Food Supply Chain Management and Food Safety: South & East-Asia Scenario

Athapol Noomhorm and Imran Ahmad*

Food Engineering and Bioprocess Technology, School of Environment, Resources and Development Asian Institute of Technology, PO Box 4, Khlong Luang, Pathumthani 12120 Thailand

Abstract

This paper reviews current state of agri-food business in Asian economies, specifically, East Asian countries. In the post 1997-crisis era, food and agri business sector remained the least affected in most of the countries. Moreover, the sector has seen tremendous growth in recent years in Thailand, Philippines, Vietnam, and Malaysia. Korea and Japan, despite being agro based economies largely depends on imported agricultural inputs showed a different picture. Traditional supply chain has evolved into a high tech robust end-to-end distribution system with increasing emphasis on customer satisfaction across Asia. Countries like Thailand, have responded to changing faces of global agri-business by employing modern techniques like RFID traceability system. Rise of supermarkets in Asian countries is mainly driven by increasing middle class and higher incomes with increasing sense of quality and price sensitivity. Effective Supply Chain Management (SCM) is taken as a tool for combating fierce competition, cutting cost and improving economic performance. Mergers and alliances are playing vital role providing huge volumes through supermarkets but have the role of wet markets is reduced? Green initiative, on the other hand, claims improved economic performance and an alternate solution for small to mid size farm owners to stay competitive in front of large conglomerates. A brief introduction of role of food safety standard ISO22000 SCM is also included.

Key words

Food Supply Chain, Food Safety, Thailand, South East Asia, East Asia

Introduction

There are many ways to define supply chain; however, in terms of the fundamental nature it comprises of assets, information, processes that provide supply. Links of the chain are various interconnected organizations, right from the raw material and component suppliers, sub-assembly suppliers, service providers, distribution channels, and finally the consumer or customer as may be the case. In order to optimize right quality, reasonable inventory costs and to get rid of herds of suppliers to an organization, sophisticated supply chain strategies are essential more than ever before. Those strategies are often termed as supply chain management (SCM). Worthen (2006) put SCM as the combination of art and science that goes into improving the way companies find the raw materials needed to make a product or service and deliver it to customers. Basic components of SCM are plan, source, make, deliver and return. Each component of SCM involves various organizations and even sections within the organization implementing SCM progressively. Therefore, a partnership of organizations involved with a specific supply or value chain of activities could be another definition of SCM (ISTC 1998). Partnerships in SCM are of two types: Vertical integration is the term used to describe the consecutive stages in a marketing chain when they come under single ownership. Breaking With Tradition whereas partnerships in the food industry are between successive links in the food chain (e.g. retailer with processor and processor with farmer), alliances are, generally, between firms at the same level (e.g. processor with processor), hence, termed as horizontal partnerships (Hughes, 1994).

Food SCM is differentiated from traditional SCM (e.g., auto parts) due to an additional dimension of safety concerns in addition to quality. The Food Safety failures have led to the development of standards like HACCP (Hazard Analysis and Critical Control Point), GAP (Good Agricultural Practice), GMP (Good Manufacturing Practice) and various protocols have been intro-
duced by Codex Alimentarius and International Standard Organization (ISO). The latest on the list is ISO22000 that directly associated with the SCM.

This paper covers International perspective’s in supply chain management in context with food and agri-business. Situation in Asia, manufacturing and production responses to supply chain management and the importance of food safety initiatives to supply chain management.

Factors bringing changes in supply chain model in global food market

Increasing globalization of food supply chain has led to consolidation and evolution of transnational companies, whether by vertical or horizontal integration, and the development of business clusters. There are significant benefits in these economies of scale, especially improved purchasing power and greater production resources for organizations to enable them to serve differentiated customer needs. The consumer has seen the benefit of globalization in lower commodity food prices, wider product choice and the advent of “convenience” food.

However, globalization has led to increased risk to the supply chain from the spread of pathogenic bacteria present in foods specially meat and the global spread of animal disease. The impact of a major bird disease outbreak such as Avian Influenza, as shown currently in Asia and previously in the EU countries, is significant to the security of food supply (Manning and Baines 2007).

Growth of Food Sector in South East Asian Region

Thailand’s food and agribusiness sector continued to grow through the 1997–98 crisis in Asia. GDP growth in 1997 was 3.8% and 4.7% in 1998. The food and agribusiness sector grew 1.7% and 1.2% respectively. The importance has continued in 1999 with a 2% GDP growth for food and agribusiness and a 0.9% GDP overall. Vietnam, on the other hand, has experienced strong economic growth in recent years, but unlike many of its neighbors, Vietnam has not been affected by the Asian financial crisis (ITSC 1998). In 2002, the country’s gross domestic product (GDP) rose by 7 per cent. Although the urban population in Vietnam only constitutes 20 per cent of the total population, this proportion is growing with strong migration from the rural areas (Drakakis-Smith and Dixon, 1997). In addition, cities account for 70 per cent of the national GDP due to industrial and trading activities. This brings annual per capita GDP to US$1,395 in the urban centers of the country.

In Malaysia, for instance, the overall GDP growth rate was 5.1% whereas their food and agribusiness growth rate grew by 8.5%. Thailand’s GDP in 1998 was 7.0%, whilst its food and agribusiness sector grew by 11.0%. Vietnam had a GDP of 5.8% but its food and agribusiness GDP improved by 8%. The Philip-
Income Growth, Urbanization and Spread of Supermarkets

The astonishing rise of supermarkets in developing parts of the Asia-Pacific region is primarily started with the rapid economic growth, which in recent years was almost twice that of the region’s developed economies. China, for instance, now has 200 to 300 million middle-class consumers; across the region, as per capita incomes approach $10,000 and a country’s middle class expands, supermarket penetration rises sharply, reaching about 50 percent. At income levels above $20,000, supermarket shares of total food retail sales level off at 70 to 90 percent. Rapid urbanization in the region’s developing economies has also accelerated the spread of supermarkets. The Asia-Pacific region’s urban areas are expected to grow by more than half a billion people in the next 20 years, accounting for more than half of the region’s total population. The less-developed economies of the region will generate three-quarters of this growth, with urban population increases of 300 million only in China (China Retail News 2008).

Emerging technologies that will affect SCM

SCM is directly affected by the infrastructure of a country. Food commodities require specific handling tools, containers and transportation modes. For instance, frozen sea-food, fresh dairy products, fresh fruits and vegetables need to ship and store in special packaging materials, at optimum temperature and other environmental factors need to be considered that largely depend on the type of commodity. Frozen trucks, modified atmosphere packaging, over pressured container etc. are a few examples of special requirements. Therefore, developing a supply chain for a particular commodity is a lot of different from other commodities if not unique at all. Modern tools like ERP Software (Electronic Resource Planning) are increasingly employed in food enterprises throughout Asia instead of cumbersome Excel spreadsheets for inventory updating and managing suppliers and customers database. Newly emerging RFID (Radio Frequency Identification) technology is rapidly finding its way in food supply chain system to improve their ability to quickly and accurately trace the produce they sell, from the time the product arrives at processing plants, until it is exported to customers in Japan, European countries and the United States. The companies are employing the technology to reduce labor costs by replacing manual, paper-based produce-tracking systems with automated, electronic ones. Additionally, RFID will enable the firms to speed and improve their ability to trace the food’s origin, processing and expiry data in the event of a product recall. With the increasing pressure on resources and cost of quality, innovative ways of cutting transaction costs, supply line wastes and delays in delivery are combated by the innovative ideas like green productivity philosophy. The impact of the emerging technologies and the gain from them varies depending on the size of enterprise and availability of right infrastructure.

Relationship between ERP and SCM

Many SCM applications are reliant upon the kind of information that is stored in ERP software. ERP is the system that integrates all that information together in a single application, and SCM applications benefit from having a single major source to go to for up-to-date information instead of Excel spreadsheets. For example, if a company wants to build a private website for communicating with the customers and suppliers, they will want to pull information from ERP and supply chain applications together to present updated information about orders, payments, manufacturing status and delivery.

Application of RFID in Food Supply Chain

The most notable technology is Radio Frequency Identification, or RFID. RFID tags are essentially barcodes on steroids. Whereas barcodes only identify the product, RFID tags can tell what the product is, where it has been, when it expires, whatever information someone wishes to program it with. RFID technology is going to generate tonnies of data about the location of pallets, cases, cartons, and individual products in the supply chain. It’s going to produce a great deal of information about when and where merchandise is manufactured, picked, packaged and shipped. It’s going to create streams of numbers telling retailers about the expiration dates of their perishable items—numbers that will have to be stored, transmitted in real-time and shared with warehouse management, inventory management, financial and other enterprise systems. In other words, it is going to have a really big impact.

Another benefit of RFIDs is that, unlike barcodes, RFID tags can be read automatically by electronic readers. Imagine a truck carrying a container full of meat lofts entering a shipping terminal in China. If the container is equipped with an RFID tag, and the terminal has an RFID sensor network, that container’s whereabouts can be automatically sent to the involved parties without the truck ever slowing down. Provided the right infrastructure for implementation of RFID, a substantial amount of visibility can be brought into the extended supply chain.

For instance, to increase efficiency of animal production, post production and processing Seo and Lee (2007) developed a beef traceability system for animal identification to ensure that quality and sanitary meat products pass throughout the supply chain. When the RFID tagged animal passed through the automatic scale to measure live weight, its identification was read and recorded with its live weight. The identified animal ID was transferred to the hanger and maintained through slaughter house up to packing house and then printed on the label for packaged meat. Unique serial number (RF chip) was assigned to each packaged meat with animal ID to guarantee product quality and integrity. Automatic Response System (ARS) through internet is used to query information by consumers by a safe, easy and transparent manner.
Thus, consumers feed back to farmers, slaughterhouses, processing plants and retail shops can help improve quality and manage complaints in an effective and less tedious way.

**Going green—green supply chains lead to competitiveness and economic performance**

Green supply chain management is a concept that is gaining popularity in the South East Asian region. For many organizations in this region it is a way to demonstrate their sincere commitment to sustainability. However, if green supply chain management practices are to be fully adopted by all organizations in South East Asia, a demonstrable link between such measures and improving economic performance and competitiveness is necessary. Rao and Holt (2007) have outlined potential linkages between green supply chain management, as an initiative for environmental enhancement, economic performance and competitiveness amongst a sample of companies in South East Asia.

The analysis identified that greening the different phases of the supply chain leads to an integrated green supply chain, which ultimately leads to competitiveness and economic performance.

**Country profiles**

**Thailand: Frozen Shrimp supply chain**

Shrimp supply follows a cold chain which is all about getting products at their proper temperature and maintaining that temperature throughout the hand-overs in the cold chain until it reaches the consumer. Collecting data at each stage and the unbroken chain of events is often a nightmare without a proper traceability system. Recently, traceability system has attracted large conglomerates which started to apply on many products (Charoen Pokphand Foods Co. Ltd. 2007). Among them frozen seafood such as shrimps and prawns are of prime importance due to higher demand from EU, US and Japan. Thailand being world’s leading producer and exporter of frozen shrimp products, shrimp exports in 2006 topped 305,807 tonnes, earning 76,036 million baht in the processes, striving to adopt modern techniques.

RFID gives Thai shrimp exporter an edge with quick traceability over their competitors. It aims to build an advantage for local shrimp-exporters, which have to compete globally in food safety and traceability (Fig. 1). The project is being subsidized by some funding from the National Innovation Agency (Personal Communication).

In a deep study on the Strategic Development of Supply Chain Management of Thailand’s Industries; shrimp supply chain stakeholders are found to frequently apply modern management techniques in doing their business. When considered a whole picture of supply-chain system, the study found that the important function factors such as customer relation management, customer service management, order-cycle time management, product-flow management, and product development were applied to use at the medium level. However, when considered by each factor, the results stated that the related parties applied product development function and commercial approach to use in the chain system at the highest level.

Though food marketing channels are rapidly evolving in South East Asia from traditional shops to supermarkets and hypermarkets, the great majority of fresh food sold to the urban consumer still goes through a wholesale market (FAO 2006). Rapid changes in the fresh produce marketing system in greater Bangkok area are happening; government policies influence the development of food supply chains, stakeholder interactions and the role a wholesale market would play.

Several important elements appear to explain the functioning of the present marketing system:

- fast economic development is rapidly changing the structure of...
the system of stakeholders
• product technical specificity clarifies some aspects of the marketing system;
• the environmental components (domestic legal and policy factors, international trade policies and food markets, history, geography and cultural and social norms) surrounding the marketing system
• individual decisions of stakeholders within a complex network of collaborating

Fresh Produce Supply: a case to cut transaction costs

Thailand’s popular Tops supermarket chain is not just another success story of supermarkets. This chain has realized the concept of global movement of fresh commodities around the globe in a developing country like Thailand with ever increasing economic performance. In this project (1998–2002) businesses (Tops, Ahold Thailand; Syngenta; SGS; producers), research institutes (Katsetsart University, Thailand; Wageningen UR, The Netherlands) and (semi-) governmental organizations worked jointly to develop a high quality and efficient fresh produce chain in Thailand from producer to retailer. In order to curb no stock situations and cut down as many as 300 suppliers, the management initiated a ‘preferred supplier approach’, in which a small number of suppliers were selected to have strategic relationships with, reduced the total number of suppliers from 300 to 70 after critically benchmarking their performance and development potential. At farm level solutions generated were among others; Good Agricultural Practices (GAP), a safe use program for crop protection products and participation in certification programs (FAO 2007). Quality control implementation at suppliers’ location and distribution centers and introduction of GMP were the key points in achieving higher performance and quality. Lead time reduction between DEC’s (distribution centers) and suppliers and from DEC’s to stores were reduced substantially. Accuracy and JIT (just in time) reached to 98% and handling costs also reduced significantly. However, in pursuit to reducing transaction cost using economies of scale, small stakeholders’ integration has been reducing (Buurma and Saranark 2005).

Japan:

Japan is experiencing a somewhat reverse phenomena as that of other Asian markets due higher per capita income and deep penetration of international chain store operators. Supermarket operators in Japan are currently facing huge changes in their business environment. Foreign supermarket giants such as Carrefour, Costco, Wal-Mart, and Tesco have entered the Japanese market, and food distribution channels are changing rapidly. Some regional chain stores are going to extraordinary lengths to differentiate themselves from the competition. In particular, they are looking to directly source imported processed foods.

The Japanese food wholesale sector is divided by product category. Most of the large nation-wide food wholesalers in Japan started as processed food wholesalers. However, to serve their customers more efficiently, wholesalers are in the process of expanding through mergers, acquisitions, and strategic alliances to include items other than the usual processed foods, such as liquor, and frozen and chilled foods. On the other hand, smaller wholesalers are not able to survive alone due to changes in the business environment.

As the number of wholesalers shrinks, there will be fewer sources of product purchasing for Japanese retailers. In a situation in which more than 1,000 retail chain operators rely on less than 10 wholesalers for product sourcing, it will be extremely difficult for stores to differentiate themselves by their products alone. Thus, importing directly from foreign food manufacturers and suppliers is looking more and more attractive to regional chains.

Japanese consumers are more price sensitive than ever before with ever increasingly focused on quality and large volumes. Therefore, large chain owners are trying to differentiate themselves base on cost, quality and volume in addition to sourcing products overseas.

South Korea:

Being heavily dependent on imports for up to 70% of its agricultural products, S. Korea is trying to achieve self-sufficiency in specific commodities such as rice, fresh fruits and vegetables, pork and chicken. The main agricultural production is rice, root crops, barley, vegetables, fruit, cattle, pigs, chicken, milk and eggs.

Yoon (2006) takes globalization and transnational trade as a threat to Korean economy in the sense that transnational conglomerates have realized higher profits through the economies of scale in food processing, and intensified their specialization of production to increase their control on a global scale. While on the other hand Asian agricultural sector is characterized by numerous small farms, run by aging farmers with no ability to compete (Yoon 2006).

Food supply chain has experienced a great deal of technological advances over the last decade. Since 2005, law for the traceability of agricultural commodities have been in place in Korea that include beef, rice, apple, lettuce and other over 100 products. The evolution of RFID technology has eased the record keeping and traceability job to manifolds which used to be a hurdle in record keeping due to low literacy and old aged farmers or less interest in doing so. On the other hand, food safety data management is also in place which provides GAP, traceability, policies of food safety etc.

China:

Wet markets have been the most popular places to buy fresh
meat amounting 45.2 million tones (as in 2003). Despite this, the
traditional food retail sector is still dominant, but supermarket
store units are multiplying, and their share of total food retail
sales is expected to increase from 10 to 12 percent in 2002 to 50
percent by 2012. Across Southeast Asia, supermarket sales are
growing at double-digit rates. China with its first supermarket in

China has extensively adopted agrifood safety and quality cer-
tification system including GMP, HACCP, ISO9000 and EURO-
GAP. In addition China is developing its own agri-food standard.
The problem China is facing is numerous small farm owners
which are difficult to be integrated into food safety and quality
networks. Chinese agri-food chain has extra-ordinary strain of
demand due to high population and a strong will to export the
commodities making it harder organize small scale rural farmers.
To improve quality and safety, the Chinese Government encour-
ages the establishment of supermarkets. Systemic procurement
system of supermarkets has not only increased competitiveness
and higher profits, but also safety and quality objective are realiz-
ing (Hu 2006).

**ISO 22000 Series on Food Safety Management across Supply Chain**

ISO standards on food safety management systems aim to com-
plement regulatory requirements and assist in reducing weak
links in the food supply chain. Failures in food supply chain can
be dangerous and costly. A few examples of such failures without
naming or giving date of the incident have been depicted by the
ISO on their website are: glass/razor blades in baby food
(depressed market ca. £100 million)\(^\text{1}\) cross-contamination of
*Salmonella* from raw milk (76 illnesses, one death, contaminated
chocolate (245 people ill; £500 000 cost), benzene in bottled min-
eral water (160 million bottles destroyed: US$ 79 million cost),
some 65% of ISO’s food standards (700 to date) deal with analy-
sis and test methods, however, extension of these standards to
supply chain is the recent initiative taken by the ISO. In fact, ISO
has prepared a series of international standards on food safety
management systems, namely:

- ISO 22000:2005, Food safety management systems—Requirements for any organization in the food chain
- ISO 22003:2007, Food safety management systems—Requirements for bodies providing audit and certification of food safety management systems
- ISO 22004:2005, Food safety management systems—Guidance on the application of ISO 22000
- ISO 22005:2007, Traceability in the feed and food chain—General principles and guidance for system design and development

ISO 22000 specifies the characteristics of a management sys-
tem designed to

- carry out the hazard analysis,
- design the HACCP plan,
- identify the prerequisite programmes (PRP), and
- select the operational prerequisite programmes

ISO 22000 allows an organization (even small or less devel-
oped ones) to implement an externally developed combination of
control measures. ISO 22000 can be applied independently of
other management system standards. However, it can easily be
integrated with existing related management systems. The struc-
ture of ISO 22000 is aligned with ISO 9001:2000 in order to
enhance the compatibility of the two standards for the benefit of
the users. Although ISO 22000 was published only a year ago, it
has already been implemented by more than 50 countries, and at
least 350 companies have been certified to it (www.iso.org).

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Received August 4, 2008
Accepted August 23, 2008
Division of Application and Extension of ICT