Supply Chain Disruption in the Kenya Floriculture Industry: A Case Study of Equator Flowers

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Abstract

The floriculture industry is one of the most crucial sectors in Kenya's economy. It contributes a significant percentage of the Gross National Product (GNP) and employs tens of thousands of workers. The industry has, however, faced a decline over the last five years. This empirical research had the overall objective of investigating the factors contributing to supply chain disruption in the industry and used Equator Flowers Limited in Eldoret, Kenya as a case study. The research applied descriptive survey research design and employed random sampling technique. The data collection was done with the aid of structured and semi-structured questionnaires containing relevant questions on the supply disruption phenomenon. The study found that the most significant amongst the factors contributing to supply chain disruption in the floriculture industry in Kenya are natural disasters, logistics process design, labor union actions and finally production function mechanics. To address supply chain disruptions, the study recommends: implementation of comprehensive business continuity plans to mitigate against the supply chain effects of natural disasters, development of logistical process redundancies, formulation of creative policies to contain labor unions agitations and investment in research to develop resilient and scalable production function mechanics.

Key Words: Supply Chain, Supply Chain Disruption, production function mechanics,   Supply Chain Resilience.

1. Introduction

Modern supply chains are dynamic and interconnected networks that are gradually lengthening and globe-spanning (Christopher & Peck, 2008). The expansion and the internationalization of the supply chains translate them from the simply linear structures into an endless and complex system susceptible to disruption. According to Hendricks and Singhal (2011), disruptions in the supply chain at global level devastate corporate performance. Kenya has faced supply chain disruptions since the year 2007 (Omondi, 2011). The history of the export of fresh floricultural produce from Kenya dates back to the period before independence when Kenya, then a British colony, was required to contribute to the running of the budget for East Africa. Kenya's horticultural sector currently ranks as one of the economy's top industries, the third largest foreign exchange earner after tourism and tea (World Bank, 2010).

Equator Flowers Limited is a flower farm situated 150 Kilometres from Nairobi. It is situated some 14 kilometers from Eldoret town in Western Kenya. It is one of the leading producers of high quality roses and calla lilies. The firm is Fairtrade Certified and is interconnected with the local community through Corporate Social Responsibility (CSR) projects and the employment opportunities it offers. The farm has 360 workers and exports the bulk of its floricultural produce to European markets. The company was started in 1996 and produces four varieties of cut-flowers: *Marie Royale, Vanilla Sky, Dekora* and *Velentino*. Eighty percent (80%) of its produce is sold in the Holland auction whereas 20% are exported directly Germany, Sweden, Italy, United Kingdom, Dubai, Japan, Russia and Australia. The farm is situated on 100 hectares of land and by the Kenya Flower Council industry standards this is a large farm. The supply chains of Equator flowers Limited are global and hence susceptible to international supply chain susceptibilities.

2. Statement of the Problem

Despite its lucrative position in the Kenyan economy, the performance of the floriculture sector has been on the decline since the year 2007. According to the World Bank (2010), floriculture accounted for 51.8 per cent of the shilling value of exports in 2009 making it the most important foreign exchange earner after tea. The country's foreign exchange from horticulture, 94 per cent of which constitutes floriculture, dropped by 2.8 per cent from Sh73.7 billion in 2008 to Sh71.6 billion in 2009 and in 2010, the sector contracted for a fourth consecutive year (World Bank, 2010). The supply chains in the floriculture sector display inadequate capability to consistently match supply with demand over the long term notwithstanding the prevailing productivity momentum (Lim, 2009).

The Kenya floricultural supply chains have been unable to display consistency and stability in performance (World Bank, 2010). The supply chains have frequently experienced costly discontinuities in the current dynamic markets and vastly-changing technological environments. According to Mckinnon *et al*. (2007) the floriculture supply chains are inflexible and susceptible to disruption since they unable to swiftly and suitably respond to emerging international protocols, certification requirements, and to governmental and regulatory changes. All these signs are symptomatic of supply chains typified by disruption (Toigo, 2006). When the floriculture supply chains are disrupted, the economic fundamentals are affected since horticulture is one of Kenya's chief exports (World Bank, 2010). Therefore, a study to investigate the causes of supply chain disruption in the industry was critical in the quest to identify, manage and reverse the negative growth experienced.

3. Objectives of the Study

The study had the overall objective of investigating the factors contributing to supply chain disruption in the floriculture industry in Kenya. It had the following specific objectives: investigate whether logistics process design contributes to supply chain disruption, find out whether natural disasters contribute to supply chain disruption, establish whether labor union actions contribute to supply chain disruption and determine whether production function mechanics contribute to supply chain disruption in Equator Flowers Limited.

4. Literature Review

According to Mckinnon *et al* (2010), logistics is a key function in the supply chain as it acts as a physical link between customers and suppliers, the firm and its markets; and it enables the flow of materials and resources. A poorly designed logistics chain is unable to accommodate uncertainties and is bound to cause supply chain disruption (Mckinnon *et al*, 2010). Natural disasters cause devastating disruptions of floricultural supply chains (Craighead, 2011). The eruption of Iceland's volcano in 2010 affected Kenya's floricultural supply chains causing losses in millions of dollars. Labor union actions such as strikes disrupt the supply chains since they cause supply-demand disharmonies within the floriculture supply chains (Mckinnon *et al*, 2010). According to Jessop and Morrison (2004), production function mechanics such as inventory, process issues, lead-time variability, and flexibility and up-times affect the robustness or not of the supply chain and can cause potentially disruptive situations. Supply chain disruption can be caused by production function mechanics such as industrial process inflexibility, product defects, and equipment breakdowns (Snyder, 2007).

A supply chain is a sequence of processes and flows that take place within and between different stages and combine to fill a customer need for a product (Chopra and Meindl 2008). According to Chopra and Meindl (2008), there are two different ways to view the processes performed by a supply chain: cyclic model and push/ pull model. The cyclic model has five stages with each cycle interfacing between two successive stages of the supply chain: customer order cycle, replenishment cycle, manufacturing cycle and procurement cycle. The push/ pull model divides the supply chain into two categories depending on the timing of their execution relative to customer demand. With the pull model, execution is initiated in response to a customer order whereas in the push model execution is initiated in anticipation of customer orders (Chopra and Meindl (2008). These models are important in considering strategic decisions relating to supply chain management.

Saxena and Sircar (2009) broadly classified the supply chain management (SCM) framework components into three parts: upstream, internal and downstream. The upstream supply chain is mainly concerned with procurement of raw

materials, internal supply chain concerned with transforming inputs into outputs and the downstream supply chain concerned with delivery processes of the finished products to the final consumer (Bailey *et al.*, 2005).

In the face of continuing globalization and complexity of the international business environment it is vital that supply chain managers gain a lot more clarity on the factors causing supply chain disruption. Supply chain disruption has caused the decline of many business enterprises, including the floriculture industry, and affected many livelihoods across the globe. In this regard, supply chain managers need to gain deep practical understanding on the dynamics of the root causes of such disruptions so as to be better placed to craft preventive and remediation strategies. Shah, (2009) indicates that supply chain uncertainty and disruption have not received enough attention in the contemporary supply chain literature. This research sought to bridge the knowledge gap with regard to the causes of supply chain disruption in the floriculture industry.

5. Research Methodology

This study adopted the descriptive case study research design. The target population to which the research results were generalized consisted of the 234 flower farms in the country (Kariuki, 2010). The study population constituted of Equator Flowers Limited. The flower farm has a total population of 360 employees. The respondents were selected through stratified random sampling to ensure participation from all departments. Semi-structured questionnaires were used for data collection. After operationalization, data was analyzed using Statistical Program for Social Scientists (SPSS).

6. Results and discussion

6.1. Transport modes

A great majority (78%) of the respondents agreed that road transport affected the delivery of flowers whereas a few (19%) disagreed. The findings imply that the road transport has huge potential to affect the floricultural supply chains. These findings tally with the views of McKinnon *et al*, (2010) who indicates that road transport has the capacity to precipitate supply chain disruption.

To the question of whether air transport affected the supply of flowers to the destination markets the response was as follows: the majority (73%) affirmed but a significant number of respondents (20%) indicated that it was the contrary. The findings indicate that air transport indeed is an important node in the floriculture supply chain with the potential to cause supply chain disruption in the floricultural supply chain in the farm. The research findings corroborate with McKinnon *et al*, (2010) who argues that air transport affects, mostly adversely, the supply chains in industries that have got global supply chains. Balakrishnan *et al*. (2008) disagrees with this view and states that the factors that cause supply chain disruption are mostly to do with intra-industry processes as opposed to externally-generated factors such as transportation bottlenecks and external market variations.

The respondents were asked whether delivery of flowers to their final destination was affected by sea transport, to which a few (33%) agreed and considerable number (64%) disagreed. Respondents who agreed cited reasons such as transportation of flowers to Tanzania and Uganda which had to be is done through the Lake Victoria. The respondents for the idea that it did not affect supported their position by the fact that flowers are perishable goods and sea transport was not ideal for their transportation. These findings imply that there is little impact of sea transport on the floriculture supply chains and hence minimal potential of causing supply chain disruption in the industry. These finding supports BCI, (2010) argument that the floriculture industry needs to develop advanced storage technology and explore the usage of sea transport as it is less vulnerable to disruption and is less costly compared to air transport.

6.2. Storage impact to supply chain disruption

Majority of the respondents (71%) indicated that they never experienced flower storage issues whereas a few (21%) indicated there were storage bottlenecks on the farm. The findings imply that the flower storage issues do not affect the floriculture supply chains significantly implying that they have limited potential to cause disruption. The finding agrees with Christopher and Peck (2008) who stated that the horticulture industry has invested in the latest storage technologies which lead to enhanced probability of the produce reaching the customer in acceptable state. The

finding, however, disagrees with McKinnon *et al*, (2010) who believes that storage is one of the leading causes of supply chain disruption.

6.3. Effects of natural disasters to supply chain disruption

An overwhelming majority (91%) of respondents agreed that natural disasters affected the floricultural supply chains. The respondents listed natural disasters such as earthquakes, harsh weather, hailstones, torrential rains and volcanic eruptions as affecting the farm. The findings imply that natural disasters do indeed happen and that they affect the floriculture supply chains with a potential to cause supply chain disruption. These findings corroborate those of Shah, (2009); Goodwill, (2011); Toigo, (2006) and Craighead, (2011) who asserts that floriculture supply chains display vulnerabilities to natural disasters. The findings, however, contradict Fisher (2011) and Handifield (2011) who assert that with proper strategic planning, industries can significantly insulate their supply chains against the ravages of supply chain disruptions caused by natural and other disasters.

6.4. Labour unions on supply chain disruptions

Majority of the respondents (67%) indicated that they were not allowed to join unions whereas a minority (33%) indicated that they were allowed. The findings point to the fact that majority of the management employees are not allowed to belong to trade unions or to form unions. This corroborates Dessler (2011) that most organizations in the horticulture industry and other labor-intensive agro-based industries do not relish and discourage the their employees to unionize.

The respondents were asked to indicate whether there has been any unionized labor strike in the farm to which an overwhelming majority (84%) indicated that there has been no strike. A few (16%) indicated that there has been one. Those respondents, who indicated that there has been labor strike, stated that strikes were experienced in the year 2008 when their salaries were delayed and this affected the supply chain node to the final consumers as this paralyzed the operations in the company for three days. These findings show that labor union strikes are few and far between in the floriculture industry. It implies that this is not a very strong factor with regard to the supply chain disruption phenomenon in the industry. The findings tally with Lysons and Farrington (2006) to the effect that modern organizations have highly developed mechanisms to contain labor union activities and hence are capable of minimizing or eliminating any effects on the supply chain.

On the effects of go-slows and wildcat actions on the floricultural supply chains, 27% of the respondents indicated that there are frequent go-slows whereas the majority (73%) indicated that there have been no go slows. The respondents who indicated there are go-slows indicated that the action disrupted production and the produce delivery processes in the farm. This finding implies that go-slows is a factor and indeed affects, to somewhat small extent, the disruption of the floriculture supply chains. Dressler (2011) asserts that labor union actions which include go-slows, strikes and perpetual bargaining of employment terms, affect the relationships between employees and employers within the organizational settings. The findings contradict Mohanty and Deshmukh (2009) who rules out adverse effects on the floriculture supply chains by unionized activity.

When asked to state whether there were other types of labor unrest in the farm few (16%) of the respondents agreed whereas a great majority (84%) disagreed. Those respondents who agreed cited demonstrations, barricading of the roads leading to the firm, maximizing rose flower stem breakages, spraying less chemicals other than required or sometimes over spraying which led to undesirable color changes. Some of these actions were quite unnoticeable. The research findings are indicative of the fact that labor unrests are a cause, but not a major one, of supply chain disruption in the industry. The research findings tally with the view by Lysons and Farrington (2006) to the effect that modern organizations have highly developed mechanisms to contain labor union activities and hence are capable of minimizing or eliminating any effects on the supply chain. These findings, however, contradict Harris and Botten (2006) who suggests that unionized employees have the capacity to cause disruption of a firm's supply chains.

6.5. Production equipment breakdown on supply chain disruptions

The majority of the respondents (71%) disagreed that the farm experienced production equipment breakdowns. The findings are suggestive of the fact that machine breakdowns are a factor though not major with regard to supply

chain disruption on the farm. The research findings concur with Naim *et al.* (2010) who discount the idea that floriculture machinery is prone to supply chain impacting breakdowns.

The respondents were asked to indicate whether the production system can be easily changed to meet changes in customer demand. A minority (20%) agreed and the great majority (80%) disagreed. Those who agreed cited the readiness of management to keep in step with customer taste trends. The majority who disagreed mentioned the utter unpredictability of customer demand and the expensive equipment required to keep readjusting the production function. These research finding is a pointer to the contributing influence of the production function to supply chain disruption in the floriculture industry. These findings corroborate Wells (2006) to the effect that floricultural supply chains are impacted to some degree by flexibility of the productivity system and customer satisfaction related factors.

6.6. Production function mechanics on supply chain disruptions

On whether the production function mechanics are the highest contributor of the supply chain disruption in the farm, 23% indicated they were, 21% indicated that it was somewhat true, 46% indicated that it was not true and 10% indicated that they were not sure. The results are indicative of the mixed reactions indicating limited influence of the production function mechanics on the floriculture supply chains. The findings corroborates with Jessop and Morrison (2004) who states that production function mechanics such as inventory, process issues, lead-time variability, and flexibility and up-times affect the robustness or non-robustness of the supply chain and can cause potentially disruptive situations in the supply chain. They also agree with (Snyder, 2007) who states that floriculture supply chain disruption is mainly precipitated by production function-related factors such as industrial process inflexibility, product defects and equipment breakdowns.

7. Inferential statistics

To construct the final data set, the researcher merged the aggregated survey data set based on the means of responses this is presented in table 1. In general, the mean score for the items in the constructs (Logistics design, Natural Disasters' Effects, Labor Union Actions and Production function mechanics) were average ranging from 1.0287 to 1.8080 on a two likert scale. To check the validity of the instruments a cronbach alpha test was conducted for all the variables had α value of the recommended 0.700 this shows that all the variables were valid.

This empirical study had the overall objective of investigating the factors contributing to the supply chain disruption in the floriculture industry in Kenya. Since the measures that are used to assess the primary constructs in the research model are quantitative scales, regression analysis was used to achieve this end. Regression analysis is a set of technique that can enable the researcher to assess the ability of an independent variable(s) to predict the dependent variable(s).

The F-statistics produced (F = 114.491) was significant at 1 per cent level (Sig. F< 0.01), thus confirming the fitness of the model. Therefore, there is statistically significant relationship between Logistics design, Natural Disasters' Effects, Labor Union Actions and Production function mechanics. The coefficient of determination R^2 value was 0.841. This shows that 84.1 per cent of the variance in dependent variable (Supply Chain Disruption) was explained and predicted by independent variables.

These research results are a strong pointer to the fact that supply chain disruption in the floriculture industry is a function of natural disasters, logistical processes, labor union actions and production function mechanics. These research results support the views expressed by McKinnon *et al.* (2010), Shah (2009), Lysons *et al.* (2006) and Snyder (2007) on the causal and disruptive effects of logistical processes, natural disasters, labor union actions and production function mechanics respectively on the floricultural supply chains. They, however, contradict and disaffirm the scholarly views on the relative less influence of these factors by Allay (2008), Fisher (2011), Muthukrishnan and Sulman (2006) and Naim *et al.* (2010).

It can be observed that every time natural disaster effects are increased by 1 unit, supply chain disruption is increased by 0.647 when all other variables are held constant. When logistic designs are increased by 1 unit, supply disruptions is increased by 0.503 when all other variables are held constant and when labor union actions are increased by 1 unit supply chain disruption is increased by 0.314 when all other variables are held constant. When production function mechanics is increased by 1 unit, supply chain disruption is increased by 0.238. Therefore,

supply chain disruption is caused by natural disasters, logistical processes, labor union actions and production function mechanics in that order.

8. Research findings

The major findings of the research include: natural disasters are the highest cause of supply chain disruption in the Kenya floriculture industry. These natural disasters are mainly volcanic activity, harsh weather, earthquakes, tsunamis, hail storms, heavy rains and drastic change of weather. The natural disasters affecting the supply chains are not restricted those that occur in-country. The floriculture supply chains are global. Natural disasters affecting the market countries are translated into local effects. The natural disasters that hit the source countries of input supplies also lead to impacts on the supply chains meaning that the productivity activities in the farm are delayed. The impact on the inputs supply chain has multiplier effects in terms of the delayed products supply chain.

Logistics process design is a strong cause of disruption in the floriculture supply chains. The road transport means is not reliable and is subject to frequent discontinuities. There are recurrent truck breakdowns and traffic jams that lead to delays of the produce reaching the airports. These culminate in supply chain breakdown where the produce is actually composted. The road transport also leads to a reduction in the vase life of the flowers.

The offloading and on-loading of the flowers also causes damage to the product. The customers are very precise on the delivery quality of the product. Within the farm, the packaging is sometimes not done correctly since the process is manually driven and hence not easy to enforce seamless standardization. The process is prone to man-made errors. Storage is also an issue since during peak harvests there are capacity issues with the cold rooms. Overall, the main components of the floriculture logistics process design that cause the supply chain disruption are road transport, air transport, packaging and storage. Sea transport was found to be a less significant factor disrupting the floriculture supply chains.

The floriculture farms are tolerant towards unionized activity. The management and the entrepreneurs allow their non-management workforce form or join labor unions. These labor unions sometimes use militant means in the pursuit to attain their aims. They result to wildcat actions, strikes and go-slows. Although the actions reported are far-between, they do affect the supply chain end to end. A go-slow by the truck drivers leads to delayed delivery of the produce to the airports. Similarly, a go-slow in the flower sorting unit implies delayed processing and on-loading of the product into the transportation vessels.

Within the floriculture firms there is the 'in-transport' component involving the transportation of the flowers from the greenhouses into the grading and sorting stations. Go-slows and strikes leads to delays or ultimate cut-off of this critical 'in-transport'. Generally, the labor union actions play a role in causing paralysis and disconnects within the floriculture supply chains. The labor union actions were found to be the second least influential factor among the variables researched.

The production function mechanics within the floriculture industry causes supply chain disruption. The production systems are not flexible enough to accommodate changes in customer taste and to meet the precise lead times as specified by the consumer. The floriculture industry is delicate in the sense that there are frequent changes in the customer demand patterns. Additionally, the customers are very demanding in terms of adherence to delivery lead times.

The floriculture machinery requires time and relatively heavy investment to effect the necessary changes to accommodate the frequent changes in market appetites and taste. The production system has an impact on the supply chain through breakdown of machines, guillotines, cooling infrastructure and pump systems. The servicing of the machines requires specialized expertise implying supply chain impacting time-lags in their procurement process. Relative to the other factors, however, the production function mechanics causes supply chain disruption to a lesser extent.

9. Research Conclusion

The research concludes that in order of significance amongst factors contributing to supply chain disruption in the floriculture industry in Kenya natural disasters ranks first, followed by logistics process design, then labor union actions and finally production function mechanics. The study established that the four independent variables that

were studied explain only 82% of the factors causing supply chain disruption in the floriculture industry. There are, therefore, other factors not studied in this research contributing 18% of the factors causing supply chain disruption in the industry.

10. Recommendations

Based on the research findings, four recommendations were made:

Firstly, the floriculture entrepreneurs should develop and document strategies and contingency plans for insulating the supply chains against the effects of natural disasters by creation of business continuity intelligence to avoid costly surprises. The floriculture management should also consider doing benchmarking with their peers in other countries to learn and implement best strategies for mitigating against natural disaster effects on the supply chains. The floriculture industry can also develop partnerships with reputable firms that deal with prediction of weather patterns. The structured analysis and interpretation of trends from such organizations can enable the floriculture firms to be better prepared to strategically manage and control the effects of natural disasters.

Secondly, the floriculture management needs explore investment into advanced storage technology that can permit the transportation of the produce by rail and sea to provide the necessary redundancies for the road and air transport that are prone to supply chain disruption leading to enhancement of the logistics process uptime in the industry.

Thirdly, the floriculture management should spearhead negotiations and common understanding with the non-management workforce to avert union actions that can lead to disruption of the supply chain. They should foster an environment of dialogue and tighten their pre-employment screening to ensure that they do not engage potentially disruptive employees. Very importantly, the floriculture enterprises should seek ways of automating the 'in-transport' within the farms. This is the transport component between the greenhouses and the holding, storage and sorting units within the farm and is mostly disrupted by go-slows and other union actions.

Finally, the floriculture industry strategists need to evaluate the weaknesses in the production function and develop the necessary capabilities of the processes to absorb the impact of machine failures. The industry can develop partnerships with learning institutions to research into resilient production systems and advanced forecasting tools. This will enable the firms to forecast production requirements in the short and long runs.

The firms should also institute regular production function audits to diagnose areas of weakness for corrective action.

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Table 1: Regression Coefficients

	Co-efficients	t-values	Significance	R Square	Adjusted R. Square	Model F-value
Constant	0.264	1.651	0.103	.848	.841	114.49
Production fn mechanics	0.238	1.871	0.035			
Labor Union Actions	0.314	5.268	0.000			
Natural Disasters'	0.647	2.577	0.012			
Logistics design	0.503	12.017	0.000			