TECHNOLOGY CHANGE AND SUSTAINABLE SUPPLY CHAIN MANAGEMENT IN TEA PROCESSING FACTORIES IN NYERI SOUTH SUB COUNTY.

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ABSTRACT

Supply chain management effectiveness, efficiency as well as sustainability have weighty implications on every capability of an organization to meet demands of its customers, its general financial performance as well as its reputation. Supply chain performance refers to the extent to which a supply chain attains the requirements of the stakeholder as well as end-user regarding the appropriate indicators of performance at every point over time. This research sought to analyze the effects of technology change on sustainable supply chain management in Tea factories in Nyeri South Sub County. The study's target population was 120 management level employees drawn from three Tea factories. The study employed a census sampling method since all the targeted employees were contacted for collection of data. A self-administered and semi-structured questionnaire was given to the target population. Analysis of primary data was done by use of Statistical Package for Social Sciences (SPSS) software to produce mean, percentages as well as frequencies. A variety of variables aspects were presented by graphs, tables and pie charts. In order to enhance the validity as well as reliability of the instrument of data collection a pilot study was carried out. Cronbach alpha coefficient of 0.7 was utilized to test the data collection instrument reliability. Data that was analysed was obtained from 112 respondents out of the targeted 120 achieving 93.3% response rate. Bivariate linear regression as was utilized to study the relation between dependent and the independent variable. The results indicated that technology change had a positive and statistically significant effect on sustainable supply chain management in Tea factories processing factory. In addition, the findings of the study further indicated that technological change leads to reduction of cost of the systems maintenance and reductions of system delays. The study recommends that tea processing factory should consider focusing on technological change with a view to ensure that most of the transactions are done using the computerized systems. Future research could focus on challenges tea factories in Kenya face when they focus on technology change with a view to ensure sustainable supply chain management.

Key words: *Technology Change, Sustainable Supply Chain Management, Tea Factory*

INTRODUCTION

According to Wolf, (2014) institutions are under pressure by non-governmental institutions to function in a sustainable way. Pressures coming from stakeholders hold institutions answerable for its decisions as well as actions concerning its design of the product, production, distribution and sourcing (Parmigiani *et a*l., 2011; Wolf, 2014). Carter and Easton, (2011) reported that the benefits of a SSCM is to assist directors discover approaches for success as well as survival of an organization over durable periods of up to twenty years and more. It might be considered as a viewpoint of the supply chain process and also technologies which goes past cost, inventory as well as delivery. According to Carter and Rogers, (2008), that sustainability not only addresses stakeholder pressures, but also reduces lasting risks linked to pollution and waste management, liabilities of the product and changes of energy prices.

According to Carter and Rogers (2008) and Styger, (2010) sustainability may be only attained when aspects of economic, environmental as well as social go together to attain lasting economic benefits as well as performance. According to Van der Vorst, Beulens and Van Beek, (2000) supply chain management is described as an integrated planning combination, the control as well as coordination of every activities and processes down the supply chain to give a service that is value added whilst decreasing the total expenditure of every stakeholder within the supply chain. Supply chain management is as well defined by Håkansson and Persson, (2004) as a series of processes of business and activities which divide as well as transfer information, cash as well as physical materials across the supply chain. Harland, (1996) noted that supply chain management is essentially a process-oriented management technique where the aim is usually on production sourcing as well as services and goods delivery to the end consumer.

According to Miller, (2008) sustainable supply chain management is at the present said to be the "best way" to enhance effectiveness within supply chain. Therefore, the aim of this research is to look at the Kenyan tea sector with a specific focus at Tea Factories in Nyeri south sub county, where many farmers are small scale farmers, having an objective of tackling the sector in an extra sustainable way. According to Lummus, (1999) supply chain management has increasingly become critical because of less organizations being integrated vertically, the improved understanding of the impact that a single organization has on the whole supply chain, larger emphasis on flexibility, the want to produce novel products extra quickly and raised competition. Altekar, 2005 and Chin *et al*., 2004 noted that the approach of supply chain management (SCM) is increasingly renowned by numerous institutions as an approach to accomplish their today's business goals objectives. Cai, Xiao, and Liu, (2009 reported that improving performance of supply chain is a vital strategy for attaining companies' competitive advantages.

The actual supply chain of a KTDA factory begins with the farmer who is the supplier of green leaves. The green leaf leaves the farm and it is transported by the farmer to a tea collection centre where weighing is done using an Electronic Weighing Solution (EWS). The green leaf is then transported to the factory using tea collection trucks. At the factory the green leaf is received and the weight is confirmed before processing begins. Once the processing is completed, the processed tea is packaged and transported to a Mombasa warehouse where auction is done and the tea ends up either with a local or international buyer. The KTDA factories obtain inputs such as fertilizers and machinery from India; spares are obtained from both international and local manufacturers and energy is mainly from KPLC (Ngatia & Chirchir, 2013).

Problem Statement

Supply chain management effectiveness, efficiency as well as sustainability have weighty implications on every capability of an organization to meet demands of its customers, its general financial achievement as well as its reputation (Waters & Rinsler, 2014; Ambe, 2009). According to Feldman (2003) inefficiency of supply chain management represents the only principal opportunity for inefficiencies in operations within every institution. A study conducted by Transparency International, (2014) noted that the view of several people is that supply chain management in the institution is way less than the expectations of the stake holders. Whereas it is clear that supply chain management execution has an influence on the outcome of tea supply in Kenya and globally, the question still remains as to which specific factors have an effect on the performance and sustainability of the supply chain management that have the greatest effect. This research thus sought to investigate the factors affecting sustainable supply chain management in tea processing factories in Kenya. To address this question, the study specifically focused on factors affecting the sustainable supply chain management in Kenyan tea processing industries.

Theoretical Review

Theory of Supply Chain Management was used in this study: The theory supply chain management chief success relies on the activities incorporation of the supply chain, detonating collaboration, sharing of information as well as organization all through the whole supply chain. Within tea factories the supply is regarded as a procedure where there is a relationship between farmers, factory employees, information flow and capital throughout the supply chain.

Theory of Constraints: The Theory of constraints (TOC) is pioneered by Eliyahu Goldratt. It identifies that organizations' resources are limited. It can be used to find the root of variables limiting the organization's performance. This theory states that each system, regardless of how well it performs, it has in any case one constraint which confines its performance and this is the weakest link of the system (Manktelow, 2015). Companies must therefore identify these limitations and eliminate them to attain smooth operations. Companies can use this theory to apply into their operations. They can identify the aspects that need change, what to change into and how the changes can be implemented. According to the theory the study sought to focus on technology change and its effect on sustainable Supply Chain Management.

Empirical Review

It has been noted that twenty years ago, supply chain management was viewed as something which happened secretly with no dedication of resources as well as employees (Mishra, 2014). According to Mangan & Lalwani, (2016), technology was considered as a need for simply the biggest companies or brands with global distribution. An interruption to the supply chain would lead to a fix and an organization could draw a few of employees from what they were previously doing and place them to address that problem. Just after the twists were sorted out then those employees would return to the irregular work. During those time customers were less aware, definitely more patient as well as less demanding, as they were not conversant in doing orders online with the capability to track their shipments to an opportune as well as anticipated date of delivery. It was reported that even things which were custom-made, starting when a particular order arrived through the Postal Service in U.S, were handled with a perceptive that delivery as well as completion could be erratic (Mishra, 2014).

According to Thapa, (2014) in his book, adoption of new technology in supply chain management, the author reported that supply chain management has been in existence for as a minimum as long as the line of assembly, although until lately, the principal supply officer concept has been unfamiliar. At the present that task is viewed as an extremely strategic concept which is gradually more important from both a business viewpoint as well as a consumer service. Since the task has advanced with time it has turn into a vital one, as management of a supply chain is loaded with risk, its complex, cause to undergo

complex fines, regulations, global shipping restrictions, competition, and others. Since the email, internet plus additional technologies have grown to be omnipresent the consumers' expectations have correspondingly gone up (Xiang, *et al.,* 2015). The organizations of today are gradually more complex as well as global, with competition rising on each acquisitions and front which shift processes of business happening with amazing occurrence. Simultaneously, responsibilities as well as roles in organizations have stretched and turn into more precise. Mishra, (2014), in his book, Role of Information Technology in supply chain management highlighted that the skills of novel technologies have turn into more precise, and organizations are greatly less probable to desire to draw employees from significant work to center their concentration on problems of supply chain.

Supply chain has turn into progressively more complex, having a high number of components and ingredients bringing about a refined product, and with a more as well as broader extensive suppliers base. It is obvious that observing the goods path by use of tax on a map no longer does the work it's supposed to do (Black, 2017). Technology has sneaked into supply chain management gradually, starting with invoicing electronically, computerized shipping as well as tracking, and automated notifications which were highly developed by organizations such as UPS and FedEx. Originally planned for interactions of business-to-business, it took sometime before that tracking as well as accountability level was offered to customers. However, even during those early times it was obvious that the capability to inform everybody alongside the supply chain was significant (Thapa, (2014).

This was not until organizations that were consumer-focused such as Zappos, the online merchant having the tagline "Powered by Service," came upon the prospect that customers acquired a taste of how engaged they would be with their acquisitions. Online populace such as Zappos, did not begin with stores that are brick-and-mortar, thus instead of adjusting to novel technology, the populace were born into its arms (Asmuni, (2015). Customers adore such businesses since they can immediately see that the orders they placed have been received by relevant body, they are informed when their orders are to be shipped, as well as they can track the purchase they made each step along the way. Prior to ordering, the customers can study products' wide reviews they are planning to buy, and the organization they are planning to buy from. With such systems in place a novel standard for online consumer service has been set; organizations which can surpass or meet the set standard have competitive advantage that is distinct. According to Chaudhuri, (2015) organizations such as Harley Davidson and Apple utilize that advantage to personalize further the experience of purchase by taking routine orders, afterward creating a product to the precise specifications of the customers. Such kind of accountability as well as tracking may be useful to almost all links within the supply chain to offer a moment by moment picture of how supplies/goods move around the world. Such is the objective of a manager of a supply chain, to identify where a given inventory is as well as to expect any hitches and delays before they have an effect on the ultimate line of assembly (Mishra, 2014). Furthermore, at the same time as technology has offered the business setting with several more abilities; it has played a role in supply chain management novel recognition like a discipline as well as a profession. Nowadays, managers of supply chain who are knowledgeable must be given respect and equally high wages Alexander, (2016).

Current managers of supply chain appreciate that technology offers improved accountability as well as visibility; consequently, a strong competitive edge and tight supply chain control is worth being investing in it (Ross, 2016). Chief to such kind of efficiency is the capability to inform everybody alongside the supply chain at the time when things are not happening exactly as intended. The technology of notification has adapted alongside with supply chain management to give a simple way of sending single message at once to many, by a broad range of devices. Therefore workers at desks will receive an email and a call, and somebody out within a plant will receive a text message sent to their smart phone. Teams within an organization are permitted to adapt as well as change to suit the circumstances when the relevant information is shared immediately aiding to keep lines of manufacturing on track as well as on time (Mishra, 2014). For instance, a company manufacturing condiments which are packaged in glass jars got a shipment of bottles which looked fine, although revealed a flaw that was visible after being filled with the product. The product was packaged, followed by labeling and shipped to merchants prior to the flaw being discovered, and therefore whole lot produced had to be recalled from the market. Having technology of notification in place, the complex duty of issuing a recall was finished within minutes. The manufacturer is able to notify everybody alongside the supply chain by sending one automated alert message. Even if the goods had been shipped

to a thousand or a dozen clientele, ingredients tracking as well as notifying clientele would still take only few minutes.

Unluckily, although the technologies as well as the profession of SCM are growing, a lot of organizations are still ingrained in monolithic, outdated systems, using fax, email and phone to converse all through their supply chains which are complicated and lengthy (Mishra, 2014). Although even these organizations experience the pressures of keeping the costs down as well as competition pushing them towards better and more technology as well as processes which are automated that give a way to inform everybody alongside the supply chain. The fact that notification technology has impacted the scene of supply chain management is clear by the rising trend towards management of inventory that is just-in-time. Just-in-time is an immense way to ease up money and raise working money by letting inventory dilapidated (Gao, 2017). By doing so many millions of dollars can be free up, not only held within the goods themselves, but in security, storage as well as goods management. This as well decreases the risk of inventory turning into outdated whilst in storage space.

Just-in-time as well has some risks, a number of these risks have been plainly demonstrated by the subsequent tsunami as well as earthquake within Japan, which have left international manufacturers jumbling for substitute materials and parts which were affected by the two disasters (Mishra, 2014). By the moment those disasters happened, alerts started immediately. Managers of supply chain speedily utilized notification technology to reach everybody alongside the supply chain; both customers and suppliers, to evaluate the state and preserve the materials they knew could shortly be in small supply. In turn, suppliers would react easily to such alerts, and those reactions were logged, thus making it simple for managers of supply chain to track materials and accordingly adapt. Regardless of the risks, just-in-time manufacturing has turned into so ingrained that lots of organizations just cannot afford to stock as well as store as much stock as they used to sometimes back. Therefore, if the supply chain is affected, downtime within the plant happens or orders are affected. Just-in-time that is successful depends on a supply chain that is tightly managed, with the capability to quickly alert the suppliers during the case of a raised want for goods or materials. Such tight management is just achievable when the technology of supply chain management is integrated tightly with notification abilities (Radjou & Prabhu, 2015).

The process of manufacturing is complex, and interruptions of supply chain may cause levels of inventory to fall abruptly. There have got to be a clear communication from start to end of the supply chain in order to sustain a steady flow of components, finished goods as well as ingredients. These necessitate a solution which is extra sophisticated as well as efficient than drawing employees to make panic phone calls or sending a mass email (Mishra, 2014). At the time when the tsunami and earthquake occurred earlier that year, lots of executives globally had emergency conventions to evaluate how the

tragedy could impact their organizations and establish what they would do to reduce that effect. The executives who had a system of notification in place were capable to do very quickly, informing every top manager immediately through phone, SMS, email and others, and linking these makers of the decision by use of a conference call bridge which everybody would link by touching their keypad. Such assisted them to share relevant information, make imperative decisions as well as manage efforts of response. Those tragedies reminded everyone that, regarding continuity of business, it is vital to do planning for the most horrible situations. This as well revealed the fact that old ways as well as old systems of executing things just do not work in such type of severe circumstances. When such kind of disruption occurs, customers begin yelling for information as well as solutions; their prospects are higher as compared to past time. It is vital to get ahead of customer response speedily, since call centers will speedily be busy with calls to get information. Having a plan in place makes it possible to utilize a bad state to make trust as well as goodwill with clientele (Mishra, 2014).

The Japans situation reminded many people that there is a possibility of bad things happening and that an incident may have a vast effect, even on companies/individuals which are extremely ready. Sorrowfully, lost of organizations stop right there, comprehending that they do not have any plan, as well as paralyzed regarding where to go next from where they are. The survivors from such situations over the long-standing are those individuals/companies who have put in mind the what-ifs plus have put firm measures in place for managing any disruption. Intelligent organizations will begin the supply chain management technology use as well as a notification resolution. Any organization which does not utilize technology as part of supply chain management is at a discrete disadvantage, despite how good their plans of business continuity are (Mishra, 2014).

In line with experts of supply chain, four chief areas exist where technology of supply chain management with notification will assist. These areas are reverse logistics, management of supply relationship, execution of supply chain and global trade (Mangan & Lalwani, (2016). On other related areas, global trade is burdened with regulations that are changing constantly. A company that is well respected received lately an extremely heavy fine for involuntarily avoiding regulations as well as doing the shipment of night-vision goggles which ultimately got in the terrorists hands (Thapa, (2014). According to Tate, (2013), notification that is automated, as a component of supply chain management technology, would have kept everybody alongside the supply chain aware of the newest updates and aided to shun such a circumstance. Management of supply relationship in the year 2007, Mattel was forced to recall more than ten million toys since lead paint was detected in them (Tate, 2013). In order to stop the tainted toys spread, the organization was forced to work backwards alongside the supply chain to detect the origin of lead, and as well forward to where the toys were shipped in order to execute a recall. Having notification as an element of supply chain management toolkit, a lot of this

communication would be automated, therefore making the process fast as well as offering a dependable audit track.

The term reverse logistics refers to the process of recycling of batteries plus extra components, managing the goods returns, products disposal coming off lease, as well as the auctioning of those products et cetera. When an abrupt arrival of new goods happens, processors must quickly offload outdated commodities. A notification may assist alert a range of recyclers plus additional parties immediately, permitting them to react with times they are accessible to eliminate redistributed commodities (Mishra, (2014). Execution of supply chain is where one big discount seller utilizes notification technology to make the cycle of delivery extra resourceful. At the time a delivery reaches its destination, employees have previously been informed to be standing by to immediately receive it. If employees are not available, it is simple to alert truck to do delivery to an alternative store and to redirect employees, thus saving both money as well as time (Thapa, (2014). While global competition as well as business complexity increases plus loyalty of consumer turns out to be extra weak, increasingly organizations are exploring technology of supply chain management to achieve operational effectiveness (Mishra, 2014). Technology utilization matched with a dependable notification resolution, such can set up a basis for reliable leadership as well as secure a positive competitive edge.

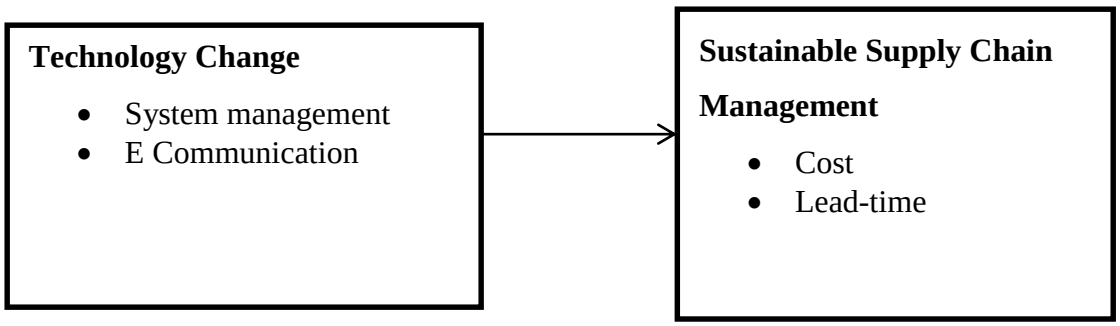

Figure 1.1: Operational framework

RESEARCH FINDINGS

Response Rate

The study targeted 120 respondents who are the management level employees of Tea factories in Nyeri South Sub County. Out of the 120 questionnaires that were issued 112 were dully filled and returned to the investigator for their analysis. This gave a response rate of 93.3%. This response rate was considered adequate as recommended by Mugenda and Mugenda, (2003) who stipulated that a rate of response of 70% and above is excellent.

Working Experience

The study sought to determine working experience of the respondents under the study. From the findings in Figure 4.2 below, it presents that most of the respondents (68.7%) had a working experience of more than 4 years. It's important noting that a respondents' minority (30.3%) had a working experience of less than 3 years. This is an indication that the majority of the respondent could clearly identify the factors affecting sustainable supply chain management in Nyeri South Sub County tea factories.

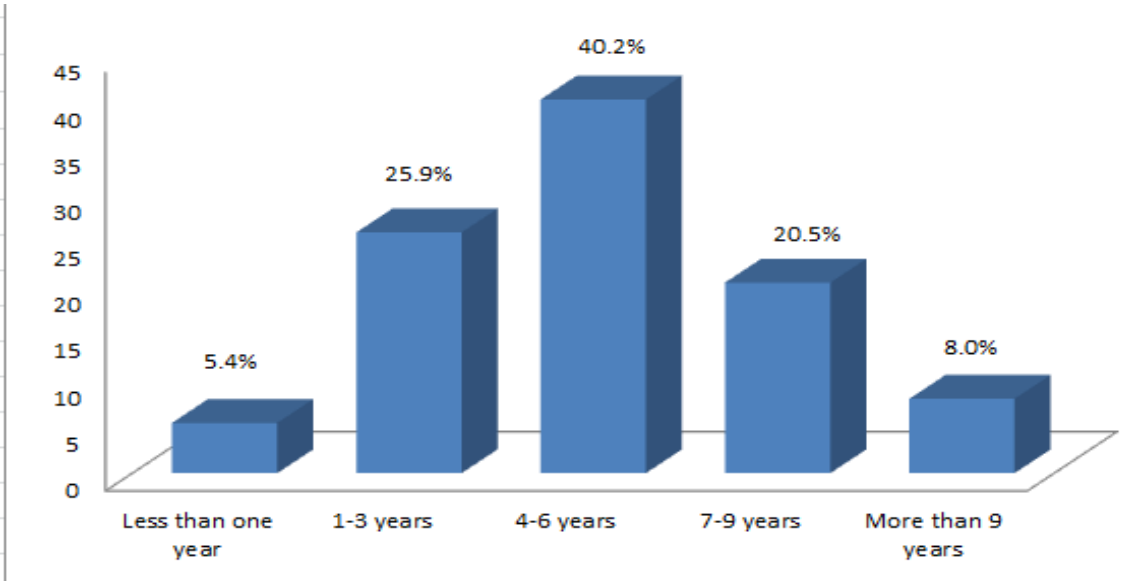

Figure 1.2: Working Experience of the Respondents

Use Technological Systems in the Factory

The study sought to establish how often factory do use technological systems. As shown in figure 4.4, majority of the respondents (81.3%) said that they always use technology, 10.7% said that they sometimes use technology while 8.0% said that they rarely use technology. The indication is that most of the management level employees working in tea factories in Nyeri South Sub County use technology in their day to day activities.

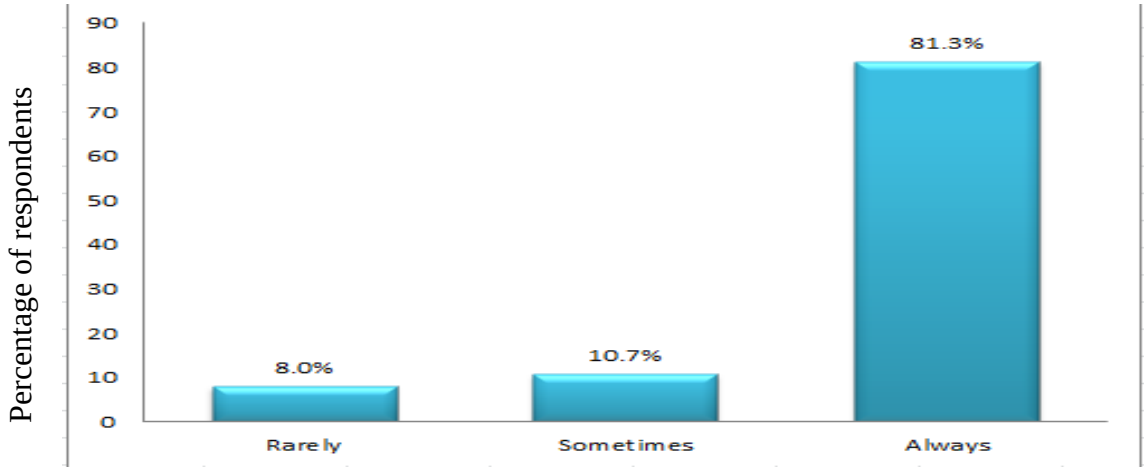

Figure 1.3: Use technological systems in the factory

Frequency of Staff Training on the Use of Technology

This research sought to determine how often the staffs are trained on the use of technology. Figure 4.5 showed that most of the staff indicated that they are trained annually, 8.0% indicated monthly while 3.6% indicated training is done weekly. This could be attributed to the skills required and the target group within the factory.

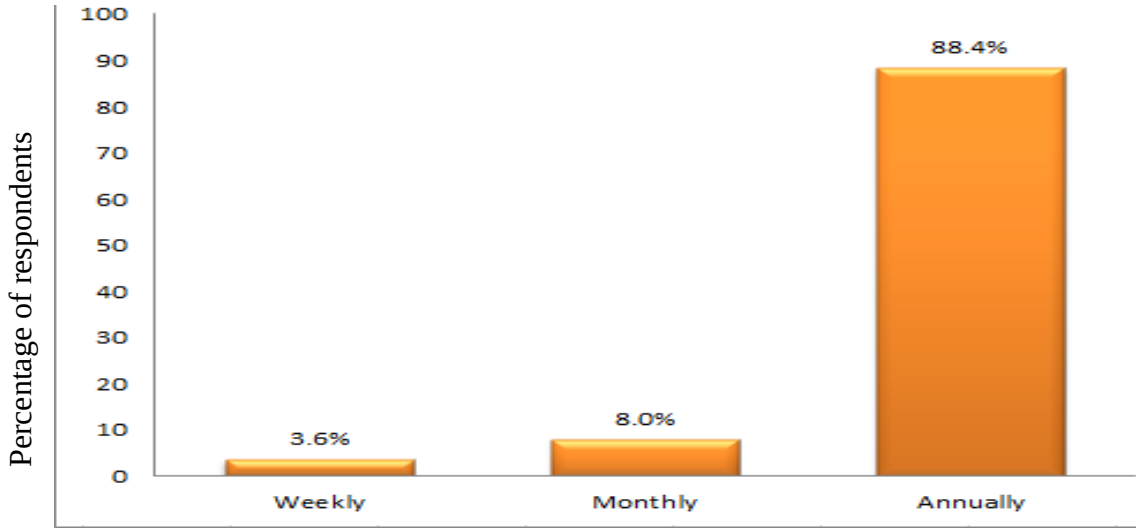

Figure 1.4: Frequency of staff training on the use of technology

Descriptive Analysis for Technology Change

The objective of the study sought to examine the effects of technology change on sustainable supply chain management in Tea factories in Nyeri South Sub County. Descriptive statistic was done to establish the effect of technology change on sustainable supply chain management in Tea factories in Nyeri South Sub County processing factory. The result of the descriptive statistic was indicated in Table 1.1.

Table 1.1: Descriptive Statistics of Technology change

Technology change	SD %	D %	N %	A %	SA %	Mean	Std. Dev
There is no system delays	0.0	12.5	33.0	25.9	28.6	3.71	1.02
There is reduced cost of systems maintenance.	0.0	0.0	25.0	47.3	27.7	4.03	.73
There is impact of technology on SSCM	4.5	0.0	13.4	21.4	60.7	4.34	1.02
There is use of online services	25.9	3.	3.6	31.2	35.7	3.47	1.62

As shown in Table 1.1, the impact of technology on SSCM was rated highest with a mean score of 4.339 (SD=1.02) followed by the reduced cost of systems maintenance with a mean score of 4.03 (SD=0.73). The study also revealed a number of respondents indicated that there is no system delays with a mean score of 3.71 (SD= 1.02) while the use of online services had a mean score of 3.47 (SD= 1.62). From the research findings, it was revealed that technology plays a major role on sustainable supply chain management in Tea factories and has led to reduced cost of systems maintenance. According to Thapa, (2014) in his book, adoption of new technology in supply chain management, technology was found to be among the factors which enhance sustainable supply chain management. This was in line with Xiang, *et al.*, (2015), who noted that since the email, internet as well as additional technologies have become omnipresent, the consumers' expectations have grown-up equally. Mishra, (2014), opined that the responsibilities as well as roles in organizations have stretched out and become extra precise hence the need to embrace new technology. In his book, Mishra stated that the skills of novel technologies have grown to be more precise, and organizations are much less probable to desire to draw employees from vital jobs to aim their concentration on problems of supply chain.

Influence of Technology Change on Sustainable Supply Chain Management

The bivariate linear regression analysis was carried out establish the association between sustainable supply chain management and change of technology. The findings as shown in Table 1.2 revealed that R and R^2 values for the regression model were 0.712 and 0.506 respectively. The R value of 0.712 portrayed a positive linear association between the sustainable supply chain management and technology change in Nyeri South Tea Factories. The R^2 value of 0.506 implied that 50.6% of the variation in sustainable supply chain management in tea factories in Nyeri South is explained by technology change. The model was significant with the F ratio = 112.880 at p value 0.000 < 0.05. The indication is that technology change had significant effect on sustainable supply chain management in Nyeri South tea factories. The coefficients results to the model $Y= 0.792+ 0.726X_1$ indicates that technology change is statistically significant at the 0.05 significance level as shown on Table 1.4. This was because the p value of 0.000 was less than 0.05. The constant term implied that at zero consideration of technology change, sustainable supply chain management in Nyeri South Tea Factories would be at 0.792, increasing the technology change would increase the sustainable supply chain management by 0.726

Table 1.4: Coefficients for Technology Change

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.792	.265		2.991	.003

Technology Change	.726	.068	.712	10.625	.000

R= 0.712, R^2= 0.506, Adjusted R^2= 0.502, Std Error = 0.265, F =112.880 and Sig =0.000

a. Dependent Variable: Sustainable Supply Chain Management

DISCUSSION

The study explored the relationship between technology change and sustainable supply chain management. Descriptive results revealed that most of the respondents reported that there is impact of technology on SSCM and reduced cost of systems maintenance after technology change. In addition, system delays reduced hence ensuring smooth running of the day-to-day operations. The study further revealed that technological systems are always used in the factory and the staff training is normally conducted annually. The bivariate regression results that technology change had significant effect on sustainable supply chain management in Nyeri South Sub County Tea Factories support earlier finding by Thapa, (2014), who found out that technology has crawled into supply chain management gradually, starting with invoicing electronically, shipping that is computerized as well as tracking and automated notifications which were highly developed by companies such as UPS and FedEx. According to Ross, (2016), current managers of supply chain appreciate that technology offers improved accountability as well as visibility; consequently, a stronger competitive edge as well as tight control of the supply chain is worth investing in it. According to Tate, (2013), notification that is automated, as an element of supply chain management technology, would have kept everybody alongside the supply chain assessed.

CONCLUSION

This study concludes that technology change is a one of the main factors that affects sustainable supply chain management in Nyeri South Sub County Tea Factories. In addition, use of technology has a major impact on sustainable supply chain management and change of technology lead to reduced cost of systems maintenance and reduces the frequency of system delays. Nyeri South Sub County Tea factories were networked and they and respondents were found to make use of online services.

Tea processing factory should consider focusing on technological change with a view to ensure that most of the transactions are done using the computerized systems.

RECOMMENDATIONS

The finding revealed that technology change had positive and significant effect on sustainable supply chain management among Nyeri South Sub County Tea Factories. Following this finding, this study recommends that Tea processing factory should consider focusing on technological change with a view to ensure that most of the transactions are done using the computerized systems. In addition, Tea processing factory should focus on implementation of just in time manufacturing system that will

effectively enhance sustainable supply chain management in Nyeri South Tea Factories and across the country as a whole.

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