

An Exploratory of Thai Herbs Supply Chain Connectivity: A Case Study

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Abstract

The worldwide demand for herbs is increasing yearly, especially in the treatment and beauty industry. The northern part of Thailand is one area that grows herbs and supports domestic and international markets. Even though growing herbs in the Northern area generate a high value in the Thailand herbs market, the stakeholders in the supply chain system of the herbs business are still faced with some barriers which affect the performance of the company, the quality of the products, and marketing. Therefore, this study aims to investigate the current situation of Thai herbs' supply chain management system and also find the essential barriers and opportunities for Thai herbs' supply chain management. This study focused on the three potential herbs, which are Limonella (*Zanthoxylum Limonella*), Turmeric (*Curcuma longa* Linn), and Kariyat (*Andrographis paniculate*). The unstructured interview was used to collect the data from the stakeholders in the supply chain system. The finding of this study found that there are some barriers, such as market distance barriers, marketing barriers, and lack of laboratory tests. Different opportunities arise for Thai herbs' supply chain management, which includes resourceful location, adequate labor force, government promotion, and international market demand. The results of this study can be the guideline for further research of researchers and other related industries.

Keywords: Thai herbs; Supply chain management; Limonella; Turmeric; Kariyat

Introduction

Nowadays, the global herbal market is overgrowing. Many countries can make a profit from selling herbs worldwide due to the increase in customer demands for both treatment and beauty. The trend of using herbs as a medicine is around 80% of the worldwide population, and it can reach 95% in developing countries (Rivera et al., 2013). Herbs also used to be the main components in many products such as cosmetics, medicines, food, beverages, and other products. In 2020, it was estimated that the value of herbal remedies and global herbal supplements would be around US \$115 billion (Witkittiluck & Kortana, 2021). The countries with a high market value of herbs are Japan, Korea, China, France, Germany, and Asia.

In Thailand, more than 300 kinds of herbs are in the global herbal market. The value of exporting herbs is around 100,000 baht annually, comprised of herbal extracts, fresh herbs, and

cosmetic products (Witkittiluck & Kortana, 2021). The Thai spices in the food supplement group have a full use and export value of more than 80,000 million baht, while the spa group and products are worth about 10 billion baht, and the traditional medicine group, according to the wisdom of Thai traditional medicine, is worth about 10,000 million baht. The Covid-19 pandemic at present also increased the domestic demand for Thai herbs, especially in the pharmaceutical industry and cosmetics, which have received a lot of attention from entrepreneurs interested in using herbal extracts to produce medicine and cosmetic products. The northern part of Thailand is one of the areas which grow herbs, and the value of the herb market is around 10,000 million baht. Although the growing herbs in the Northern area generated a high value in the Thailand herbs market, stakeholders in the herbal businesses in the north of Thailand are still faced with barriers which made the performance of their businesses, the quality of the product, and the supply chain system inefficient. Therefore, this study aims to explore the supply chain management of the herb businesses in the Northern part of Thailand, which focuses on three main herbs comprise of Limonella (*Zanthoxylum limonella*), Turmeric (*Curcuma longa* Linn), and Kariyat (*Andrographis paniculate*).and find out the key opportunities and barriers of supply chain management. This study is organized as follows: Section 2 literature review. Section 3 illustrated the research methodology. Finally, the results and conclusions are presented in section 4.

Literature Review

Supply Chain Management

Supply chain management is concerned with the planning and managing all logistics activities along with the supply chain system. It also includes collaboration and coordination with the stakeholders. For a supply chain management network, there are three main aspects of the company's network structure: 1) supply chain stakeholders, 2) structural dimensions of the network, and 3) the different types of process links across the supply chain (Lambert et al., 1998). Many researchers studied supply chain management in various industries, such as Zhou et al. (2014), who investigated supply chain practice and information quality for North American manufacturing companies. Rai et al. (2021) studied supply chain responsiveness, focusing on logistics performance, supplier, and downstream responsiveness in the Indian garment industry. Panich et al. (2018) examined vital success factors for improving the supply chain management efficiency of community-based tourism in Thailand. Nayak et al. (2021) studied the supply chain management of the Indian manufacturing industries, which focused on the green concept and determined the driving and challenging forces in the case study. Min (2021) applied the international organization decision support system to synchronize and coordinate the flow of information systems of the global supply chain management network. Hasachoo and Kalaya (2013) studied the supply chain management of the longan fruit trade between the North of Thailand and China for the competitiveness of local agriculture. Rajak et al. (2021) assessed the efficiency and effectiveness of sustainable transportation by focusing on supply chain management. Loukili et al. (2021) evaluated performance and organizational management by focusing on the case study of the Mohammedia port. Therefore, supply chain management became a role in many industries for managing all logistics activities and their supply chain system.

Supply Chain Management in the Herbal Industry

The herbal industry is one of the industries which applied this concept to increase the efficiency of the supply chain system. Some research papers have studied supply chain management related to herbals, such as Octavia et al. (2020) analyzed the effect of supply chain management of Indonesia's traditional herbal medicine on the competitive advantage and the capabilities of innovation perspectives. Golonko et al. (2021) have studied integrating the supply chain in the herbal industry in Poland, which focused on the economic aspects. Suresh (2008) identified the opportunities and the challenges for quality assurance of herbal raw materials in the herbal product manufacturing industry. He and Shi (2021) used internet of things agricultural sensors, which applied to the circulation traceability system of the Chinese herbal medicine supply chain. The internet of things used to be the platform for planning and implementing data inspection and traceability system details. Litvinova et al. (2020) applied the supply chain management concept to study laminaria herbal substances for the pharmaceutical industry. This study focused on the selection of the various transportation types and routing for the delivery of raw materials through both the territory of Russia and China. Ye (2017) analyzed the supply chain management of herbal medicine enterprises in China which focused on the operations costs. Warathaphorn & Suteera (2021) studied the supply chain structure of the Thai innovative cosmetics industry, which started from the upstream industry (the production of raw materials), midstream industry (manufacturers), and downstream industry (distribution and marketing channels).

Even though some research papers applied the supply chain management concept to the case of herbals, few research papers studied the supply chain management of Thai herbs, especially the supply chain management of Limonella, Turmeric, and Kariyat. They are potential herbs in high demand in the domestic and international markets. Therefore, this study focused on investigating the current situation of the Thai herbs supply chain and finding the essential berries and opportunities for Thai herbs supply chain management.

Research Methodology

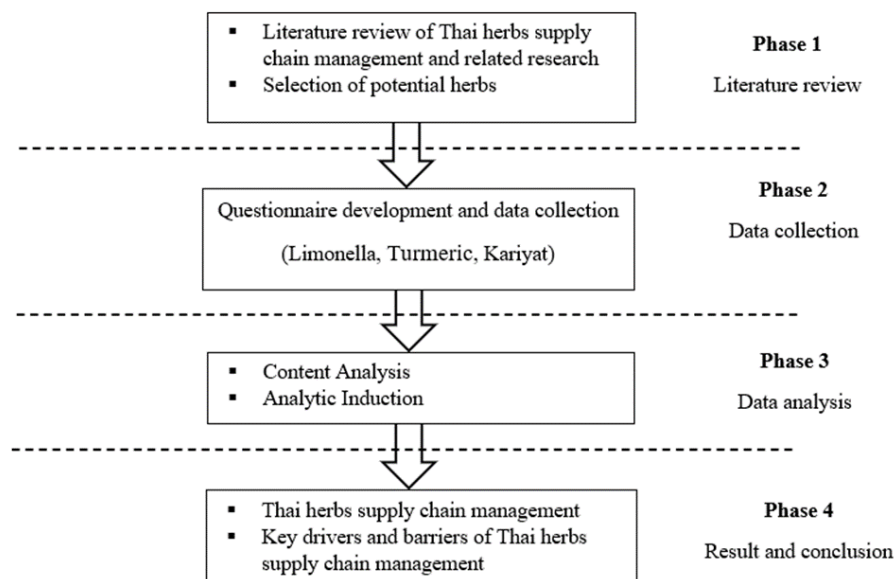


Fig. 1 Research methodology

This study has four phases to explore Thai herbs supply chain management and discover the key drivers and barriers of Thai herbs supply chain management.

Phase 1: Literature review

The first phase of the study was to study the overview of the Thai herbal industry, the current situation of the Thai herbal industry, and related research papers to get important information about the herb industry in Thailand, such as planting areas, statistics of potential herbs, etc. Then use all information to select the size of the study, which is in the Northern part of Thailand, and the possible herbs of the case study, which are Limonella, Turmeric, and Kariyat.

Phase 2: Data collection

For data collection, this study selected three potential herbs, Limonella, Turmeric, and Kariyat, to be the case study; these three herbs have high market demand and have a large area of cultivation in the northern region. The questionnaire for an interview was developed, and the sample was selected following the processes of the supply chain system, which are upstream, midstream, and downstream, using purposive sampling for each type of herb presented in Table 1.

Table 1. Sample Size of the Herbs

Samples size	Number of samples
Limonella farmers	2
Turmeric farmers	2
Kariyat farmers	2
Limonella collectors	2
Turmeric collectors	2
Kariyat collectors	2
Limonella community enterprise	1
Turmeric community enterprise	1
Kariyat community enterprise	1
Herbal producer	1
Herbal customers	2
Total	18

Phase 3: Data analysis

This phase used content analysis to analyze the data from phase 2, which are the data from the group of farmers, collectors, cooperatives, producers, and customers to find the supply chain mapping, opportunities, and barriers faced by the stakeholders. Two coders analyzed the coded interview data using analytic induction methods and used Kappa's coefficient with the inter-rater agreement of 0.75, which is an acceptable rate (Cohen, 1960).

Phase 4: Result and conclusion

Phase four was the result and conclusion of this study, which presented each herb's current supply chain management and the key drivers and barriers of Limonella, Turmeric, and Kariyat supply chain management.

Research Results

Fig. 2 is the supply chain mapping of herb businesses in the north of Thailand. This research focuses on three potential herbs: Limonella, Turmeric, and Kariyat. All herbs had the same supply chain management processes but might differ only in the details of their working processes and the stakeholders. The supply chain mapping shows details from upstream to downstream. Upstream represent farmers and suppliers who find herbs in the supply chain, while downstream represents customers.

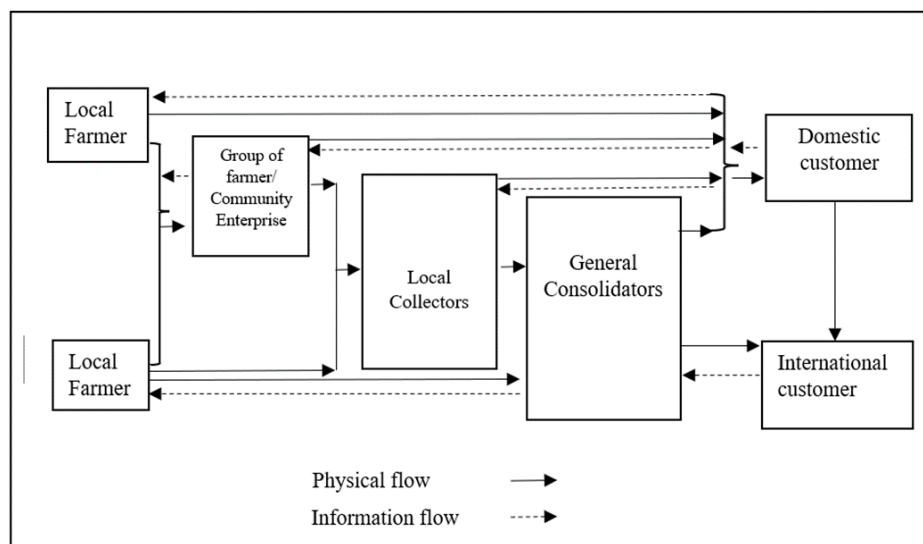


Fig. 2. Supply Chain Mapping of Herb Businesses in the North of Thailand

This supply chain system also presented 1) the network of the stakeholders. 2) The flow of goods and information (Physical and Information flow), and 3) Cooperation and collaboration within the supply chain system. The details are as follows:

Upstream stakeholders

From the data collection of three potential herbs: Limonella, Turmeric, and Kariyat. Chiang Rai, Nan, and Phrae provinces are considered important cultivation areas of North Thailand. The results found that the stakeholders in the upstream are as the following:

Plant Breeder

For three potential herbs, the plant breed can divide into two types. The first type will be the plant breed that had grown in the local area, and the second will be the plant developed from state agencies to support the growing plant of the local people in each area.

Grower

The growers of three potential herbs will use the same pattern of doing business which grows the herbs in their area (small size) and sell their herbs only in the domestic market. Some of the growers (large size) grow herbs for commercials and sell their herbs in both domestic and international markets.

In the case of Limonella, it takes about 3-5 years to start growing from seed. The average production rate is 100-200 kg/tree/year. When dried, it will lose one time of its weight, a dry yield of approximately 50-100 kg/tree/year. Due to the physical characteristics of the Limonella tree, it is pretty tall but not thick. This makes the harvesting process quite tricky. So, middle-aged growers can harvest about 5-6 plants per day. While the wages of experienced local people for harvesting Limonella is about 1,000 baht per day. The time of harvesting is around October of every year. The price of dried Limonella is about 100-120 baht per kilogram.

In the case of Turmeric, the planting process starts with preparing the planting plot and then planting the seedlings. The grower said some customers or buyers would not allow using the chemical fertilizers. If the buyers found that the growers used chemical fertilizers, they would reject buying the Turmeric from those growers. For the process of growing, they would let all Turmeric grow in nature. 100 kg of Turmeric, when processed and planted in 1 rai. The yield will be approximately 2,000 kg, and the Turmeric can be harvested after 10-12 months of planting. The price of Turmeric, and fresh Turmeric price will be around 25 baht per kilogram, and for dry Turmeric, the price will be about 100-150 baht per kilogram.

In the case of Kariyat, it takes about three months before harvesting. Kariyat will have an average fresh yield of 2,000 - 3,000 kg/rai/cycle (picked two times/year, can be collected after the first cut for about 2-3 months, and the second cut, the yields will be reduced). 6 kg of fresh produce yields approximately 1 kg dry of the Kariyat. The dry Kariyat price will be around 120 baht per kilogram.

Community Enterprise

In community enterprise, it is found that there are two patterns of working processes. Firstly, community enterprise with a clear structure and an action plan. E.g., an allocation plan of each member's quota when there is an external order and set up the selling prices for customers on behalf of community enterprises. Secondly, community enterprises with unclear structures and patterns when there are customer orders. Some members may respond to external demands by self-supply without resorting to other members. The importance of local growers or community enterprises to the herbal supply chain, they are a buffer for the community and be like an intermediary for business matching to avoid buying through the middleman.

Midstream stakeholders

The stakeholders' role in the supply chain system's midstream is to change the supply from the limonella, Turmeric, and kariyat's grower to products and services that meet the customer's needs. The pattern of doing business for the three potential herbs is the same. The explanation of all stakeholders in the midstream is as follows:

The local collectors/consolidators

The duty of the local collectors/consolidators they will collect herbs from the local people who are in the village and the village nearby. After they receive all herbs, they will sell the herbs to the customers, and the price of the herbs will increase because they can bargain with the customers to get a higher price. The quality of the spices depends on the area of cultivation.

The general consolidators

This group of consolidators is the people outside the cultivation area. Therefore, the pattern of doing business with these consolidators will be different from the local collectors. This study found that the consolidators will order from the local collectors or sometimes order directly from the growers by phone or line application. In another case, sometimes the collectors and the local growers will offer to sell their herbs to the general consolidators through many channels such as phone, e-mail, website, line application, etc.

Downstream stakeholders

The role of downstream stakeholders in the supply chain is herbs buyers. Most of the customers of all potential herbs are in the country (Domestics Customer), and some herbs are distributed to the international market.

There are two groups of domestic customers: the customer in the wellness industry, such as hospitals, spas, massage, etc., and the customer in the industrial sector, such as herbs processing plants, herbal medicine factories, cosmetic factories, etc.

International customers, this study found that there are importers who are the consolidator of herbs from Thailand and then distribute them to their customers inside their country.

Opportunities and Barriers to Thai Herbals Supply Chain Management

Opportunities for Thai Herbals Supply Chain Management

1. Opportunity from a resourceful location

Northern Thailand comprises up to 64% of the forest area where several local communities live. It is in a forest area because many communities existed before it was declared a forest area. Currently, government agencies have projects to encourage communities in this manner to turn to plant herbs to reduce forest destruction. Six collectors all say it is an opportunity for the herbal supply chain in the northern region to expand its production capacity

if there are more orders in the future because the abundance of forests produces high-quality products.

2. Opportunity from the adequate labor force

This study found that most herb supply chains in the northern region were planted within communities. Six farmers from three different herbs say most of them are Farmers or General labor. In addition to the seasonality of the main crops, growers are unemployed and available for labor in the production of herbs if demand increases.

3. Opportunity for government promotion

As mentioned above, more than 60% of the northern region is a forested area. Several communities are in the overlapping area because it was established before the declaration of forest area. Two of three community enterprises say the government has a policy for communities and forests to coexist without destruction and invasion. In the past, the main crop was maize which had to be cleared to expand the cultivation area. Therefore, government agencies have a project to encourage the community to turn to planting herbs. Where they can be planted without clearing the forest or encroaching on the forest, the price is higher than maize, including more government agencies supporting the distribution of seedlings, training in cultivation, etc. Therefore, it is another opportunity for the herbal supply chain from the government's support.

4. Opportunities from international market demand

This study found that the trend of Thai herbal orders in the global market is increasing yearly, as confirmed by the herbal producer. These results encouraged domestic cultivation. Therefore, it is an opportunity that can help improve the purchasing demand for Thai herbs in another channel.

Thai Herbals Supply Chain Management Barriers

1. Market distance barriers

In this study, four growers cultivate in high-mountain communities. It isn't easy to deliver their product to the market. Some places may be 2-3 hours away from the economic zone or Muang district, resulting in high transportation costs to the market compared to herbs grown in the area closer to the market.

2. Marketing barriers

This study found that most growers were inhabitants of traditional communities and quite old. While the new generation, such as the children, prefers to leave the community to find work in the community. Therefore, three of six growers lack commercial, marketing, and technology skills.

3. Lack of laboratory test report

This study reveals that many buyers have some evidence to confirm the quality of herbs, such as the substances contained in the herbs they are grown or the levels of dryness, etc. However, due to the location as well as most of the growers are local people and old. Therefore, all six growers have no examinations, certification requests, or attempts to obtain laboratory certification results. And some buyers rejected the purchase of the herbs from the farmer for that reason.

Discussions and Conclusion

This study aims to explore the current situation for supply chain management of herb businesses in the northern part of Thailand and find out the key opportunities and barriers to supply chain management. This research focuses on three potential herbs: Limonella, Turmeric, and Kariyat. All herbs had the same supply chain management processes but might differ only in the details of their working processes and the stakeholders. The whole supply chain system of the herb business in the northern part of Thailand started from the upstream activities concerned with the plant breeder, grower, and community enterprise responsible for growing and supplying the herbs in the supply chain system. The midstream activities involve the local collectors/consolidators and the general collector, which are the stakeholders responsible for collecting all herbs from the stakeholders upstream of the supply chain system. The last, downstream activities concerned the customers with domestic and international markets. Most customers are in related industries such as hospital, cosmetics, food, hotel, spa, etc. But Thai's herbal supply chain management is still faced with some barriers such as market distance, marketing, and lack of laboratory tests. These results are the same finding of the challenges in the research paper of Suresh (2008). This study also found that there are opportunities to increase Thai herbs' potential. To grow in domestic and international markets, such as opportunities from resourceful locations, opportunities from an adequate labor force, government promotion, and global market demand. These results found the same direction as the previous paper by He and Shi (2021). The stakeholders in the herbal supply chain need to use new technology to improve the production quality, such as the internet of things agricultural sensors.

Further research shows many opportunities and barriers to managing Thai's herb supply chain system. Therefore, to increase the efficiency of the decision-making for problem-solving, create policy and strategies, etc. This study proposed multi-criteria decision-making methods such as AHP, BWM, VIKOR methods, etc., to be the tools for finding the result to support the decision-making.

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