

Assessing and Mapping the Supply Chain of Pineapple Production in Ghana

ABSTRACT

The aim of the study was to evaluate fresh pineapple production processes and activities in Ghana and to graphically map the various stages of the value stream involved. The study targeted pineapple producing organisations in Ghana. Three organisations were selected based on experience in the field and their readiness to provide data and other relevant information for the study. Names of the elected organisations are withheld for ethical reasons. The study adopted qualitative approach using primary data. Departmental heads and supervisors from the selected organisations constituted the target population of the study. The primary data was collected using semi-structured interview and observation instruments. The data obtained was analysed through deductions and inferences. The study established that pineapple Supply Chain (SC) processes and activities starts from the supply of pineapple production inputs from various suppliers to production of pineapples, export, through to retailing at the destination countries. The value chain of pineapple production and export was mapped graphically. The SC mapping developed from the study could serve as management tool that can be applied in the production of fresh pineapple fruits to improve efficiency and productivity. It is recommended that parties in the pineapple SC should collaborate and coordinate their activities through effective communication and information sharing in order to maximize consumer satisfaction and SC profits.

Keywords: Pineapple Production; Pineapple Supply Chain; mapping; Value Chain; Ghana

1. INTRODUCTION

Beyond their nutritional value which is essential for human development, fruits have become important commodities for income generation. Fruits and vegetables play important role in the global economy. Developing countries, including Ghana, are increasingly becoming important part of the global food chain as demand for exotic product across the globe increases (Trienekens & Willed, 2007). The

production of fresh fruits and vegetables for export has increased among several countries in the sub-Saharan African.

In Ghana production has increased in volume as a result of rise in global demand. Pineapples rank first as the most important non-traditional horticultural export commodity within the fruits and vegetables sub-sector in Ghana. Indeed, pineapples contribute about 24% of total horticultural exports and there is an indication of more prospects in the sector on the evidence of rapid growth in demand for fresh pineapples on the world market (Ghana Export Promotion Council (GEPC), 2002). According to Fold and Gough (2008) the export sector of the pineapple industry has provided significant benefit to Ghana since 1983. This gives indications of positive economic potential for Ghana, one of the largest producers of pineapple in West Africa (National Resources Institute, 2010).

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. Apparently, Supply Chain (SC) has become a key business process model for organizations to be able to compete favorably in the market place, both locally and internationally (Otchere et al., 2013; Ou *et al.* 2010; Baharanchi, 2009). In the pineapple sector of the fruit and vegetable industry, the roles SC plays include coordination in the supply network, alignment with customer satisfaction and sustainability of the overall competency throughout the supply chain (Faisal and Banwat, 2006, Chopra and Sodhi 2004). Due to the immense contributions from the pineapple production sub-sector to Ghana's economic growth in terms of foreign earnings, there is the need for systematic study into the pineapple operations to develop a structured supply chain configuration for fresh pineapple production in Ghana. Such configured network of value stream for the pineapple production sector will not only inform theory and contribute to knowledge but also serve as spring board to developing pineapple SC in Ghana in order to compete favorably on the global market. It is on this basis that this study is set out.

The general objective of the study was to assess the value stream of pineapple SC and to offer suggestions that will inform policy decision to improving pineapple production in Ghana. Accordingly, the study is guided by the following specific objectives: to establish and map the SC network for pineapple production in Ghana and to determine specific activities within each stage of the value chain of pineapple production in Ghana.

2. RELATED STUDIES

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 effective supply chain. The reality of the current business environment involves a complex network of suppliers, partners and customers (Christopher et al. 2006, Otchere et al. 2013, Faisal & Banwat, 2006; Chopra and Sodhi, 2004; Ou, et al. 2010; Baharanchi, 2009). The term supply chain is defined in many ways, but it is defined in this research as the network of organisations, which are involved through upstream and downstream linkages, in different processes and activities that create value in the form of products and services to customers (Christopher, 1998 cited in Peck, 2005). Again, Supply chain management 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 intensification of global competition and the demand for better customer service have considerably increased the need for SCM. The basis of SCM is characterised by cooperation, collaboration, information sharing, trust, partnerships, shared technology, and a fundamental shift away from managing individual functional processes, to managing integrated chains of processes (Otchere et al 2013, Vickery, Jayaram, Droge and Calantome, 2003; Kahn 1998; Pagell, 2004).

A supply chain consists of all stages involved, either directly or indirectly, in fulfilling a customer request. The objective of supply chain management is to maximize the overall value generated rather

than profit generation. Although the importance of supply chain relations is widely acknowledged, seamless coordination is rarely achieved in practice (Hussain and Nassar, 2010; Otchere et al 2013). Indeed supply chain has essential roles in the development of the pineapple industry. These roles take the form of coordination in the supply network, alignment with customer satisfaction, and the sustainability of overall competency throughout the supply chain (Faisal and Banwat, 2006; Chopra and Sodhi, 2004).

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. Accordingly, the adoption of SC as a key business process model for organizations to be able to compete favorably in the market place, both locally and international is imperative. The competitive nature of the international business environment as well as trade restrictions and barriers imposed on organizations in various countries such as strict regulations on export makes SC one of the effective drivers for firms to compete and improve performance (Ou *et al.* 2010; Baharanchi, 2009). This means that close and seamless coordination among all the members of the supply chain, i.e. growers, shippers, wholesalers and retailers is required (Habib and Jungthirapanich, 2010).

2.4 Pineapple Production

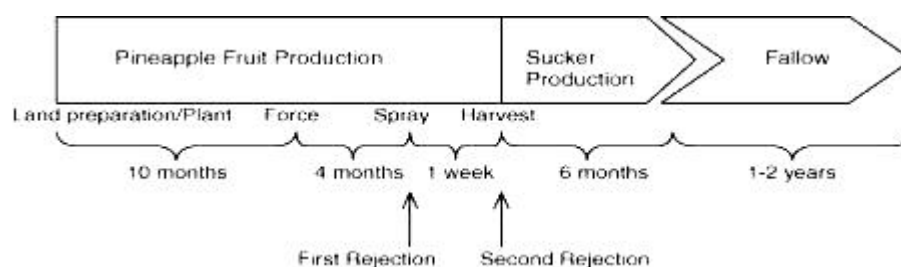
Fruits and vegetables are critical source of nutrients and other substances that help protect against chronic diseases, including heart diseases and cancer, stroke and other chronic diseases, (Prior & Cao, 2000; Produce for Better Health Foundation, 1999; Quebedeaux and Elisa, 1990; Southon, 2000; Tomas-Barberan and Robins, 1997). Fruits, and vegetables play a significant role in human nutrition, especially as sources of vitamins (C, A, B6, thiamine, niacin, E), minerals, and dietary fiber (Quebedeaux and Bliss, 1988). The production of vegetables and tropical fruit for export in Ghana is expanding. Pineapple is now a crop of great importance to Ghana as traditional crops such as cocoa, yam and maize are facing increasing pressure due to low world market prices. Producers are becoming aware that production of pineapples for the export market is a very profitable business and generate

108 fast returns (12 to 15 month's production cycle) and remain on the plant for a longer time without
109 spoiling.

110

111 Pineapples are sprayed at two stages: first to force maturation (forcing) and second to change fruit
112 colour from green to yellow (de-green). The yellow colour adds value to pineapples sold in EU
113 markets, but not in the domestic market. Exporters spray to de-green only fruits that are of export
114 quality, and harvest occurs one week after (Suzuki, Jarvis & Sexton, 2011; Ghana Export Promotion
115 Council (GEPC), 2002; Trienekens and Willems, 2007). Besides that, pineapple is a relatively easy
116 product to cultivate. It is considered one of the Ghana's most important non-traditional horticultural
117 export products, contributing around 24% of total horticultural exports (GEPC, 2002; Trienekens and
118 Willems, 2007).

119 **Figure 2.1 Production processes of pineapples.**



120

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

122

123 Pineapple share of the world's production of tropical fruits is 20%, and about 70% is consumed fresh.
124 The world production has risen up by 400% over the last five decades with Brazil being the world
125 leading producer but Costa Rica is the world largest pineapple exporter, followed by Philippians, Cote
126 d'Ivoire, Ecuador, Honduras before Ghana (French Ministry and Agricultural and Statistical Division,
127 (FAUSTAT) of Food and Agricultural Organizations of United Nations (FAUN), 2011; Kleemann,
128 2011). Currently Ghana's market share in Europe has improved (Suzuki, Jarvis & Sexton, 2011). The
129 production level of pineapple in Ghana was 63,798 metric tons in 2001, and has been fluctuating since
130 2002. It went up to 71,637 metric tons, dropped to 60, 000 metric tons in 2005, from there it increased

131 to all time high of 74, 715 metric tons in 2009, and eventually dropped to 73,700 metric tons in 2010.
132 (National Resources Institute, 2010).

133

134 The production of pineapple for export is geographically concentrated in the peri-urban zones along
135 the coastal savanna near the capital, Accra. This is due to the proximity of the international airport in
136 Accra and of a major port in Tema. The perishable nature of the produce and underdeveloped transport
137 networks in rural areas are the main reasons for this concentration. In addition, processing companies
138 producing pineapple juice are concentrated in the cities of Accra, Nsawam, and Tema (Trienekens and
139 Willems, 2007). Furthermore, these cities offer a major domestic market for fresh pineapples. These
140 factors constitute an advantage for the peri-urban regions; as compared to the rural population in
141 remote areas who have less chance of participating in export pineapple production (Takane, 2004). The
142 world market for fresh pineapple has been growing rapidly during the past years. Like other tropical
143 fruits, pineapple is grown predominantly in developing countries, where two thirds of rural people live
144 on small-scale farms of less than two hectares (IFPRI, 2005). According to the Ghana Living Standards
145 Survey (2008) 170 627 households (2 percent of all households in Ghana) grow pineapples although
146 not all of them are on commercial basis.

147

148 **2.1.1 Cold chain management**

149 Because fruits and vegetables are perishable, the retail value of the product lies in the ability to
150 transport the product to the market in a timely fashion. Despite their strategic importance and
151 profitability, perishables subject grocery retailers to losses of up to 15 percent due to damage and
152 spoilage. Cold chain management is paramount to ensure the freshness of fresh produces. Temperature
153 management of perishables begins with proper handling at harvest. Produce should usually be picked
154 in the cool hours of the day and shaded to protect it from the sun. Ideally, produce is cooled to its long-
155 term storage temperature in special facilities designed for rapid refrigeration. There are six common
156 cooling and temperature control methods of which Forced-air 12 cooling is the most widely used
157 cooling method (Thompson, Mitchell, T. R. Rumsey, Kasmire and Crisosto, 1998).

158 **2.1.2 Packing**

159 Good packaging is critical to extend the shelf life of produce and vegetables. Optimal temperature and
160 packaging slows down the aging of fruit and vegetables by more than 800% (Steeman, 2010). The
161 important parameters for this shelf life extension are temperature, moisture and a modified atmosphere
162 (oxygen, carbon dioxide and ethylene). When the product consumes oxygen and expels carbon
163 dioxide, water and heat, carbohydrates and other substances important to the product's freshness, taste
164 and health quality are broken down. Fruit and vegetables expel ethylene. Ethylene is a gas which
165 accelerates the ripening process in fruit and vegetables. Thus, an important design goal is to reduce the
166 accumulation of product decomposition liquids in the packaging and slow the product's respiration
167 (Trienekens & Willems 2007). In Ghana basic packing and storing facilities have been constructed in
168 the harbor by various exporters. There seem to be no supply chain system innovation. Transportation
169 infrastructure is still weak with old transportation facilities (except for a few modern trucks owned by
170 large producers such as Golden Exotics) (Trienekens & Willems 2007; Pegge, 2003).

171

172 **2.1.3 Trading and export**

173 Fruits and vegetables processing, trading and marketing require some vital support of integrated supply
174 chain management system. Due to its perishable nature and more consistent application of quality
175 standards, the organizations involved in business of these horticultural commodities have to face
176 colossal quality problems (Trienekens & Willems 2007; Pegge, 2003). According to Trienekens &
177 Willems (2007), there are no longer many traders in Ghana who only trade in the pineapple fruits.
178 Most traders acquired pineapple farms during the past few years to ensure regular and sufficient
179 supply. The number of exporters has fluctuated between 50 and 70 during the last decade, although just
180 10 companies accounted for over 80% of all exports. The other exporters can be classified as medium-
181 scale (diversified) export farms. 16 large producers are members of Seafreight Pineapple Exporters
182 Association Ghana (SPEG) (Trienekens & Willems (2007).

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184 **2.1.4 Transportation**

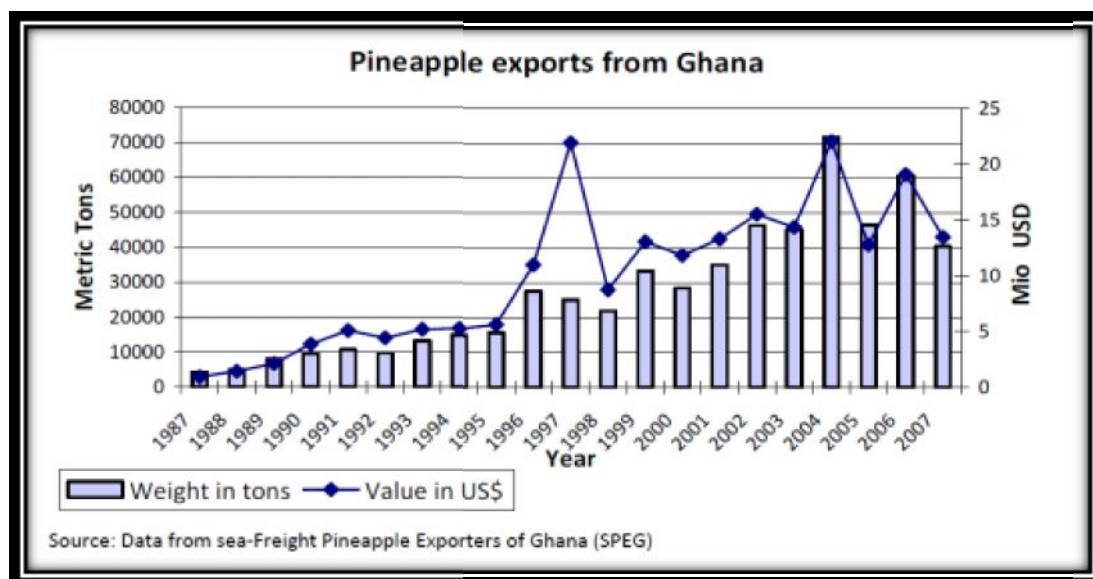
185 In transportation logistics management, better information is required throughout the supply chain
 186 from crop-picking, demand forecast, continuous monitoring and adjusting to truck timing. It also calls
 187 for clear and efficient procedures at receiving docks and responsiveness in changes in delivery
 188 schedule. For instance, warehouse and retailer should have flexible unloading procedures allowing the
 189 drivers to do less than-truck-load (LTL) unloading and reducing truckers' waiting time at receiver
 190 docks. In Ghana, we can distinguish two means of transport from farm to port; privately owned trucks
 191 and contracted trucks. The contracted trucks are mainly operated by one-man businesses that accept
 192 almost any type of load. The trucks are often in poor condition and they don't have a cooling facility.
 193 Privately owned trucks are mainly used by large scale export firms and by organized smallholders.
 194 Most of these trucks are in good condition and some have a cooling facility (Pegge, 2003). Around
 195 95% of the total pineapple export is transported by boat. Due to the relatively small scale of the
 196 Ghanaian exporters, they are often forced to accept the residual space available on ships and airplanes,
 197 resulting in delays and extra costs (Pegge, 2003; Trienekens & Willems 2007).

198

199 **4.1 Pineapple Export in Ghana:**

200 Export of fresh pineapples in Ghana began in 1940s and initiated air export of fresh pineapples to the
 201 EU market in the 1970s (Danielou & Ravary, 2005). Export has increased constantly since the mid-
 202 1980s. The export volume of fresh pineapple in 1983 was only 57 tons, and significantly moved to
 203 15,319 tons in 1994, while in 1999 it exceeded 33 thousand tons despite the temporary decrease in
 204 1998-1999, due to drought. It further went up to 46,391 tons in 2002 (Takane, 2004; Trienekens and
 205 Willems 2007). According to Fold and Gough (2008) the export sector of the pineapple industry has
 206 provided significant benefit to Ghana especially between 1983 and 2005. This gives indications of
 207 positive economic potential for Ghana, one of the largest producer of pineapple in Africa (National
 208 Resources Institute, 2010). Again Ghana volume of export declined from all time highest of 56,094
 209 metric tons in 2004 to 17,780 metric tons in 2010, representing over 68% (FAUSTAT of FAUN,
 210 2011), Figure2.2.

211 Figure 2.2 Volumes and Value of Pineapple Export from Ghana 1987-2008



212

213 Adapted from Kleemann, 2011

214

215 Fresh pineapples constitute 15% of the total value of Ghana's nontraditional agricultural exports in
 216 1999. Most pineapple is exported to the EU, with Germany as the most important importing country
 217 (30% of total exports) followed by countries such as Belgium, Switzerland, France, Italy, Luxembourg,
 218 the Netherlands, and the UK (GEPC, 2003). The rapid increase in pineapple export has been
 219 associated with series of liberalization policies adopted under the Structural Adjustment Programme
 220 (SAP), began in 1986, of foreign exchange controls. By the end of 1992, Ghanaian exporters were free
 221 to repatriate all foreign exchange earnings, which they can use for any purpose (Obeng, 1994). In
 222 addition, all nontraditional exporters became exempt from export duty and eligible to claim a corporate
 223 tax rebate. Such increased incentives among exporters contributed to the increased volume of
 224 pineapple export. As of 2000, 57 companies were registered as pineapple exporters, although not all
 225 were actually exporting Takane, (2004).

226

227 In terms of value, Ghanaian pineapple exports were US\$13,316,459 in 2001 and US\$15,519,989 in
 228 2002. Almost 50% of the total export volume was exported by four large companies: Jei River Farm
 229 (8403 tons), Farmapine (6255 tons), Koranco Farms (4147 tons) and Prudent Farms (3420 tons)
 230 (GEPC, 2003 Trienekens and Willems (2007). However, recent statistics indicates that Golden Exotic

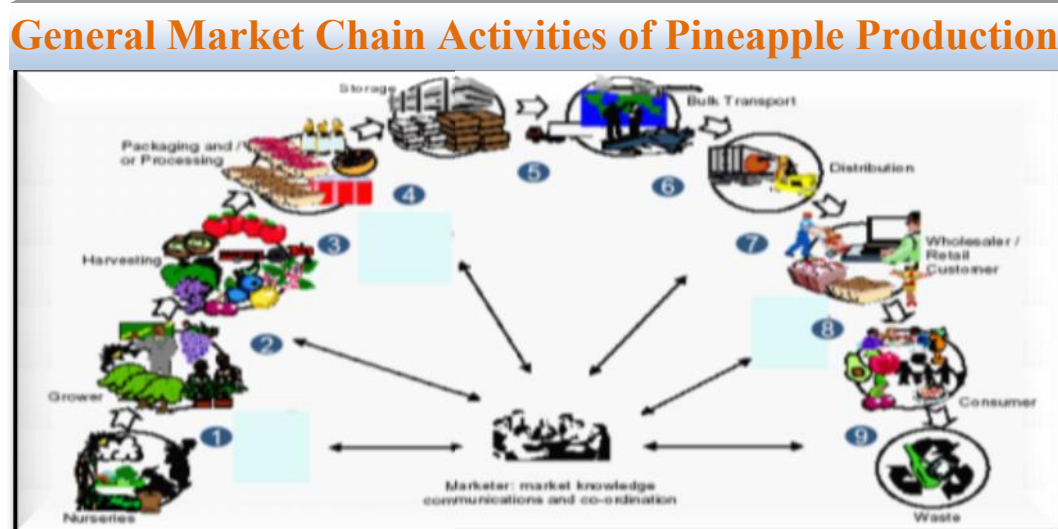
231 limited has taken over the export market with 41.0% in 2007(Suzuki, Jarvis &Sexton, 2011).
 232 Notwithstanding, Current statistics from SPEG according to Suzuki, Jarvis &Sexton (2011), indicates
 233 that as at 2011, Ghana was the third-largest supplier of fresh pineapples to the European Union after
 234 Costa Rica and Cote d'Ivoire with an 8% market share. This feat has being achieved because of huge
 235 investment in the sector by the new addition companies such as Golden Exotics which is run by
 236 Compagnie Fruitiere (CF) owned primarily by Dole, who invested US\$35 million; and benefiting
 237 from tariff free access to the EU market within the agreed 775,000 tons tariff free quota. In 2007 the
 238 top three exporters increased their market shares in 2006-07 to 61.6% with Golden Exotics who is the
 239 largest exporter, controlled 41.0% of pineapple export volume.

240

241 2.5 The Supply Chain Network

242 Figure 2.3 Supply chain activities of the Pineapple production industry

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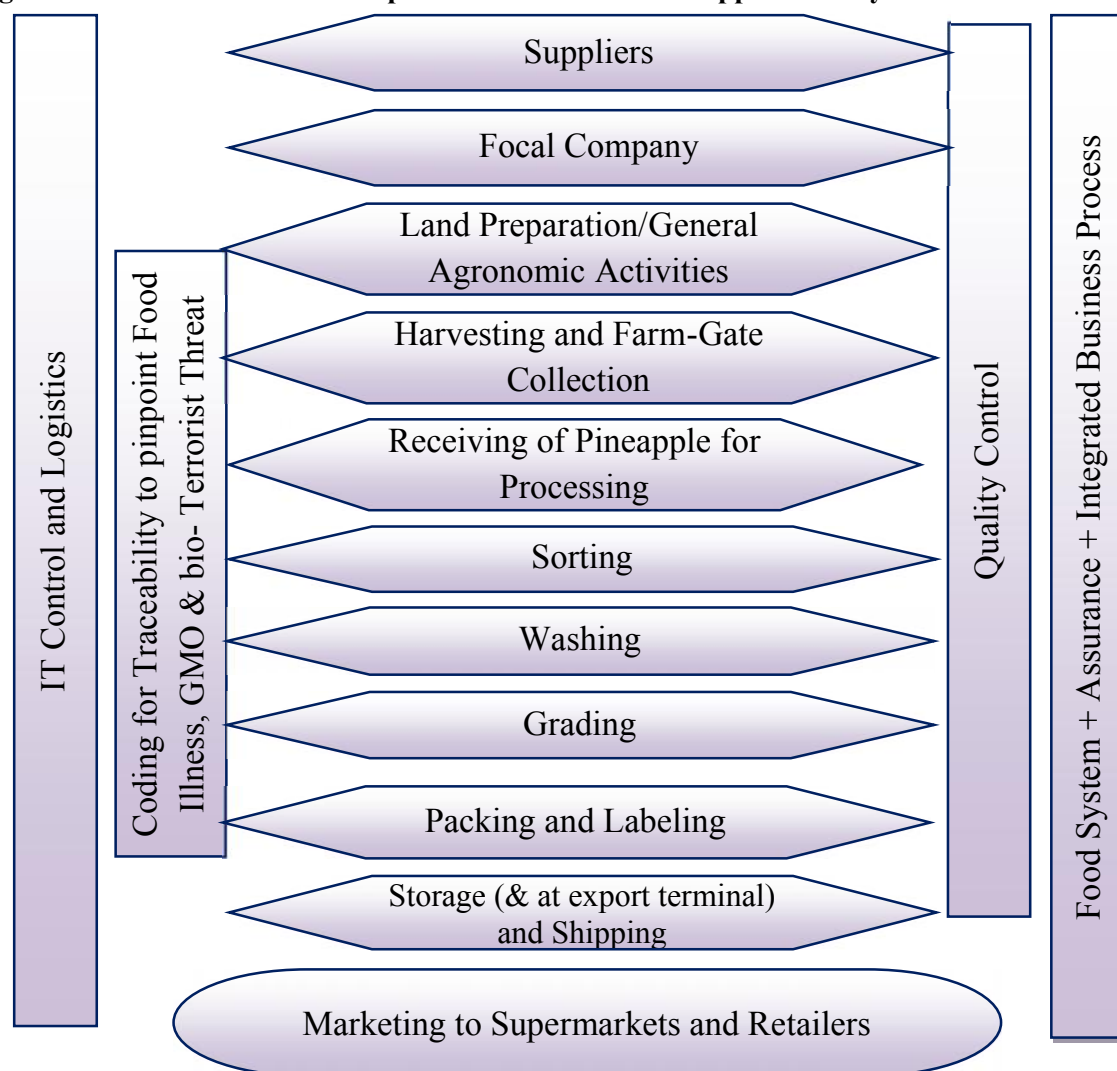
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245 Source: Adapted from Ahmad & Fehér 2009

246 The supply chain network explains the supply chain process of pineapple production that has been
 247 discussed in the literature for this study. Figure 2.3 outline the stages of pineapple production starting
 248 from the agronomic practices such as nurseries activities and growers activities, followed by harvesting
 249 activities, packaging and/ processing activities, storage activities, bulk transportation activities,
 250 distribution activities, wholesaler/retailer/customer activities, consumer activities and waste

management activities. All the nine stages are moderated through the marketer (market knowledge, communication and coordination). Figure 2.4 shows flow chart of business processes of SCM of Pineapple industry

Figure 2.4 Flow chart – Business processes of SCM of Pineapple industry



Source: Adapted from Ahmad & Fehér 2009

Figure 2.4 also explains the flow chart or business processes of SCM in the Pineapple industry. Suppliers, focal company, land preparation and general agronomic activities, harvesting and farm-gate collection, receiving of pineapple for processing, sorting, washing, grading, packing and labeling, followed by storage and shipping and finally, marketing to supermarkets and retailers. All these processes are affected by IT control, logistics and food system, integrated business process among

others. The focal company also ensures quality control from their suppliers to the storage and shipping processes. Finally, from the agronomic stage to the packing and labeling stage the certification organisations and the focal firm ensures that there is compliance of coding for traceability to pinpoint food illness, bio- Terrorist Threat, etc. This is because the new age consumers are becoming more health conscious in terms of hygiene, source of the food, ingredients of processed food and caloric content (Loader and Hobbs, 1999). Therefore enforcement of standards and also to carry out certification by organisations such as: Fair Trade, GLOBALGAP, TESCO and HACCP right from planting to-produce, best pre-harvest practices is mandatory for each grower, for ultimate produce traceability. Otherwise, fresh produce pack will be rejected by the buyers.

3. METHODOLOGY

The study targeted pineapple producing organisations in Ghana. Three organisations were selected based on experience in the field and their readiness to provide data and other relevant information for the study. Names of the elected organisations are withheld for ethical reasons. The study adopted qualitative approach using primary data. Departmental heads and supervisors from the selected organisations constituted the target population of the study. Eight (8) people from each organisation, (comprising two (2) each from administration, procurement, production, marketing departments and units) totaling twenty-four (24) were purposively selected based on their ability to provide relevant information to the study. The primary data was collected using semi-structured interview and observation instruments. The data obtained was analysed through deductions and inferences.

Based on the data collected from the interview and the observations made, the supply chain network for pineapple production and export was mapped using Microsoft Word 2007 Software. This was presented to the representatives of the organisations involved in the study for revision and confirmation as the true reflection of the activities on the ground. The necessary corrections and revisions were

301 made based on the collective advice and consensus of the respondents. The value chain of pineapple
302 production and export was finally re-mapped graphically.

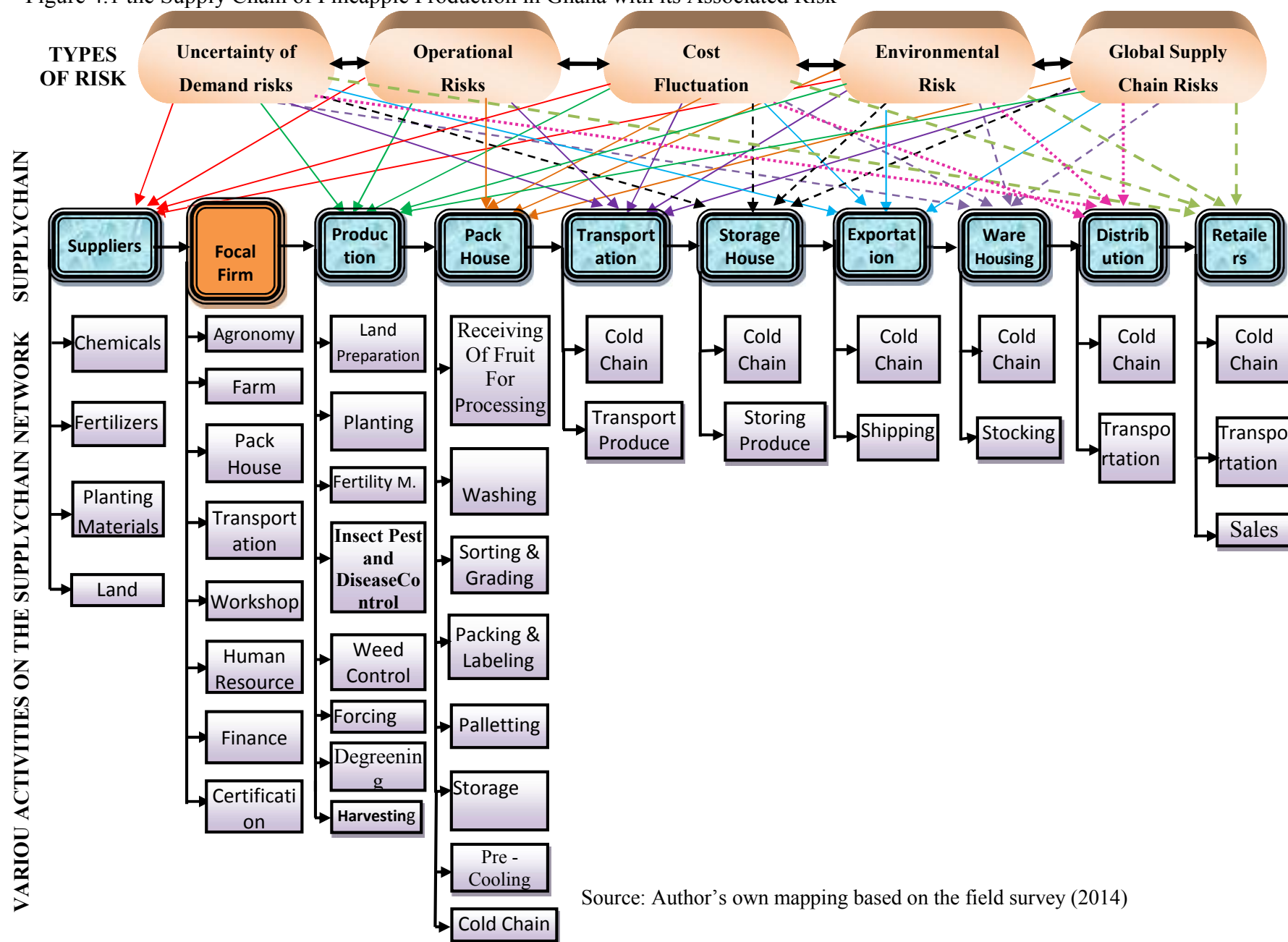
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304 **4. RESULTS AND ANALYSIS**

305 **4.1 The nature of pineapple supply chain in the selected organisations**

306 The pineapple supply chain network in Ghana and their activities involved is graphically illustrated in
307 Figure 4.1. This is based on the interview session held with the three selected organisations involved in
308 the study and the observations made during the studies. The stages and the associated activities at each
309 stage on the network, start from the suppliers who supply various inputs and logistics for production
310 through to the retailers where consumers pick up the produce for consumption. Tier one indicates the
311 suppliers involved in the pineapple SC, followed by the focal firm (pineapple producing companies).
312 This is followed by the production stage, pack house activities, transportation, storage, exportation,
313 warehousing, distribution and retailers. The various activities are indicated under each tier on the
314 network shown in figure 4.1.

Figure 4.1 the Supply Chain of Pineapple Production in Ghana with its Associated Risk



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

5.1 DISCUSSIONS

Three pineapple production organisations involved in the study were interviewed on the business process and activities involved in the production of fresh pineapple fruits. It emerged from the interview sessions that the value stream of pineapple production starts from supplies of production inputs through to Sale of fresh pineapple fruits to final consumers (retailing). Various stages of value addition along pineapple supply chain in Ghana as established from the interview session and observations are detailed in table 5.1

Table 5.1 SC Processes and Activities

SC Stages of Value Addition	Business Processes and Activities
Suppliers activities	Supplies of production input: land, chemicals, fertilizers, planting materials.
Focal Firms	Production and Export of pineapples
Pineapple Production	Land preparation, Planting, Agronomics activities (Fertility Management, Insect Pest and disease control, Weed control, Forcing, Degreening) and Harvesting.
Pack House activities	Receiving of fruits, washing, Sorting and Grading, Packaging and Labeling, Palletting, Pre-cooling and cold chaining.
Transporting	Transporting produce and Cold Chaining.
Storage House (Export Terminal)	Storing produce and Cold Chaining.
Exportation	Shipping and Cold Chaining.
Warehouse	Stocking and Cold Chaining.
Distribution	Transporting produce and Cold Chaining.
Retailing	Sale of fresh pineapple fruits to final consumers.

Source: Author's field survey (2014)

The first stage in the pineapple production process is the Suppliers activities which involve supply of production inputs: land, chemicals, fertilizers, planting materials to the production organisations (the focal firms). This is followed by the activities of the focal firms, i.e, mobilising and allocating resources for the production and distribution of fresh pineapple fruits. Production stage has to do with preparing the land, planting activities, agronomics activities (Fertility Management, insect pest and disease control, weed control, forcing, Degreening) and harvesting of pineapple. The freshly produced pineapples are then sent to the Pack House. Pack House activities, which follows harvesting involves receiving the fresh fruits, washing, sorting and grading the fruits. It also involves packaging and labeling, palletting, pre-cooling the fruits

to the desired temperature that will keep the freshness of the fruits. This condition is maintained and preserved through consistent refrigeration, a situation referred to as cold chaining.

Transportation is a crucial value adding stage in the pineapple SC since it constitutes the logistical driver of SC and creates place utility. It involves in the distribution and transporting (physical movement) of the fresh fruits to various points of needs, i.e. the ports and various retail points to reach the final consumers. At the export terminal, pineapple products are stored in the temporary Storage House prior to export to maintain the freshness through cold chaining.

Exportation stage is where physical movement of the pineapple produces from the producing country to the destination countries takes place through Shipping. At this stage the required temperature is again maintained through cold chaining. The fresh pineapples are then warehoused at the destination countries prior to distribution. Distribution involves inland movement of fresh pineapples to the various wholesale and retail outlets in their fresh state. Finally the fresh pineapples are sold to the individual final consumers for consumption. The process involved in fresh pineapple fruits supply chain is mapped in figure

5.2 Conclusion

The study was set out to evaluate fresh pineapple production processes and activities in Ghana and to graphically map the various stages of value stream involved. The study established that pineapple SC processes and activities starts from the supply of pineapple production inputs from various suppliers to production of pineapples, export, through to retailing at the destination countries (fig.4.1 and table 5.1). The SC mapping developed from the study could serve as management tool that can be applied in the production of fresh pineapple fruits to improve efficiency and productivity. We recommend that parties in the pineapple SC should collaborate and coordinate their activities through effective communication and information sharing in order to maximize consumer satisfaction and SC profits.

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