresh produce firms is explained by cold transportation mode and the remaining 33.6% is explained by other factors not considered in the model. This implies that majority of the firms had started recognizing the role of cold transportation mode on enhancing performance of the cold chain in the fresh produce sector. The findings of this study are in agreement with literature review by Chau & Chung, 2010) who states that cold transportation mode strategies are essential as they contribute to minimization of waste in the cold chain hence enhancing performance.

The findings, as depicted in Table 6, imply that a unit improvement in cold transportation mode would lead to a 0.941 improvement in the performance of fresh produce firms. Further, the p-value (0.000) was less than the significance level (0.05) signifying a statistically significant improvement on performance.

The r-squared for the relationship between cold material handling and the performance of fresh produce firms was 0.607. This shows that cold transportation mode can explain 60.7% of the performance of fresh produce firms. This implies that 39.3% of the performance of fresh produce firms is accounted for by other factors not considered in the model. The adoption of cold material handling practices was hence found to be essential. In addition, it can be deduced that one of the most critical factor which affects a fresh produce firm is the increased customer service level that results from cold material handling. This infers that application of cold material handling has been effective thus affecting the profitability of firms in the fresh produce sector. The findings of the study are in agreement with literature review by Sangeeta (2012), who indicated that cold material handling involves use of specialized cold conditioned equipment aimed at eliminating wastes and improving productivity.

As shown in Table 9, the F-calculated (192.047) was greater than the F-critical (4.160) and the p-value (0.000) was less than the significance level (0.05), these imply that the model is a good fit

for the data and hence can be used to predict the influence of cold transportation mode and cold material handing on performance of fresh produce firms.

The findings, as depicted in Table 10, show that the performance of fresh produce firms has an in index of 1.522 when cold transportation mode is held constant. In addition, the Beta coefficient was 0.659 for the relationship between cold material handling and the performance of fresh produce firms. This shows that a unit improvement in cold material handling would lead to a 0.659 improvement in the performance of fresh produce firms.

Conclusion

The study concludes that cold transportation mode has a positive and significant effect on the performance of fresh produce firms. The study found that cold transportation influences firm performance to a great extent. This implies that improvement in cold transportation mode (refrigerated trucks, refrigerated cargo containers, reefer trailers and isothermal carriers) would facilitate the performance of fresh produce firms. In addition, the study concludes that cold material handling has a positive and significant effect on the performance of fresh produce firms. The study found that cold material handling influences firm performance to a great extent. This implies that improvement in cold material handling (freezer spacers, cold packaging material, plastic pallets and cold conditioned fork lifts) would facilitate the performance of fresh produce firms.

Recommendations of the Study

The study findings revealed that some fresh produce firms lack adequate refrigerated trucks to handle cold chain transport capacity. The study recommends that the cold transport systems for the fresh produce firms need to be improved and that the firms need to develop a cold chain fleet management policy so that the safety of fresh produce is guaranteed in having fully functional and enough vehicles for transport of cold chain items. Temperature validation should also be ensured by having special vehicles bought and fitted with the correct temperature controlling and monitoring gadgets for cold chain transport. This study therefore recommends that the top management of these firms should increase their budget allocation on the purchase of enough storage facilities to handle cold chain transport capacity.

In addition, the study found that cold material handling influence firm performance. This study therefore recommends that the top management of the fresh produce firms should procure additional cold material handling equipment. The study further recommends that storage freezers of varying temperature ranges need be purchased since all the fresh produce are not stored at the same temperatures. With regard to this, proper cold packaging materials are recommended during handling of temperature sensitive fresh produce. Additionally, cold conditioned fork lifts should be qualified by Kenya Bureau of Standards to ensure capacity to maintain the required temperature during the cold chain, these will help the companies to increase their customer service and profitability levels.

The study also revealed that cold storage facilities influence the performance of fresh produce firms. The study therefore recommends that cold storage facilities need to be closely monitored and continuous improvement implemented so that the safety of the fresh produce is guaranteed, this is because the research findings indicate that safety of the fresh produce is greatly compromised in the current situation. Validation of storage facilities also need to be done on a regular basis and storage temperatures checked (Bishara R.H, 2006). This study also recommends that the top management of these fresh produce firms should continue using of cold racks to maximize floor space and storage capacity. The companies should also invest more in building more cold storage facilities that are well equipped with cold racks to improve their products quality.

The study also found that cold information management systems influence the performance of fresh produce firms. There is therefore need to for the firms to set aside a substantial part of their resources for the implementation of cold information management systems as this improves traceability within the cold chain and subsequently have a major effect on the rest of the organizational process. The study also recommends the use of cold information management systems so as to minimize paper work within the supply chain as well as improve efficiency.

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