International Food Research Journal 25(2): 481-486 (April 2018)
Journal homepage: *http://www.ifrj.upm.edu.my*

The analysis of a vertically integrated organic rice company: a case study in Thailand

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Article history

Received: 11 December 2016
Received in revised form: 16 January 2017
Accepted: 17 January 2017

Keywords

Business Process Analysis
Vertical Integration
IDEF0
Organic Rice
Value Chain

Abstract

Vertical integration is one of the corporate strategies implemented in large companies in several industries, such as oil, cement, IT and food. Our objective is to analyse the supply chain of a medium-sized vertically integrated organic rice company, comprising a farm, a rice mill, a packing house and retail stores. Due to the limited number of vertically integrated organic rice stakeholders in Thailand, we scale our study to a single case. An in-depth interview was performed to collect data so that we could analyse the business process using Integration Definition for Function Modelling (IDEF0) and suggest improvements. We compare key aspects such as quality, supply quantity, reliability, cost and lead time between general and vertically integrated elements of the organic rice supply chain. A vertically integrated company has the advantage of the ability to control the quality and quantity of organic rice throughout the supply chain, however, a medium-sized company has less economy of scale and less flexibility compared to large vertically integrated companies in Thailand. The company is obliged to contact a group of farmers to source the organic rice from an external chain. The company should then centralise the information so that it can be shared and a traceability system can be implemented.

Introduction

At present, the demand for organic rice is increasing due to an awareness of health, safety and environmental issues. The key export markets of organic rice include the European countries, particularly Germany, the United Kingdom and France. Other major markets importing organic rice are the United States of America, Japan and high-income countries in Asia such as Singapore, Hong Kong and Malaysia (FAO, 2013).

Traditional rice is the main export product of Thailand with a value over billions US dollars per year. Surprisingly, only no official export statistics exist for Thai organic rice (FAO, 2013). The data can be retrieved by special request. Based on statistics for the export volume of organic rice from 2007 till today, the amount of organic rice is only 0.48% of traditional rice (Office of Agriculture Economic, 2015; Department of Foreign Trade, 2015). However, organic rice export has shown an increasing trend since 2007. In 2014, the export volume of Hom Mali rice was 1.87 million tons, with a value 1.63 billion dollars. The cultivated area in 2013 was increased by 0.61% from 2012 (Bureau of Rice Trade Administration, 2014); however, the supply of organic rice is limited due to requirement of organic rice production and a bottleneck in the certification system at farm and rice mill.

A vertically integrated chain is a supply system which is fully integrated and completely systemwide-controlled, including production, processing, marketing, and planned by the central authorities (Mpoyi, 2003; Rozelle and Swinnen, 2004; Dries and Swinnen, 2004; Swinnen and Maertens, 2007).Integrated businesses may face risks due to inappropriate technologies that lead to less flexibility. In the traditional supply chain, a company can move its sourcing to another supplier with better technology fitted to shifting market conditions (Harrigan, 1983; Harland, 1996). Vertical integration is one of the corporate strategies leading to a greater control of raw materials, from the upstream supply chain down to manufacturing and distribution in the downstream supply chain, so that the company can tightly regulate across the entire supply chain (Zhang, 2013; Grant, 2016). This strategy is opposed to the outsourcing motivations. There are many large companies using this strategy, such as Apple, Oracle, PepsiCo Inc., General Motors Co., and Boeing Co. (Zhang, 2013). Hart and Tirole (1990) proposed a theoretical model to present the effect of vertical integration on competitive environments in the upstream and downstream markets and estimate

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the market situation under different conditions. They analysed the economic aspects of vertical integration, such as market competition and social welfare. They also explained the applications of vertical integration in three case studies, the cement and ready-mixed concrete industries, the computer reservation system in airline industries and railroad terminal cases.

There are various studies exploring the benefits and risks of vertical integration, such as Röder (2007) who studied its implementation in the leading international media corporates, and Walston *et al.* (1996) who studied vertical integration in the health care industries. They also evaluated firm performance, and Lehtinen (2012) studied the advantages and disadvantages of vertical integration in the construction industry. There exists some literature related to the competitive effects of economic aspects of vertical integration (Hart and Tirole, 1990; Riordan, 2005; Bresnahan and Levin, 2012). Harrigan (1984) proposed a framework to develop effective vertical integration strategies based on theoretical establishments based on firm behaviour. Zhang (2013) studied how strategies affect changes of the vertical integration level and performance. The results showed that changes in vertical integration level depend on the costs and benefits.

Prasertwattanakul and Ongkunaruk (2016) analysed the business process, identified problems and recommended improvements in efficiency for the supply chain of a community enterprise in Uthai Thani in Thailand. Vorapai and Ongkunaruk (2016) studied risk management in the Geographical Indication rice supply chain of a community enterprise in Phatthalung. Sharma *et al.* (2013) explored the rice supply chain in India. They analysed supply chain activities such as procurement, inventory management, distribution and collaboration with the downstream supply chain and proposed a supply chain redesign to improve management of the rice supply chain.

Our objectives are to analyse the business process of a vertically integrated organic rice supply chain of the case study company. Then, we compare key issues such as quality, supply quantity, reliability, cost and lead time between traditional and vertically integrated organic rice supply chains. The key activities and problems of the case study are analysed by using Integration Definition for Function Modelling (IDEF0), which is used to analyse business processes in the agricultural supply chain, such as in hotel, restaurant and catering (HORECA) businesses (Ongkunaruk and Kessuvan, 2013), and in a raw milk collection centre (Ongkunaruk, 2015).

Materials and Methods

We conducted the analytical research based on the purposive sampling. The company has been selected based on the certified organic list. First, we searched for the website of certification bodies for international standard such as Organic Agriculture Certification Thailand (ACT) who received the accreditation from the International Federation of Organic Agriculture Movements (IFOAM). Then, we selected and contacted the certified IFOAM rice farmer and manufacturer from the ACT website. We selected the case study since there are only a few cases of vertically integrated organic rice companies which are certified by IFOAM. We selected this company because the owner is open-minded, positive thinking and willing to provide information. In addition, he allowed us to visit the farm, miller and retail stores. Next, we conducted an in-depth interview with the owner of a vertically integrated company so that we could identify the supply chain and the major activities such as planning, sourcing, making, delivering and returns. We then analysed the business processes in terms of farm and processing activities, using Integration Definition for Function Modelling (IDEF0). IDEF0 is a tool to model the activities of an organisation or system (Colquhoun *et al*., 1993; Ongkunaruk and Kessuvan, 2013; IDEF, 2014). The activities are characterised using square boxes with a code in the right corner in order to indicate the rank of each activity, such as A1, A2 and A3. Activities can be defined by their inputs, outputs, controls and mechanisms, which are denoted by four types of arrows. The input arrow indicates the material and information that drive the activity, denoted by the arrow entering the activity box on the left. The output arrow leaving the activity box on the right denotes the material or information created by the activity. The control arrow entering from the top represents the standards, regulations, or requirements of the activity. Finally, a mechanism arrow entering the bottom of the activity box indicates resources such as people, machines and/or equipment that are used to perform the activity (Ongkunaruk, 2015). A solid line indicates the current activities and a dashed line identifies the improvements that are suggested after investigation of the business process.

Results and Discussion

Company background

The owner of the company has been in the family rice business for decades. In 2008, he began to learn how to farm organic rice because he thought that the

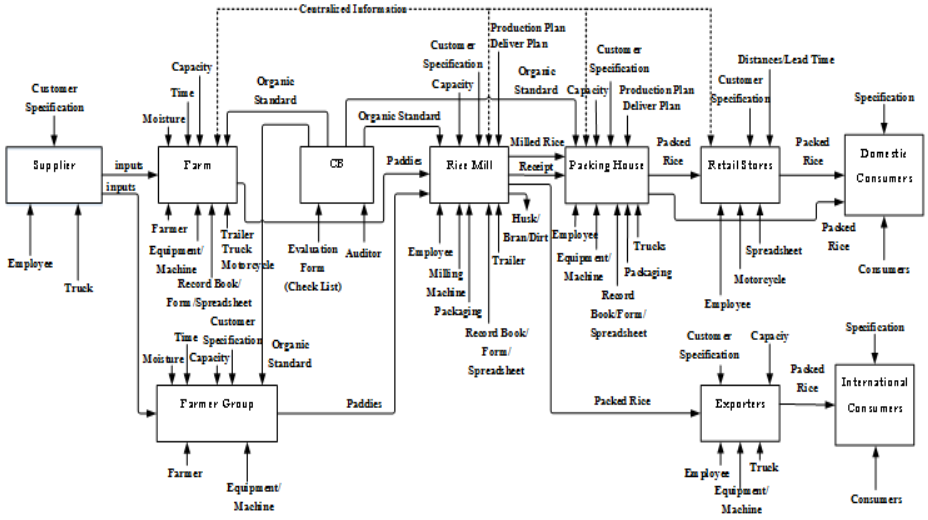

Figure 1. The business process of a vertically integrated organic rice company (IDEF0 level 0)

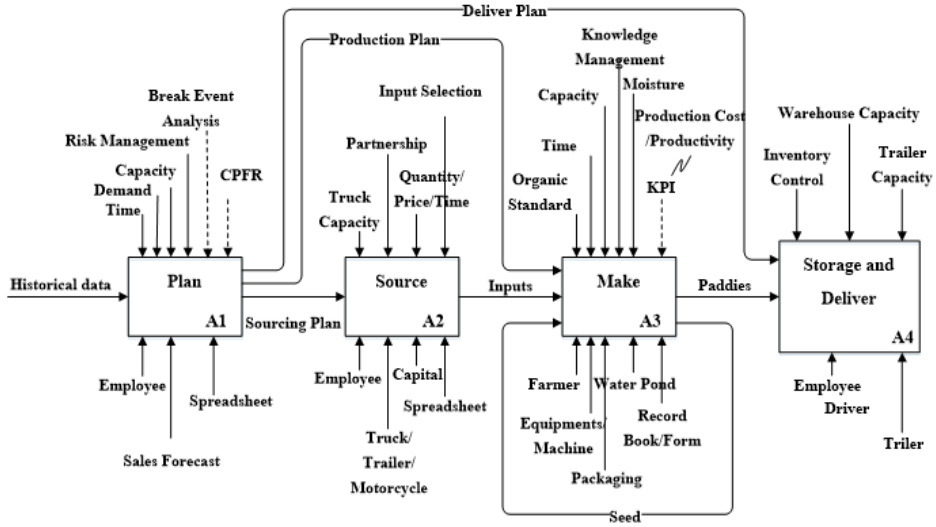

Figure 2. The business process of an organic farmer (IDEF0 level 1)

current organic products were of poor quality and not safe to consume. He learned organic farming from Khao Kwan Foundation and started cultivating jasmine rice (Hom Mali), glutinous rice (sticky rice) and brown rice. At present, the farm and rice mill are certified to the national standard of organic farming and processing accredited by the Rice Department, called Organic Thailand, for domestic consumption. The farm is also certified to the international standard, called EU for the EU, and COR for Canada, respectively, which are accredited by the Organic Agriculture Certification Thailand (ACT).

The quality inspection of rice paddies relates to moisture content, head and broken rice yields. Rice prices are decided based on market price, export price, and rice mill prices. The company also owns an organic rice mill with a capacity of one ton/day. Organic farming contributes to better health and a better environment. The owner is proud to be organic farmer. He needs the government to minimise unnecessary regulation, reduce barriers to export, expand distribution channels for organic products, and support the price gap between organic and non-organic products. He stated that the cost of organic farming is less than that of chemical farming due to no chemical substances cost. The first year after converting to organic farming, he had lower yields, but productivity has been gradually increasing over time.

Organic rice supply chain of a vertically integrated company

The company owns 9.6 hectares of organic rice farming in the north of Thailand, an organic rice mill in the north of Thailand, a packing house in central Thailand and 22 retail stores in Bangkok and

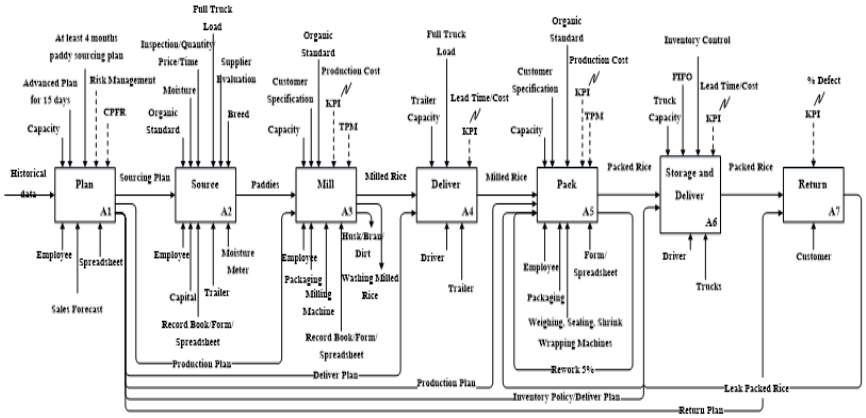

Figure 3. The business process of a rice mill and packing house (IDEF0 level 1)

Table 1. Summary of current problems and suggestions for improvement

Activities	Problems	Improvement guidelines
Plan	Lack of CPFR	Centralised information among farms, mill, packing house and retail stores.
Source	Lack of traceability	Construct traceability system
	Low productivity	TPM
Make	High volume of water usage	Implement green technology
Deliver	Real-time tracking	Real-time control

metropolitan areas, as shown in Figure 1. A solid line implies paddy flow and the dashed line implies milled rice flow. The other stakeholders are a supplier who supplies the input for farming, and a group of farmers that forms a strategic partnership of the company. The company sources organic rice from this network. They have also three certifications, the international standard (certified by ACT), the national standard (Organic Thailand by The Rice Department) and the local standard (The Northern Organic Standard Association: NOSA). Third party logistics providers (3PL) deliver organic rice directly to consumers in the domestic market. The company also sells rice to exporters.

Business process analysis of the company

The analysis of a vertically integrated company business model starts from level 0, which is similar to its supply chain, as shown in Figure 1. At present, there is no centralised information system, so each stakeholder individually plans, forecasts and replenishes separately. Due to a limited amount of paddy in the chain, the company sources organic rice from a group of farmers to fulfil the demand in both domestic and international markets. Also, there is no traceability system. We suggested that the company should set up a centralised information system so that the vertically integrated company can perform collaborative planning, forecasting and replenishment (CPFR) to increase efficiency of the supply chain performance and improve customer service in terms of traceability in the system.

The certification body plays an important role in the organic rice supply chain, verifying that the product is approved to be organic. There are limited numbers of farms which can be certified, however, and the number of certification bodies is limited, especially for national certification by the Rice Department. We analysed the activities at the farm, rice mill and packing house, as shown in Figure 3 and 4, respectively. We identified the current input, output, control and mechanisms and suggested that there are missing controls, such as CPFR, break-even analysis, and appropriate key performance indicators (KPIs) such as cost, lead time, and defective rate. The company should also implement Total Preventive Maintenance (TPM) in the milling and packing processes so that the yield of milled rice is increased while the defective rate is reduced.

Proposed strategies for supply chain management improvement

A summary of current problems and suggestions for improvement of the vertically integrated company is presented in Table 1. Information technology could help improve efficiency in the supply chain management, such as in information sharing, traceability, and real time tracking. To increase yield or productivity, the company could also implement green technology and Total Productive Maintenance (TPM). These strategies could reduce waste or increase yield in a milling process. Next, we compared key aspects between traditional and vertically integrated elements of the organic rice supply chain, as presented

Table 2. Comparison of the key aspects of traditional and vertically integrated organic rice supply chains.

Aspects	Performance Measurement	Vertically integrated Chain	Traditional Chain
Quality	Product conformance probability	High due to lack of tight control	Low if lack of supplier evaluation process/partnership
Supply Quantity	Proportion of raw material shortage	Limited because the company is medium-sized	Depends on the numbers and sizes of suppliers in the chain
Flexibility	Flexibility to change product mix,	High because it is depends on the owner	Low
	Flexibility to change volume,	Low because there is not enough supply (need outsourcing)	High
	Speed of new product introduction	Fast due to design collaboration	Slow if without collaboration
Reliability	On-time delivery	High since there is internal control	Low
Cost	Production unit cost Transaction cost	Low because there is economy of scale	High cost due to double marginalisation
Lead Time	Delivery lead time	Short	Long

in Table 2. In general, vertically integrated companies are large in size. However, it is different in the organic rice supply chain due to the limited supply quantity. The results show that a medium-sized vertically integrated supply chain is better off in terms of the ability to control the quality, quantity, reliability, lead time and cost of organic rice production and transactions; nevertheless, without the economy of scale due to size, there is less flexibility in terms of volume. The company contacts a group of farmers to source organic rice from the external chain. It is crucial to have horizontal integration in the upstream supply chain. Even though, the company is vertically integrated, there is no centralised information in the internal supply chain. It is required to establish such a system so that the information can be shared and the traceability system can be implemented in the entire supply chain. We found that the supply chain integration in an organic rice supply chain can increase the reliability of the supply chain. With the internal control of the vertically company, the supply quantity and quality is controlled from upstream to downstream supply chain. On the other hand, the limitation of the vertical supply chain in the organic rice is lack of flexibility. However, the owner of the case study company increases the flexibility of the supply by establishing a strategic partnership with the group of farmers. Hence, this strategic partnership is the key to implement for other supply chains as well.

Our limitation is that we only study one organic rice supply chain since it is one of major organic foods in Thailand. In addition, the number of vertically integrated organic rice companies is very small. However, it is worth to study since it can be a good guideline for other SMEs in the organic rice supply chain or other supply chains to analyse and improve their supply chain management.

Conclusion

The business process of an organic rice vertically integrated supply chain of a medium-sized company has been analysed. In addition, the advantages and disadvantages of supply chain integration have been identified. The advantage of a vertical company is that it is easy to control the quality and quantity of organic rice. However, a medium-sized company has less economy of scale and less flexibility. This company should contact a group of farmers to source organic rice from an external chain. This implies that the company should centralise its information so that it can be shared and a traceability system can be implemented afterwards. Our suggestion could be implemented to the company in the future to increase supply chain performance. Other small and medium-sized companies can learn from this case study.

Acknowledgments

The authors would like to thank the owner of the vertically integrated company, who kindly provided the necessary information for this research. In addition, we would like to thank two anonymous reviewers who kindly provide constructive suggestions and polish the manuscripts.

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