Managing Supply Chain Risks: A Perspective of Exportable Pineapple Fresh Fruits in Ghana

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Abstract

Businesses operate in environments that are full of dynamism and uncertainties. These uncertainties constitute risks in the business operations. In the context of pineapple production, risk is inevitably, an integral part of the supply chain and comes in various forms. The principle of risks management recognizes the fact that risks are potential source of threat that undermines corporate strategy. Therefore, the need for systematic and proactive measures to deal with risk is paramount and should not be left to chance. This study assesses the overall supply chain network of selected organisations, identifies the risks inherent along its supply chain, analyses the risks and categorises them according to their level of impact on the company's operations   and develops mitigation strategies to dealing with them. Primary data was used for the study through questionnaire instrument. Pareto analytical model with Failure Mode and Effect Analysis (FMEA) framework was adopted in analyzing the data. The results revealed that lack of good planting materials, timely availability of skilled labours, electricity fluctuation, ineffective pre-cooling and cold chain facilities were the major risks facing most pineapple supply chain in Ghana. The need to develop in-vitro planting facilities, staff development and continuous improvement program through modernization and re-tooling is recommended.
Keywords: Supply Chain Management, Supply Chain Risk, Pineapple Supply Chain, Exportable, Fresh Fruits

1. Introduction

Supply Chain (SC) of exportable pineapple fresh fruits contributes immensely to national economy. It promotes the interest of the nation on economic, social and environmental dimensions (Chartered Institute of Purchasing and Supply (CIPS), 2012).The global market environment, including the pineapple industry is becoming increasingly competitive. This has great influence on business activities, especially in the era of trade liberalization. SC has become a key business process model for organizations to be able to compete favorably in the market place, both locally and internationally.

Given the turbulent nature of the international business environment as well as trade restrictions and barriers imposed on organizations in various countries, such as strict regulation on exports, SC as a business process model, then becomes one of the effective drivers for firms to compete and improve performance (Otchere et al., 2013; Ou*et al.* 2010; Baharanchi, 2009). For example the aim of every fresh fruits is to ensure that the fruits get to the consumers in their fresh and tasty state. This requires close and seamless coordination among all the members of the supply chain (Habib and Jungthirapanich, 2010), thus effective pineapple SC requires the coordination of the growers, shippers, wholesalers and retailers.

However, pineapple SC is prone to variety of risk including, among others, low quality planting material, low quality packing materials, transportation inefficiencies, ineffective cold chain facilities etc. at various levels along the chain given the time-sensitive nature of the products (Trienekes and Williams, 2007). These risks and their concomitant effects have resulted in poor performance over the years. Whereas the global demand for pineapple export increases, export volume and production from Ghana has been fluctuating between 63,798 and 74,715 metric tons from 2001 to 2010 (Kleemann, 2011;Triennnkens and Williams 2007, Takene, 2004).

Several Researchers like Kleemann (2011); Trienekens and Williams (2007), Takene (2004) have done studies in the fruit industry in Ghana. However, the issue of risk inherent in the pineapple supply chain seems not to have been given enough attention and gradually and increasingly, affecting growth in productivity in the fresh pineapple production subsector. For example, fluctuation in production and export volume from Ghana (Kleemann, 2011; Triennnkens and Williams, 2007) provides empirical evidence of challenges facing the pineapple supply chain in Ghana and require the needed attention given that pineapple production contributes to Ghana's economy.

It is against this backdrop that the researchers intend to examine the pineapple SC in Ghana, identify the inherent risks and to develop strategy that can help address them. This study aims at examining the types of risk inherent in the various operational levels of the pineapple SC of three selected organization (names withheld for ethical

reasons) and to develop risk mitigation strategy to overcome it. Specifically the study was guided by the following research questions: What are the kinds of risks mostly inherent along pineapple SC in Ghana? And what is the appropriate risk mitigation strategy(s) required to address the situation? The study seeks to bring into fore various risks that attach themselves along the pineapple SC in Ghana and the mitigation strategies that could help address those risks to overcome the challenges in pineapple SC.

This paper is organized as follows. In the first section we introduce the background of the study. We then discuss existing literature followed by the methodology used. In section four, we present our analysis and results, followed by discussions, implication and mitigation strategies. We finally present our conclusion and recommendations.

2. Literature Review
2.1 Supply Chain Management (SCM)
Dealing with today's ever changing and turbulent business environment have put a substantial pressure on most businesses to adopt and employ the required measures and assessment procedures in their supply chain to avoid unpredictable risks that may cost the business to huge loses. The reality of the current business environment involves a complex network of suppliers, partners and customers which have brought about more risks and uncertainties to businesses (Christopher et al. 2006, Otchere et al. 2013, Faisal &Banwat, 2006; Chopra and Sodhi, 2004; Ou, et al. 2010; Baharanchi, 2009). Supply chain management (SCM) seeks to enhance competitive performance by closely integrating the internal cross-functions within a company and effectively linking them with the external operations of suppliers, customers, and other channel members to be successful (Monzcka and Morgan, 1997; Otchere et al., 2013, Lambert, James and Elram, 1998; Kim, 2006; Tan, Kannan, and Hadfield, 1998). The global market environment, including the pineapple industry is becoming increasingly competitive especially, in the era of trade liberalization, hence Supply Chain (SC) has becomes a key business process model for organizations to be able to compete favorably in the market place, both locally and internationally.

2.2 The Concept of Risk
Concept of risk has been studied in several business contexts (Sitkin and Pablo, 1992; Stone, Yates &Caruthes, 2002; Khan and Burnes, 2007; Rithie&Brindley, 2007; Zsidsin, 2003; Chopra and Sodhi, 2004, and Anggara, 2008). There are numerous definitions of risk indicated by prior studies, one of them being that offered by Sitkin and Pablo (1992), who defined risk as "the extent to which there is hesitation whether potentially desired or insignificant /unwanted outcomes of decision will be realised". In 2002,Sitkin and Pablo further described risk as uncertainty about potential outcome, whether it is momentous and/or insignificant in the decision that occurred. On the other hand, Faisal *et al.* (2006) defined risk as consumer's perceptions of the insecurity and undesirable consequences for buying products or services. In a related development, Mitchell (1999) described risk as "the likelihood of loss and the implication of that loss for the individual or organisation". He formulated a principle of risk to assess the probability of loss (P) and the significance (l) of that loss as; **Risk = P (loss) X l (loss).**

However, this concept has been overtaken by further studies. For exampleZsidsin (2003) suggested that risk contains three dimensions which are outcome uncertainty, outcome expectations, and outcome potential. Moreover, Rithie and Brindley (2007) cited that there are three dimensions of risk: (1) Likelihood /probability of occurrence of certain outcomes; (2) consequences/severity from the occurrence of particular events; (3) causal pathways leading to the events. Similar to Ritchie and Brindley (2007) defined risk as the multiplication of likelihood of risk event, the severity of a risk event, and the ability to detect the risk (PMBOK, 2000). It is formulated in the notation as **Risk = Likelihood X severity X Detection.** Considering the fact that risk management always relates to those three dimensions of risk(Rithie and Brindley, 2007), this research intends to use this definition in order to analyse the sources of risk, understand the forces which might create the occurrence of undesired event, and manage these dimensions to enhance the possibility of positive outcomes and avoid negative outcomes.

There are different types of risks, ranging from market associated risks including (demand, cash flow, and availability of resources) and completion risk which include (technical risk or operational risks) to institutional risks (regulation related risks, customer acceptance risk, and independent risk) (Miller, 1992). Risk factors such as demand forecasting, environmental risks and the fruit safety and regulations are more associated with pineapples SC. There is the need to employ modern risk management techniques and analytical tools to uncover uncertainties and design the right responsive action to mitigate that risk (Trienekens&Willems, 2007). Furthermore, costs of transactions, investments in business transactions, information asymmetries between parties as well as social and cultural elements, such as family relationships and village social structures are also militating against the pineapple industry (David and Han, 2004; Grover and Malhotra, 2003; Ruben et al., 2007).

2.3 Supply Chain Risk Management

Because of Supply chain's vulnerability and exposure to many internal and external risks, most businesses have started to realize the need for mechanism to identify and assess those risks in early stages and then manage them in the most effective way to survive the adverse consequences that may come about especially, when introducing new products to the market. Also, the large number of links that need to be created between members of the SC have increased the possibility of risks being transmitted along the chain, so that a small incident in one distant area can grow into adverse consequences for other associates within the SC (Christopher et al. 2006, Otchere et al. 2013, Faisal &Banwat, 2006; Chopra and Sodhi, 2004).

SC risks varies based on the type of industry and the level of complexity of the SC network, however, it could be seen that most of the SC associated risks are common in most industries. SC risk is defined as any incident or event that could disrupt the movement and flow of raw materials across the chain (Christopher & Lee 2004). Risk management in today's business environment has become the biggest contributor to most fields of management. The frequent occurrence of natural disasters, labour disputes, uncertain supply and demand, supplier bankruptcy, political changes, war and terrorism have led to deeper concerns about risk management for the supply chain (Ritchie and Brindley, 2007; Mallman, 1996; Giannakis*et al,* 2004 & Christopher and Lee, 2004).

Supply chain management, as part of management study, cannot avoid those inherent risks. It is common today in supply chain management to adopt a risk concept and apply this concept as the key role in the supply chain management (Ellegard, 2008). Hence, the biggest challenge in supply chains today is to develop, managing and mitigating the risks that are inherent in every business situation. Companies need to know and understand the category of the risks as well as the condition that drives the risks in the supply chain context (Chopra and Sodhi, 2004). The understanding of risk in the supply chain should accommodate the following three components: one, the knowledge of a risk event; two, the probability of occurrence of a risk event and finally, the impact of a risk event. Prior researches have stated that the development of supply chain risk management, plays key role in supply chain management in today's business, and should take into account these components: 1. The identification of risk type and the drivers, 2. The action to seek deep knowledge about risk events, 3. The well-planned strategy to reduce probability of risk events (Ellegard, 2008; Chopra and Sodhi, 2004).

2.3.1 Supply Chain's Risk identification process

The identification process of supply chain risks within a certain industry is composed of a list of things that could go wrong. In the Pineapple industry, there are some SC risks that can be seen as more relevant to the industry (Trienekens&Willems 2007; Pegge, 2003). In terms of its overall outcomes, there are five kinds of risk in pineapple supply chains (environmental risk, demand risk, supply risk, cost fluctuation risk and operational risk). These risks are identified by major pineapple producing companies in Ghana.

2.3.2 Uncertainty of demand: There are some economic, political, and industry conditions which could impact consumer spending, or disposal income and consequently pose some risks in terms of demand for new products. Besides, the competitive conditions and fluctuation in energy, costs can affect customer preference and the pricing mechanism of new products pushing prices down (Henz, 2010). For instance, the demand and prices for some other fresh fruits can reduce demand for pineapple fruits resulting in decrease in productivity. According to Aitkena et al. (2003), it is difficult to accurately link agricultural production to expected consumer demand at the time the product is being harvested. Also, it is difficult for retailers to provide long term forecasts of consumer demand that match the volume decisions at the beginning of the planting process. As a result, the uncertainties associated with consumer demand for processed fruit can be seen difficult to anticipate.

2.3.3 Operational risk: Food processing industries are highly exposed to government regulation due to the nature of food products and its direct impact on consumer health. Also, developing global business relationships in particular are subject to many uncertainties caused by: poor physical infrastructures (storage/cooling facilities, roads, telecommunication, etc.), weak institutional infrastructures (government support, sanction systems, etc.), unbalanced trade relationships (dependencies, opportunistic buyer behavior) and unfavorable social and political conditions.

Information exchange between companies is in many cases hampered by large information asymmetries between chain partners, lacking communication infrastructures, and diffuse market channel structures. This makes monitoring of transactions difficult, because fruit and vegetables are time-sensitive products, inventory management is particularly critical. Information sharing among the different channel members is important to ensure fast product movement and reduce "bullwhip effect" of inventory across the supply chain (Lee et al 2000; Fearne& Hughes, 2000).

2.3.4 Cost fluctuations: The market for food products is becoming more of consumer-driven market (Kinsey, 2003). Also, it requires higher logistical performance due to restructuring in the SC of retailers and low margins in retailing which places considerable pressure on prices for the producer (Ahmad & Fehér, 2009, cited Otchere et al. 2013). As a result, the manufacturers encounter some difficulties as it has to deliver products that respond to the market needs and more importantly, being able to produce at the lowest possible cost. In other words, the producer has to maintain a reasonable level of flexibility and dependability. Furthermore, there is a shift of consumer preferences toward the variety of pineapple fruit which have also put extra pressure on new pineapple fruits to be produced and delivered at a relatively low price. In other words, variability risks in consumer preferences and new product cost and prices exist within the industry.

2.3.5 Environmental risks: Environmental risks are difficult to predict and requires carful measures. Those risks are usually identified during the growing stages before harvesting to ensure sustainable supply and good quality. For instance, Pineapple producers as well as suppliers in Ghana are less exposed to natural disasters, flooding and crop failures and are recognized for its natural fruit quality and its agriculture performance and purity (Trienekens & Willems 2007; Pegge, 2003).

2.3. 6 Global supply chain risks: Implementing a penetration strategy in certain industry to boost growth by tapping into international markets introduces risks that can impact on the supply chain activities (Wood et al. 2008). Those risks may include economic or political instability in those international markets and the performance of business in hyperinflationary environments. Some of the economic risks include the tax laws, fluctuation in the exchange rate as well as the quality of the agricultural products and replenishment risks (Wood et al. 2008). Other critical factors that can impact or disrupt the performance of a global SC are uncertainty of lead times and the reliability of suppliers. Lead time uncertainties can have a major impact in all logistics activities (Manuj & Mentzer, 2008).

2.3.7 Risk management framework: Not all pineapple companies in Ghana have developed risk management framework systematically for their supply chain. Lack of knowledge and implementation of the risk management framework in the supply chain can cause unsustainable conditions for the pineapple industry (Anggara, 2008). On the other hand, raising awareness of risk in the supply chain will be the basis of innovation along the supply chain in order to improve efficiency, effectiveness, end of chain satisfaction, and also sustainability (Subrotoet al. 2010). Therefore, it is important to develop a framework of risk mitigation strategies for supply chains, in order to create a sustainable pineapple industry so that the target set by the Ghanaian government will be reached (Anggara, 2009). One of such framework is the Failure Modes and Effects Analysis.

2.4 Failure Mode and Effect Analysis
Failure Modes and Effects Analysis (FMEA) is a methodology for analysing potential reliability problems or unwanted events early in the development cycle where it is easier to take actions to overcome the problems, thereby enhancing reliability through design. FMEA is implemented to identify potential failure forms, determine their impact on production, and identify actions to mitigate the failures (Crow, 2002). Failure Modes and Effects Analysis is a planning tool on developing the process, products, or the services. The use of FMEA has been developed for the deployment of products or services for troubleshooting and counteractive action. The standard of FMEA evaluation is based on the occurrence, severity, and detection for each risk event. The multiplication of these values obtains a Risk Priority Number (RPN) **RPN = Occurrence x Severity x Detection.** The FMEA has been developed not merely for designing services, products, and so on. Recently, FMEA is being used for analysing potential risks in project management, marketing, operations, etc. This tool is very useful because it provides a simple method for analysing crucial steps to anticipate what might go wrong with products/services (Anggara, 2008).

2.5 Pineapple Production
The production of vegetables and tropical fruit for export in Ghana is expanding. As traditional crops such as cocoa, yam and maize face increasing turbulence as a result of low world market prices, pineapple is now a crop of great importance to Ghana in terms of its contributions to the economic growth. Pineapple is a relatively easy crop to cultivate and constitute one of Ghana's most important non-traditional horticultural export products, contributing around 24% of total horticultural exports Ghana Export Promotion Council (GEPC), 2002; Ghana Statistical Service, 2008; Trienekens and Willems, 2007). Industry players have realized that production of pineapples for the export market is very profitable business and generates fast returns (12 to 15 month's production cycle), with the quality of remaining on the plant for a longer time without spoiling. Theproduction processes of pineapple fruits is shown in figure2.1(Suzuki, Jarvis &Sexton, 2011;GEPC, 2002; Ghana Statistical Service, 2008; Trienekens and Willems, 2007),
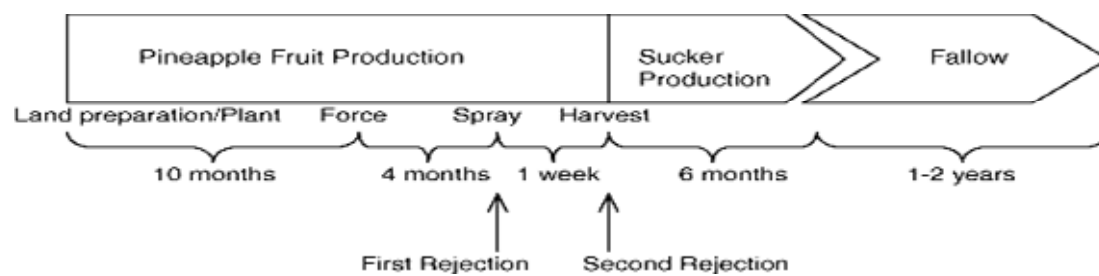
Figure 2.1 Production processes of pineapples

Source: Adopted from Suzuki, Jarvis &Sexton, (2011)

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3. Methodology

The study was undertaken within three of the leading pineapple SC organisations in Ghana. Names of those organisations are withheld for ethical reasons. A combination of descriptive and explanatory approaches was adopted in the study to describe and explain the variety of risks inherent in various levels of the pineapple SC of the selected organisations in Ghana. This study relied on primary data. Questionnaire instrument was used to collect the primary data for the study through field survey. The study targeted the entire population of management team and supervisors of the three selected pineapple SC organisations. Twenty (20) respondents from each selected organization were involved in the study, making a total sample size of sixty (60). These were purposively selected so they could provide relevant information. All the 60 questionnaires administered were returned representing 100% response rate. Notwithstanding, the challenges faced during the research, it did not in any way affect the reliability and validity of the results.

The data was collected through field generated survey using both self-administered and interviewer-administered questionnaire instruments. This allowed for responses from the respondents with varying characteristics, some of whom might require guidelines and further explanations to questions.

The questionnaires used were closed type with five point likert scale, ranging from 1= Strongly Disagree to 5= Strongly Agree. Respondents were given the chance to tick the most appropriate response(s).

The data was analysed using Pareto Analytical tool with Failure Mode and Effect Analysis (FMEA) Model adopted from Anggara (2008) "Implementation of Risk Management Framework in Supply Chain: A Tale from a Biofuel Company in Indonesia". We also used Statistical Package for Social Sciences (SPSS) version 16.0 and Microsoft Excel 2007 Software in the analysis.

The study adopted the Failure Mode and Effect Analysis (FMEA) model as the techniques to assess risks profile in supply chain used by Crow, (2002) and Carbone and Tippett, (2004) cited in Anggara (2008).The analysis was done in phases.The first phase focused on determining the various risks inherent in every stage within the supply chain of the selected organisations. This stage ensured that, as much as possible, the identifiable risks were recognized. Each risk was scored for its likelihood of occurrence, severity of impact, and need for urgent mitigation (Detection) based on FMEA model scaling guidelines for scoring each risk.

This phase was followed by the calculation of Risk Score Value (RSV) and Risk Priority Number (RPN) for each risk. The standard of FMEA evaluation is based on the likelihood of occurrence, severity of impact and detection for each risk event. The multiplication of these values gives a Risk Priority Number (RPN) i.e., RPN = Likelihood of Occurrence x Severity of Impact x Detection and Risk Score Value (RSV) i.e., RSV =Likelihood of Occurrence x Severity of Impact.After the RPN and RSV value were obtained for each risk, the Pareto analysis and risk clustering was then developed using a Scatter plot. From the Pareto analysis and the scatter plot, the risks profiling and its mitigation strategy was developed.

4. Results and Analysis
4.1 Types of Risk Inherent in the selected Pineapple SC in Ghana

Figure 4.1 shows the various categories of risk based on the study made. There are five areas of risks considered in this study, they are: Uncertainty of demand risks, Operational risk, Cost fluctuation risk, Environmental risk and Global supply chain risk. These risks affect various stages on the supply chain of the case company differently, and all the five categories affect the operations of the selected pineapple SC.
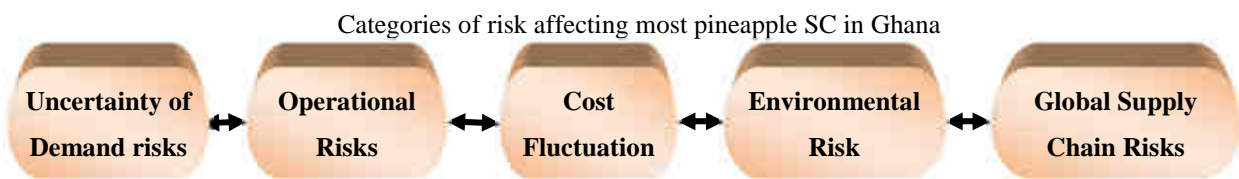
Categories of risk affecting most pineapple SC in Ghana

| Uncertainty of Demand risks | ↔ | Operational Risks | ↔ | Cost Fluctuation | ↔ | Environmental Risk | ↔ | Global Supply Chain Risks |

Figure 4.1

Source: Author's own mapping based on the field survey (2014)

Table 4.1gives the perception of the respondents in respect of the various risks that attach themselves along the supply chain of the selected organisationsand their various RSVs and RPNs. It is discernable from the table that twenty-five (25) types of risks (under the five categories of risks in fig. 4.1) were perceived to be associated with the selected pineapple SC with their RSV and RPN values. The risks were identified from the various stages of the entire SC of the selected organisations which start from production stage to distribution stage.

Table 4.1: Type of Risk inherent in the selected pineapple SC

RISK TYPE	Risk score value (RSV) Likelihood*Impact	Risk Priority Number(RPN) RSV*Need for Mitigation
Lack of quality planting materials	25	100
lack of recommended agro-chemicals	15	60
Timeliness of skilled labour availability	25	125
Bad weather condition	12	24
lack of suitable soil	20	60
lack of funding	10	20
lack of appropriate or inadequate equipment	16	48
lack of appropriate sorting equipment	3	12
lack of durable packing material	6	30
lack of environmentally friendly preservative chemicals	15	60
lack of pre-cooling facility	25	80
lack of cold chain facility	25	64
Electricity fluctuation	20	100
Lack of appropriate loading equipment	6	24
poor road network	15	75
Road traffic jam	16	48
lack of cold chain transport	5	25
lack of cold chin holding room	10	50
lack of appropriate ship loading equipment	8	32
Electricity fluctuation	20	100
Delayed of ship arriving in destination	10	50
Export restriction (Trade barrier)	4	16
Delayed clearing of fruits	4	20
lack of efficient cold chain/warehousing	5	25
lack of distribution channels	5	20

Source: Author's field survey (2013)

Figure 4.2 gives graphical illustration of the risk profile of Pineapple SC in Ghana.

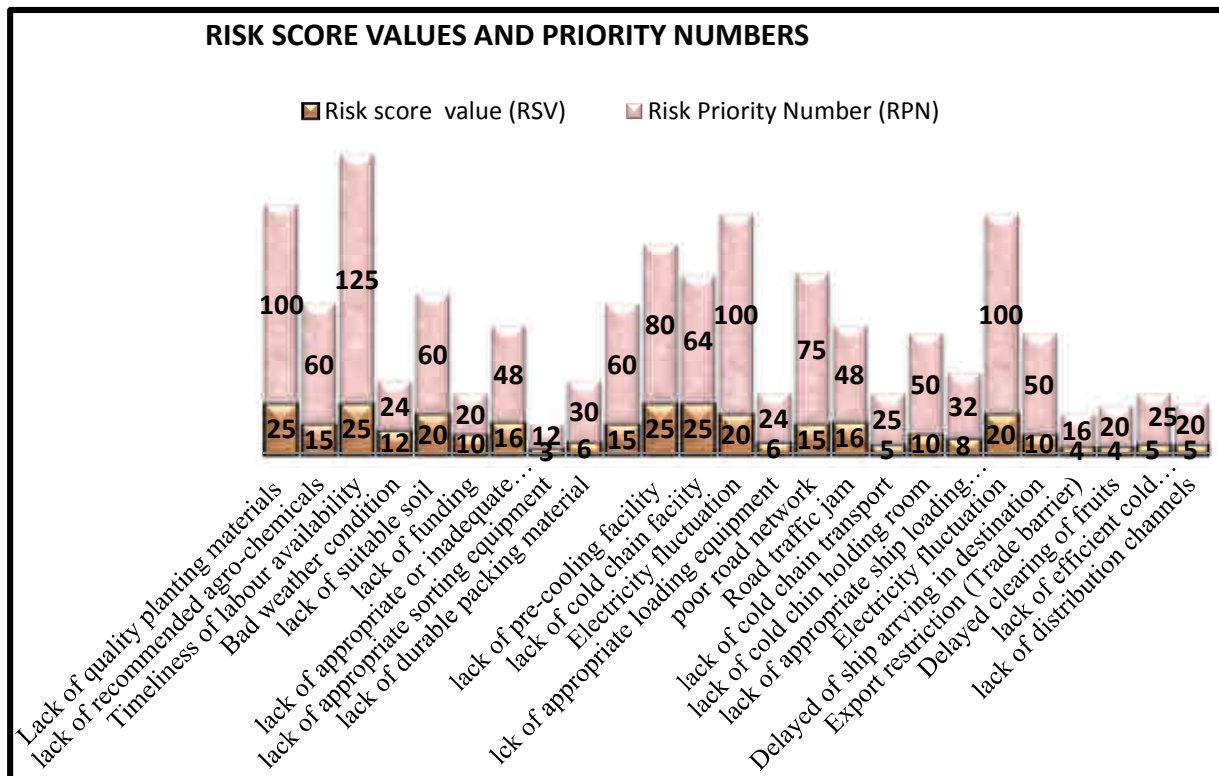Risk Profiles of Pineapple SC in Ghana

Figure 4.2
Source: Author's own computations based on the field survey (2013)

4.2 Risk Mitigation Strategies

Figure 4.3 and table 4.2 shows the scatter diagram matrix and the level of impact of various risks identified in the supply chain of the selected organisations with their suggested mitigation strategies as measures to dealing with the various risks. Using Pareto's Rule of 80/20, the critical value for RPN was 100 (80% of 125) and that for the risks score was 20 (80% of 25). This gives RPN threshold point at 100 and RSV at 20. The upper-right area of the scatter diagram in fig. 4.3 contains the most urgent risks that need immediate attention. It is evident from the diagram that, timeliness of skilled labour availability with RSV and RPN of 25;125 and lack of good planting materials with RSV and RPN of 25;100 are the risks that fall within that quadrant. This means that they are the highest scored risks of entire risk profile of pineapple SC of the selected organisations as their likelihood of occurrence and impact on the operations of the SC are high and require critical attention.
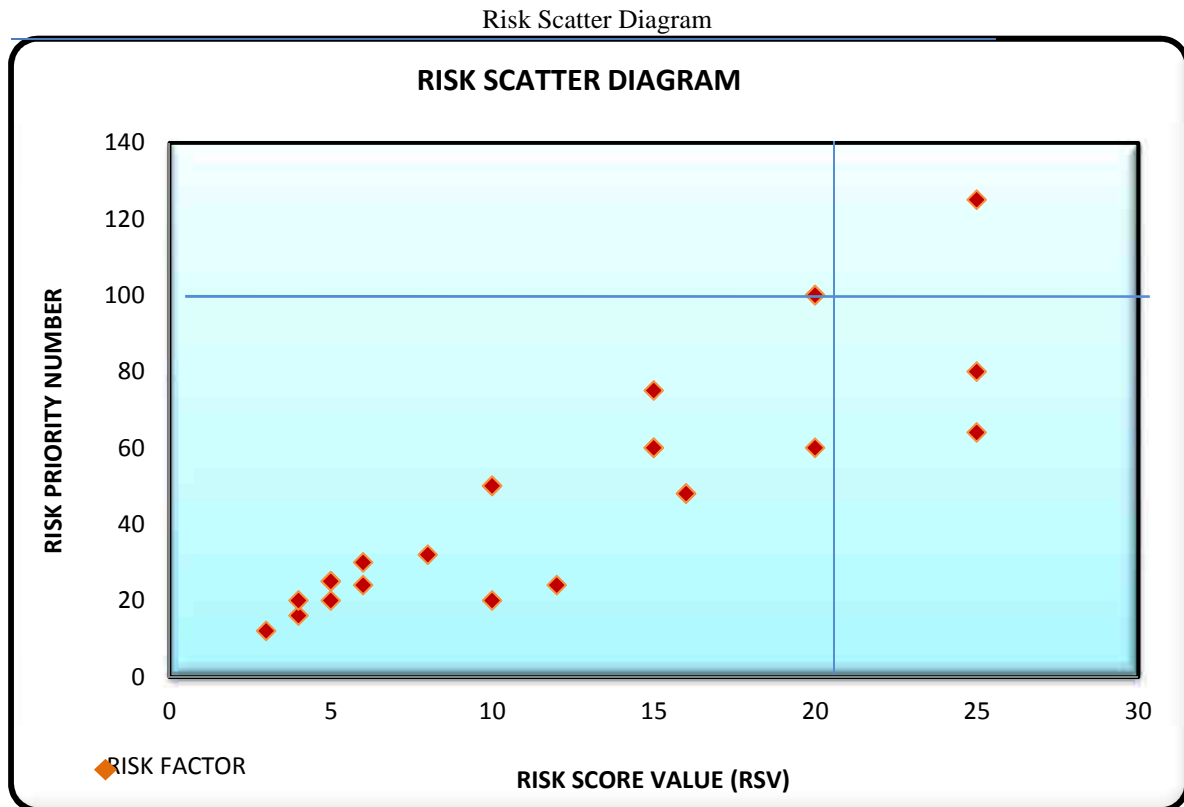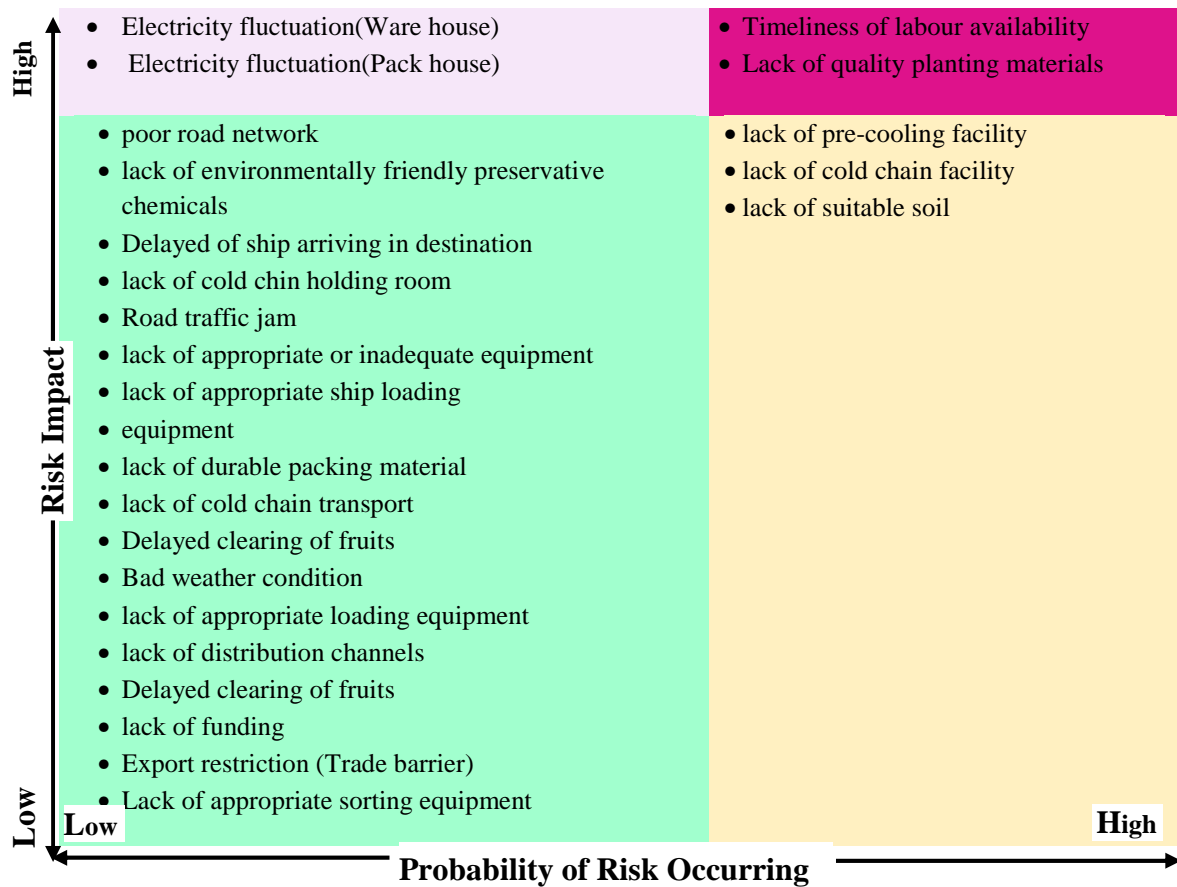
Figure 4.3 Risk Scatter Diagram

Source: Adapted from Carbone and Tippett, 2004, cited Anggara (2008)

Table 4.2 Risk Mitigation Matrix Score

High	• Electricity fluctuation(Ware house) • Electricity fluctuation(Pack house)	• Timeliness of labour availability • Lack of quality planting materials
Risk Impact	• poor road network • lack of environmentally friendly preservative chemicals • Delayed of ship arriving in destination • lack of cold chin holding room • Road traffic jam • lack of appropriate or inadequate equipment • lack of appropriate ship loading • equipment • lack of durable packing material • lack of cold chain transport • Delayed clearing of fruits • Bad weather condition • lack of appropriate loading equipment • lack of distribution channels • Delayed clearing of fruits • lack of funding • Export restriction (Trade barrier) • Lack of appropriate sorting equipment	• lack of pre-cooling facility • lack of cold chain facility • lack of suitable soil
Low	**Low**	**High**

Probability of Risk Occurring

(Source: Author's own construct based on the field survey, 2014)

Thus without timely availability of good planting materials and labour to work on the materials, production can hardly take off in the first place. In the lower-right quadrant of the scatter diagram, fig. 4.3, the risks have high likelihood of occurrence however; their impact ranges from low to medium. It is discernable from the diagram that challenges with pre-cooling and cold chain facilities are the risks that fall within that quadrant with their respective RSV and RPN of 25; 80 and 25; 64. Even though the results indicate that their impact is moderate, since they have high likelihood of occurrence, their impact can easily escalate and get out hand. Therefore they require close monitoring as changes in temperature level of the produce as a result of cooling problem could lead to product rejection or recall.

Risks in the left top corner of the scatter have high impact on the business activities but the likelihood of their occurrence is low. From the diagram, fluctuation in the electrical power supply, both at the pack house and storage house were the risk that fall within the quadrant with their RSV and RPN of 20;100. Since electrical power is a crucial driver of the entire SC, the need for its management is critical. The last category of risk falls in the bottom-left corner of the scatter diagram. These risks have low impact on the business and low likelihood of occurrence. Too much resource should not be expended on these risks; they should be managed as and when necessary.

5. Discussions and Conclusion
5.1Major Findings
The study revealed the following key risks at various stages of the selected pineapple SC:
   • Lack of timeliness of skilled labour availability
   • Lack of quality planting materials
   • Lack of pre-cooling and cold chain facilities as well as
   • Electricity fluctuation.
5.2 Implications of the Findings

Pineapple production supply chain has huge impact on national economy. Specifically the production and exportation of pineapple has effect not only on the bottom line of the organization but on economic, social and environmental sustainability at the macro level. Business success is not only measured by its level of profitability but also the extent to which it promotes the interest of the wider stakeholders on economic, social and environmental dimensions(CIPS, 2012).Consequently, the supply chain risks identified from the study as affecting pineapple production has negative effects on the economic, social and environment sustainability of the nation.

Economically risks identified from the study as being inherent in the pineapple sector can directly reduce the profit level of the supply chain in terms of low productivity, lost sales arising from these risks i.e. electricity fluctuation, difficulty of getting quality planting materials and timely availability of trained labour among others, which negatively affect quality production. This will in turn erode the beneficial effect on the society in terms of employment, payment of tax, community investment and ultimately reduces balance of payment foreign exchange earnings.

Pineapple supply chain risks also have implications on the social aspect of people's life. Loss of employment arising from low productivity reduces the level of social supports the dependents of the employees enjoy. That is, the supply chain organisations are now constraint to give back to society or communities within which they operates in the form of Social Corporate Responsibilities (CSR), thus adversely affecting social sustainability. The negative consequences of supply chain risks also affect the environment by way of excessive use of agro chemicals for pineapple plantation due to difficulty in getting quality planting materials. The outcome of this study should inform and guide management to influence and devise policies and strategies to addressing these risks.

5.3Mitigation Strategies

In terms of risk mitigation strategies, findings from the study revealed that risks with high likelihood of occurrence and high impact should be given priority of attention. These risks were: lack of timeliness of skilledlabour availability and lack of quality planting materials. Again Lack of pre-cooling and cold chain facilities should be closely monitored as their likelihood of occurrence is high. For the electricity fluctuation, its likelihood of occurrence is low but has high operational impact as it is the crucial driver of the SC and therefore requires close management.

The other risks that have low likelihood of occurrence and low impact are considered normal and be managed as and when required. Key amongst them (table 4.3) include: poor road network lack of environmentally friendly preservative chemicals, delayed of ship arriving in its destination, lack of cold chain holding room, road traffic jam, lack of appropriate or inadequate equipment. The organisations should not waste many resources on these categories of risks.

5.4 Conclusion and Recommendations

Managing risks and uncertainties in the supply chain is a common practice in businesses due to the dynamic nature of business environment and the increasing complexity of the supply chain networks. The study identified and examined the supply chain risks associated with some pineapple production organisations, their assessment and prioritization of risks as well as the management effort required to mitigate and monitor the risk. It was clear that supply chain risks come from various sources for different reasons and can disrupt the SC system unless they are managed effectively. Some of those risks are internal and can be controlled by implementing the right measures to address them whilst others are external and difficult to anticipate and so require more critical measures and advanced technological and analytical tools to be addressed and mitigated.

The study also revealed that timeliness of skilled labour availability, lack of quality planting materials, lack of pre-cooling and cold chain facilities as well as electricity fluctuation are the key risks inherent in pineapple SC of the organizations under study and require critical attention. Based on the severity of some of these risks the following measures are recommended: One, management of pineapple SC in Ghana should ensure that there is timely skilled labour availability through continuous training and development of staff, succession planning, motivation and participation so as to gain their commitment. Two, management should ensure that good planting materials are always available. This could be dealt with by building in-vitro planting facilities at strategic area where planting materials could be picked from. Management may also build long-term relationship with suppliers to ensure continuous and timely supply of planting materials. Three, pineapple SC partners should engage in long-term relationship and trust building with suppliers to develop the right specification of agro chemicals that conforms to the global standards. Four, management should engage the services of soil scientist to manage their soil organic matter. Five, continuous process improvement, modernization and re-tooling may be employed to mitigate the risks of pre-cooling, cold chaining, pack house equipment, electricity and

transportation. Six, effective communication between importers and exporters should be in place to avoid delays in arrival of ship. Finally, management should adopt negotiation approach and develop incentive packages for retailers and distributors to ensure effective distribution. In terms of further research,we suggest that future studies should use a large- scale survey in order to make the findings more generalised.

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