CHAPTER 1

INTRODUCTION

Agro-industry is defined as an enterprise that transforms agricultural products derived from plants, marine life, aquatic life, livestock, and forestry into value-added industrial products through post-harvest technology, process technology, and industrial management systems. Agro-industry is a sustainable business since the business includes various operations among agriculture, manufacturing, and rural economic activities. Various activities in agro-industrial system can enhance profitability to partners. Partners involved in the system are farmers, wholesalers, processors transporters, distributors, retailers, and end-customers. The value creation process of agro-material occurs from farms to the food table.

The price of raw materials can be increased and nutritive value can be preserved while these are being harvested, transported, transformed, stored, and distributed. Wilkingson and Rocha (2009) explained that agro-industry is understood as an industry where postharvest activities involved in the transformation, preservation and preparation of agricultural production for intermediary or final consumption. The importance of agro-industry is increasing and occupies a dominant position in manufacturing sector because developing countries begin to grow at a faster rate. In all developing countries population growth is becoming a predominantly urban phenomenon, increasing the role of agro-industry in mediating food production and final consumption. While many long-standing commodity
exports have declined in importance, ‘non-traditional’ food exports, especially fruits, horticulture and fish products and components of the animal protein complex, have become central to developing country exports. Whether looked at from the point of the domestic market or exports, agro-industry plays a fundamental role in the creation of income and employment opportunities in developing countries. The agro-processing sector covers a broad area of post-harvest activities, comprising of artisanal, minimally processed and packaged agricultural raw materials, the industrial and technology-intensive processing of intermediate goods and the fabrication of final products derived from agriculture.

Carlos et al (2009) reported that the prospects for continued growth in demand for value-added food and agricultural products constitute an incentive for increased attention to agro-industry development within the context of economic growth, food security and poverty-fighting strategies. The demand pull created by an agro-industrial enterprise stimulates businesses well beyond the closest links with its direct input suppliers and product buyers; a whole range of ancillary services and supporting activities in the secondary and tertiary sectors of the economy are also positively impacted. Because of perishability and bulky characteristics of agricultural products, many agro-industrial plants and smaller-scale agro-processing enterprises tend to be located close to their major sources of raw materials. Consequently, their immediate socio-economic impacts tend to be exerted in rural areas. Among the world’s poor, 75% live in rural areas, having agriculture as a major source of livelihood. Fighting poverty will require that economic growth and development are brought to rural areas.
1.1 AGRO-INDUSTRY DEVELOPMENT

For sustainable agro-industry development, proper attention must be given towards quality management. Good Agricultural Practice (GAP), Good Manufacturing Practice (GMP), and Hazard Analysis and Critical Control Point (HACCP) are mandatory quality assurance systems. They are required because these quality assurance systems are to prevent biological, chemical, and physical hazard risks from material sources, operation and delivery to consumers. Food safety issues and traceability become increasingly important accelerators of change in agro-industry development. There are several cases related to food scandals and food scares. Some important examples are bovine spongiform encephalopathy (BSE), high residues of pesticides and antibiotics, dioxin and toxic chemicals in the food chain, Listeria, Salmonella and other microbiological hazards, hepatitis, and recently, avian influenza. These scandals and scares received major attention in the media and contributed to consumers’ concerns. Food safety risk is playing a vital role in quality management through increasing operation controls from farms to tables in the agro-industrial supply chain. This provides opportunities for a business to distinguish itself from its competitors.

The accelerated growth of agro-industry in developing countries poses risks in terms of equity, sustainability and inclusiveness. Where there is unbalanced market power in agro-industrial chains, value addition can be concentrated among one or more chain participants without detrimental to others. Agro-industries became sustainable only if they are competitive in terms of cost, price, operational efficiency, product offers and other associated parameters. Pricing mechanism must be developed in such a way that all the stake holders should enjoy the benefits. Establishing and maintaining competitiveness constitutes a challenge for small and medium scale agro-industrial enterprises and small-scale farmers. Although agro-industries have
the potential to provide a reliable and stable outlet for farm products, the need to ensure competitiveness favors farmers who deliver larger quantities and better quality of products. The socio economic benefit of agro industries are potentially reduced when small and resource constrained farmers are left out of supply chain. Thus when developing policies and strategies for promoting agro industries issues like components, equity and inclusiveness must be taken into consideration. A need thus exists for policies and strategies that, while promoting agro-industries, take into account issues of competitiveness, equity and inclusiveness (Carlos et al 2009).

1.2 AGRO-INDUSTRIAL SUPPLY CHAIN MANAGEMENT

The supply chain of agro-industry, as any other supply chain, is a network of organizations working together in different processes and activities in order to bring products and services to the market with the purpose of satisfying customers’ demands (Christopher 2005). Agro-Industrial Supply Chain Management (ASCM) represents the management of agricultural production, transformation, distribution, and marketing activities in which a customer is supplied with desired products. The important factors that differentiate the agro-industry supply chain and also make it complex and harder to manage than the other supply chains include; food quality and safety, limited shelf life, demand and price variability and weather related variability etc., (Salin 1998).

Fresh produce is one of the most dynamic sectors of the agro-industry (Huang 2004). The largest portion of the reported increases in consumption has been attributed by the population growth. Market changes, such as the increasing public awareness of the benefits about healthier diets and higher incomes contribute to the increase in consumption (McLaughlin et al 1999). These changes in demand and distribution patterns are expected to
continue or even accelerate in the near future (Food Agriculture and Organization 2006). Regarding the identification of future needs based on industry trends, one can mention the industry consolidation and the vertical integration of the supply chains. The consolidation of the agro-food industry has evolved from the need for economies of scale, strategic positioning, risk management and market control (Boehlje 1999). On the other hand, vertical integration has been motivated by a host of technological, regulatory and financial reasons. Additionally, there have been changes in consumer preferences, such as increased quality and product safety (Hobbs and Young 2000). The importance of ASCM requires very careful planning of the harvesting, transformation, transportation and inventory decisions to reduce the deterioration of the products and preserve their value. The development of these models is an immediate need not only for the benefit of industry but also for the benefit of the final consumers.

Quality issues in the fresh produce Supply Chain include freshness, shelf life, flavor, taste, nutrition, food safety and traceability. Product attributes can be shown as diseases, over or under expected size, undesired shape, improper uniform, and undesired quality. In practice, disorder agricultural products will be separated during grading at the farm. Disorder can occur due to several causes, such as; epidemics disease, pre-harvest treatment, harvesting methods and post-harvest handling methods. The expected quality level of produce will be diverse for markets like local retail markets, modern retailers, export markets and manufactures for processing.

The market exerts a dual pressure on agro-industrial chains, forcing them into continuous innovation and agency coordination. Classical price and quality issues are more important than ever, since consumers can choose from an increasing number of products offered by competing chains. Food and agribusiness chains are greatly affected by consumers’ concerns regarding
food quality, safety and the sustainability of food production and handling methods. Higher consumer demands regarding the quality and traceability of products and processes call for fundamentally new ways of developing, producing and marketing products (Humphrey and Oetero 2000; Omta et al. 2001). This triggers the development of grades, standards and agreements regarding good production and management practices, as well as adequate monitoring systems to guarantee prompt responses and quality compliance. Integrated production, logistics, and information and innovation systems become critically important for maintaining a competitive market position. Firms and companies involved in global food and agro-industrial chain networks are facing fast changes in the business environment, to which they must respond through continuous innovation. New procedures and practices for organizing food supply networks with direct ties between primary producers, processors and retailers emerged to cope with food safety and health demands. Optimizing the performance of individual stages in a chain usually results in sub-optimal solution that is not adequate for sustainable agro-industry business. Hence, optimizing the performance of all the stages in the integrated manner must be considered.

Twenty years from now, more than 60 percent or even more of World’s population will live in cities. This rapid urbanization and the related income increase cause important changes in dietary patterns that will in turn warrants the complete restructuring of agriculture in the world. One can expect a shift towards more fruit and vegetable consumption amongst the middle and upper middle classes. The FAO (Food Agriculture and Organization) /WHO (World Health Organization) report on diet, nutrition and chronic health indicates that changes in dietary patterns will be tremendous in the future. The greatest increases in purchasing power will be felt in the group of twenty rapidly developing countries like Brazil, India, China, South Africa and others. Beyond large changes in dietary patterns, one
may attempt to match individual health and diet, leading to an increasing awareness of functional foods. This will affect the food chain in terms of the types of products (Fresco 2006).

1.3 QUALITY RISK MANAGEMENT

As with general risk management, quality risk management can be classified in three parts. These are quality risk identification, quality risk analysis and quality risk mitigation. Quality risk assessment is usually qualified with a statement of uncertainty affecting the desired quality level of the product. Several quantitative risk management techniques have been used by practitioners and researchers. However, the unique characteristics of risk cannot easily be addressed by traditional approaches. A major problem with this approach, especially for high consequence operations, is that it may not be possible to accurately determine quantitative "cost". Furthermore, the cost may not be accurately quantifiable. Similarly, it may not be possible to accurately determine or quantify the benefit of post harvest treatment operations.

Risk assessment is crucial for the quality assurance system requirement (Good Agricultural Practice (GAP), Good Manufacturing Practice (GMP) and Hazard Analysis and Critical Control Point (HACCP). Hazard in food production systems can be characterized in three categories, biological, chemical and physical hazards. Efforts must be taken in assessing, analyzing and mitigating the risk in these three hazards. The ultimate goal of a risk assessment process in food production and the supply chain is to estimate the magnitude of risk occurrence. This may be based on qualitative and/or quantitative information. All factors can lead to quality issues and risks in the supply chain. This is a challenge for scholars to understand the holistic view
through systematic approaches in order to mitigate risk and make decisions under uncertainties.

1.4 SUPPLY CHAIN RISK MANAGEMENT

Risk management has a long history, originated from gambling, insurance and actuarial studies. However, it has evolved into a core element of general management and has spread into other business functions including logistics. The context for risk management is laid out by the organization’s broad strategies, particularly its risk strategy, which is passed on to the separate functions and forms the basis of their own risk management. The supply chain is particularly vulnerable to risk, and supply chain risk management is now growing its importance. The overall aim of SCRM is to ensure uninterrupted flows of materials, but there are many more immediate goals for good SCRM (Water 2007). The overall aim of supply chain risk management is to ensure that supply chains continue to work as planned, with smooth and uninterrupted flows of materials from initial suppliers through to final customers. SCRM is responsible for all aspects of risk to the supply chain. Specifically, it ensures that principles established by senior managers are applied to logistics risk. So, a reasonable starting point for SCRM is senior logistics managers who analyze the organization’s overall risk strategy and identifying its requirements from logistics. Then start designing their own long-term plans for risk in the supply chain which contains all goals, plans, policies, culture, resources, decisions and actions that relate to risks within a supply chain (Water 2007).

Agricultural commodity supply chain are typically risky one. Because farmers face a variety of price, yield, and resource risks which make their incomes unstable from year to year. Agricultural producers are forced to make decisions based on imperfect information. Born out of this uncertainty
is the possibility of loss is more. Agriculture producers are forced to make decisions based on imperfect information. This leads to more uncertainty in turn huge loss. It is possible the weather will destroy this crops. Traders or commission agents negotiate with farmers about price and the quantity to be purchased before time of harvest. Commission agents or traders can easily choose the most economic methods of pre-harvest and post-harvest treatment methods to secure their business. Sometimes, economical pre-harvest treatment methods and post-harvest treatment methods increase chemical hazard risks for consumers. Moreover, if a product’s price cannot absorb the cost of post-harvest treatment, this also results in loss for the commission agency.

1.5 ORGANISATION OF THE THESIS

Chapter 1: Dealt with the overview of agro industry, its development and agro industrial supply chain. Also the importance of risk management in agro industrial supply chain is emphasised.

Chapter 2: This chapter deals with; the literature review related to uncertainty, selection of post harvest technology, optimal route and risk management problems in the agro-industrial supply chain and non-agro-industrial supply chain management.

Chapter 3: This chapter provides case descriptions of a banana supply chain in India and bamboo shoot supply chain in Thailand.

Chapter 4: This chapter offers solutions for selection of post-harvest technologies, optimal route selection including risk identification, risk assessment and risk mitigation for a case study of a banana supply chain in India.
**Chapter 5:** This chapter offers solutions for selection of post-harvest technologies, optimal route selection including risk identification, risk assessment and risk mitigation for a case study of a bamboo shoot supply chain in Thailand.

**Chapter 6:** This chapter consolidates the research efforts in addressing the integrated quality and uncertainty issues in the banana and bamboo shoot and supply chains. Limitations of this research and the scope of future research work are also provided.