FOOD SUPPLY CHAIN DESIGN
CASE OF WHITE SHRIMP INDUSTRY IN THAILAND

Walailak Atthirawong
Department of Applied Statistics, Faculty of Science
King Mongkut’s Institute of Technology Ladkrabang, Bangkok, Thailand
Email: walailak_ut@yahoo.com

Ninlawan Choomrit
Department of Industrial Engineering, Faculty of Engineering
Srinakharinwirot University, Nakornayok, Thailand
Email: ninlawan@swu.ac.th

ABSTRACT

Many approaches in the design of food supply chains aims to derive products with good quality, less environmental impact and low costs. This research is undertaken to propose an integrated framework of food chain by using white shrimp industry in Thailand as a case. Three actors playing roles in chain are suppliers, farmers and manufacturers which have an effect on chain performance. With literature surveys and doing an interview in those groups lead to define business process and white shrimp supply chain. Further research directions are also discussed in this paper.

INTRODUCTION

In recently years, supply chain management (SCM) has been one of the popular talked about in the business communities. It has been defined as the network of organizations that are involved, enabling suppliers to meet their customers’ requirements reliably, dependably and consistently via cost effectiveness. In addition, supply chain management includes aspects of the physicals movement of materials, transportation and physicals distribution. Its scope also deals with management, purchasing, material requirements, manufacturing management, facilities planning, customer service and information flow. The aim of managing the supply chain is to achieve a balance between the goals of high customer service, while keeping low inventory investment and low unit cost, which are often viewed as conflicting [1][2][3]. To achieve this balance, the organization should integrate supply chain management from the external customers’ viewpoint and then manage all horizontal processes that are needed to provide the customer with added value.

The concept of SCM is developing fast; however, the practices are still little. A review of supply chain management literature reveals that the research has been investigated in variety of concepts, structures and approaches [4]. In general, the studies focused on a large industry model especially in automotive companies, electrical equipment and heavy industrial companies. However, it is still in doubt whether those findings relating to position in the chain hold true in other types of supply chain in other industries such as perishable products. Even though, there are some studies results in the food supply chain arena [6][7][8][9][10]. So far no study, however, has examined the shrimp supply chain industry, especially in Thailand, which comprises of many parties.

The aim of this paper is to examine the supply chain management paradigm in the context of perishable product using white shrimps as a case study. The paper begins with a literature survey on the recent development of food supply chain design. Subsequently, a research framework is proposed to investigate current situation of shrimp supply chain in Thailand. Finally, the paper concludes with ongoing research directions.

FOOD SUPPLY CHAIN DESIGN

The food supply chain has been a linear relationship involving the primary producers, or farmers, the manufacturers or processors who fabricate the food for the table, and the retailers who gather a range of such products and sell them to the customer. The food supply chain can be sub-divided into a number of sectors. Agriculture, horticulture, fisheries and aqua-culture are the primary producers, the manufacturers who process the food into products ready for the table or...
further cooking, together with the packaging companies, are an intermediate stage, and the wholesalers, retailers and caterers are the end stages of the supply chain. At each stage in the chain the food is passed into a new ownership and “value” is added to allow for the costs of the journey, and also to provide a small margin of profit [5].

There are several researches related to food supply chain with focusing on how to design the chain to meet the goals: saving time, reduce costs, increase effectiveness and add value. Knowledge from food process technology, operations research, environmental science, marketing and business economics has to be combined to enable the chain design. Some literatures are mentioned here as good practices.

Pan and Kinsey [6] compared the supply chain of pork between U.S. and Chaina. It was showed that the consumption and production in both countries are quite different in several aspects. Recently, the U.S. pork supply chains have changed significantly to vertical coordination. Producers and processors are linked together more tightly. Information sharing becomes and vital guide for supply chain management. Still, China’s supply chain is full of insufficient marketing system, risk and low sanitary standards. Vertical integration and contracting via the U.S. supply chain benchmark are needed for further development in this industry.

Sonesson and Berlin [7] investigated the impact of future milk supply chain environment in Sweden. A mathematical model was developed to test the material flow and used to simulated possible scenarios. The scenario technique was selected in this study as it provided opportunities to test new technology in a structure way. The results were mainly analyzed using life cycle assessment (LCA) methodology. The findings indicated that it is necessary to consider the environment effects of the milk supply chain in the whole chain. The critical factors which are needed to be considered are the packaging materials and transportation of dairy products to household.

Ioannou [8] proposed a redesign distribution network of the Hellenic Sugar Industry toward developing a transportation model to derive an optimal solution. To approach a goal in minimizing transportation cost, the constraints of meeting demand and satisfying production and storage were considered with. Annual savings and improved demand coverage were achieved from getting the optimal planning of inter-node material transfers.

Apaiah and Hendrix [9] presented an operations research technique, linear programming, as a tool in designing a supply chain of pea-based novel protein foods (NPF). To minimize the production and transportation costs under some constraints in the supply of raw materials and ingredients, and the demand of the final product, the optimal result apparently presented a design/development of a supply chain network for NPF manufacturing. With total cost comparison, the decision came up with a specific location of primary production, ingredient processing and product production areas and modes of transportation.

Huang and Sheu [10] proposed the integrated approach for analyzing the beef supply chain and strategic alliances. It was revealed that there are some unique challenges in this industry for example the lack of coordination between unorganized parties, the lack of production plans based on market demand, the problems relate to information flow and information flow or pricing of beef. These challenges have caused the difficulty to design the efficient beef supply chain. In order to improve its efficiency, it is necessary to develop strategic alliances. The paper also proposed the ideas how to combine efforts from all segments in order to improve coordination and collaboration. It also suggested that a more systematic approach is necessary to improve the beef supply chain competitive.

THE WHITE SHRIMP INDUSTRY IN THAILAND

The white shrimp supply chain comprises of a variety of distinct segments. These segments include suppliers (hatchery and nursery farms), producers (farmers), primary processors, manufacturers (frozen companies), distributors, retailers/supermarkets and customers. Figure 1 illustrates a general picture of the white shrimp chain in Thailand. Each of them links together and performs the function of production, distribution and marketing. More than 90 percent of cultured white shrimp are exported to international markets, whereas the rest of them are consumed domestically. The prominent export markets of Thai shrimp production are US and Japan.

![Figure 1 White shrimp supply chain](image-url)
FRAMEWORK DEVELOPMENT

This paper intends to illustrate the research framework for investigating white shrimp supply chain in Thailand. The study will concentrate particularly on suppliers, producers (farmers) and manufacturers (frozen companies) since they create value of the chain from raw materials through the production process to customers. The important steps in the development of research framework of this study are discussed as follows.

Initial Interview: The initial part of this primary study was conducted via site visits and in-depth interviews. Several key parties i.e. suppliers, farmers, middle men, frozen companies, government officers and relevant agencies were interviewed over a three month period between September and December, 2005. Principally, the main objective of this stage was to understand the entire supply chain from both demand and supply sides. This enables to identify and examine gaps between partners in the current situation. The following issues were identified to be critical or gaps in this industry:

- A general lack of production planning;
- Pricing of shrimp is not stable;
- Insufficient quality control, hygiene and sanitation especially from farms to markets;
- Lack of information flow into the whole chain, mostly communication through classical channels, i.e. person to person, telephone or fax;
- Many small and medium of unorganized parties and lack of coordination between them;
- The regulatory requirements depend on exporter's countries and different specific standards must be met in some countries.

Develop a Quick Scan: A supply chain oriented business diagnostic termed Quick scan [11] is firstly developed by Logistics System Dynamics Group (LSDG), Cardiff University in collaboration with automotive systems manufacturer and international consultancy [12]. It has been widely applied in a variety of businesses over a number of years. The goal of the Quick scan is to collect data to clearly understand of what happening, as well as document and assess the weakness of supply chains between different partners. As such, in this research study, the Quick scan is conducted via four data collection techniques i.e. semi-structured interviews, questionnaires, process mapping and archival data. It aims to triangulate information in as many as different forms as possible. The adequate understanding of the area with the greatest uncertainty may help an enterprise to prioritize its resources when embarking on an improvement program. An overview of the Quick scan process utilized in this study is displayed in Figure 2.

![Figure 2 Quick scan overview](image)

In this research five different types of questionnaire were constructed to gain understand and document the industrials partners’ current practices in relation to their supply chain. The questionnaires include questions relate to internal, inbound and outbound logistics and product to determine of process, supplier, demand and control uncertainty sources [11][12]. Each answer will be coded using a five-point Likert Scale. ‘1’ means strongly disagree, whereas ‘5’ means strongly agree. Each of questionnaires will be then completed by each player both in demand and supply sides. Moreover, they are also required to rank barriers or problems which they are facing in this industry. The questionnaire was pre-tested with relevant practitioners and academics. After validation and verification, these questionnaires will be then issued to relevant parties i.e. suppliers, farmers, middle men, frozen companies, government officers and relevant agencies and followed by interviewing. The study is conducted mainly in Chonburi, Chasengsao and Samut Sakorn provinces. This stage is still in the process of collecting data. The authors intend to report the final results in the due course.

Value Stream Mapping (VSM): VSM is an industrial engineering tools employed to this study in order to understand and identify value and waste within a given business process [13]. Process activity mapping is found to be useful to map every step of activity from production to purchase of white shrimp products by the customer. It aims to identify key wastes, problems and opportunities across the supply chain. These activities will therefore be categorized into value adding activities, non value adding activities or non value adding but necessary activities as well as the time taken in each activity. It will help to provide insight into where productivity improvements or future state vision could be made.
Workshop: Approximately, 50 people who are involving in shrimp supply chain industry in Thailand will be invited to join the workshop. One day workshop will be arranged to brainstorm and discuss about the collaborative relationship among each party to improve overall supply chain.

Develop Business Process Model: The final stage of this study is to develop business process model for mapping the current shrimp supply chain from suppliers, producers (farmers) to manufacturers (frozen companies) using IDEF model. IDEF (Integration Definition For Function Modeling) is a group of modeling method which was primarily created by the Unite State Air Force in the late 1980’s. IDEF0 is deployed as a useful tool for describing and modeling a sequence of activity processes or a system. All activities will be described in terms of inputs, outputs, controls and mechanisms. Analysis of business processes will help us to capture and understand all the relevant information flow before radically revising them, in order to accommodate their improvements.

This research is still far to complete. The development of a research framework for applying VSM, arranging workshop, as well as developing business process model is an area for further investigation. It is hoped that this study will shade the lights on the better understanding of the current development and practices of the white shrimp supply chain in Thailand. A range of these techniques brought together in this study may help us to bring those challenges into the possibilities that can be improved the supply chain performance and give directions for action.

CONCLUDING REMARKS AND FUTURE DIRECTIONS

The paper has briefly reported on the proposed framework for investigating the white shrimp supply chain in Thailand. This current research is still at an early stage. An analysis will last by the end of this year and becomes more informed after the supply chain is mapped. However, it can be seen that there have been a number of issues raised from the preliminary data collection. A research framework presented here will aid in the understanding of what happening in terms of the current state of the whole shrimp’s supply chain. Future research will bring these tools together to map the entire supply chain and identify the possibilities for improved overall supply chain performance.

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