



Supply Chains of Handwoven Silk Production in Ban Khwao District, Chaiphum Province, during the COVID-19 Outbreak

Niparat Boongun^{*1}, Alongkorn Muangwai², Cherdchai Thuraphaeng³, and Noppadol Amdee³

¹Department of Industrial Technology Management, Faculty of Industrial Technology, Muban Chombueng Rajabhat University, Ratchaburi, Thailand

²Department of Logistics Engineering, Faculty of Industrial Technology, Pibulsongkram Rajabhat University, Phitsanulok, Thailand

³Department of Industrial Technology Management, Faculty of Industrial Technology, Muban Chombueng Rajabhat University, Ratchaburi, Thailand

*Corresponding author, E-mail: nipa_boo@hotmail.co.th

Abstract

This research aimed to investigate the supply chain, from the upstream stage to the downstream stage, of the handwoven silk of a silk store in Ban Khwao District, Chaiphum Province, Thailand, through the analysis of SWOT. The research also applied TOWS Matrix to the generation of strategic options and analyzed its value chain that could reflect major as well as support activities. Besides, the SCOR Model was analyzed to discover relationships and improve the efficiency of the supply chain. Data were collected through 30 in-depth interviews with key informants who were in the supply chain, including silkworm farmers, silk weavers, and/or silk product producers. The result revealed that the supply chain needed to be completed in all stages, from the upstream stage to the downstream stage, which would result in effective management planning and competitiveness enhancement. The research also recommended possible approaches for the increase of the potential for silk production; Silk delivery for storage, Supplying threads according to the order, Silk production for sale, and Increase the potential for online marketing for the Thai silk community enterprise.

Keywords: SWOT, TOWS Matrix, Value Chain, SCOR Model

1. Introduction

For the industrial sector, supply chains and stages of processing are closely connected. For decades, both elements have enhanced competitiveness as well as cost efficiency leading to the rapid growth of the national economy. However, during the COVID-19 outbreak, the interdependence of the global economy and the increasing reliance by businesses on global value chains has become more fragile. Too much dependency on Chinese supply chains can pose risks to the global economy. When a country implements transportation restrictions and border closures to prevent the spread of the COVID-19, a domino effect also occurs in the manufacturing sectors of other countries. China renowned as the hub of the silk industry plays a significant role in the world's production of silk as the country can produce approximately 84,000 tonnes of silk per year, representing 60% of global production.

Thailand produces silk as well. In Thailand, there are two silk thread colors available: white threads (warps) and yellow threads (wefts). However, the production of white threads used as warps is not sufficient; the import of white threads from China is a necessity. Today, the ratio of imported silk threads to domestic ones is 1.5:1 with a 10% import tax. Moreover, as China is a member of WTO, importing silk threads from China is subject to a higher import tax rate causing domestic manufacturers to suffer from higher import costs. According to the 2017 Global Value Chain Development Report, Thailand and China are connected in three stages including the export and the final service, intermediate goods used as inputs to produce finished goods, and intermediate goods used as inputs to produce products for export. Another country in this supply chain is Japan connecting China to Thailand in the simple GVCs and the complex GVCs (Liangchanthon, 2020).



According to historical evidence, silk was produced at a household level. Silk production is Thai wisdom passed down through generations. Apart from personal use, silk is now produced for commercial purposes, leading to employment promotion in the community. Silk fabric is uniquely characterized by its shininess and softness with a slightly rough feel. Besides, patterns and weaving methods vary significantly by area. Despite its variety, silk fabric can be classified into three types according to production methods: 1) *handwoven silk fabric with yellow threads*; the fabric is shiny and thick with pills on its surface, 2) *handwoven silk fabric with white and yellow threads*, and 3) *machine-woven silk fabric*; the finished fabric is soft but not so delicate as the handwoven one, and the machine can produce a more variety of colors and sizes and a higher quantity to meet customers' needs (Ministry of Agriculture and Cooperatives, 2020).

Major silk production areas are in Thai northeastern provinces with a long history of silk production. Silk production is supported by the government as well as the Arts and Crafts Center under the Royal Patronage of Her Majesty Queen Sirikit. Nevertheless, affected by the COVID-19 outbreak, the number of participants in the supply chains as well as the number of young people wishing to weave silk has declined since silk weaving requires skills and expertise. The designs and patterns that have never changed are limited to niche markets with low purchasing power, and most consumers who are new generations with high purchasing power are not interested in or realize the value of silk and the Thai wisdom. However, Thailand's silk industry still does not grow much due to a lack of sufficient support from the government and related organizations (Office of the Permanent Secretary, Ministry of Industry, 2020), so the researcher investigated the supply chain of silk fabric in Ban Khwao District, Chaiyaphum Province, during the outbreak of the COVID-19.

2. Objectives

- 1) To investigate the supply chain from the upstream stage to the downstream stage of the handwoven silk of a silk business in Ban Khwao District, Chaiyaphum Province, Thailand
- 2) To propose approaches for the management of the handwoven silk of a silk business in Ban Khwao District, Chaiyaphum Province, Thailand

3. Materials and Methods

The research used in-depth interviews with key informants in the supply chain of the handwoven silk of a silk business in Ban Khwao District, Chaiyaphum Province, Thailand. The population included silkworm farmers, silk weavers, and/or silk product producers who were SME or small entrepreneurs, weaving groups, community enterprises, and companies of business related to silk production. Data obtained through the interviews were used to analyze SWOT and TOWS Matrix. The research also recommended approaches for the management of the supply chain of the handwoven silk business in Ban Khwao District, Chaiyaphum Province, Thailand.

3.1 Instruments

The research applied in-depth interviews, in which the interview questions were aimed to obtain data of the production process, the supply chain, problems or limitations, and strengths and weaknesses that each of the interviewees involved in.

3.2 Methodology

The research was conducted to fulfill the objectives, following the process as follows:

1. Reviewing literature and theories of the supply chain, value chain, silk products and carrying out in-depth interviews with key informants;
2. Carrying out a SWOT analysis;
3. Analyzing the data of each supply chain stage using TOWS Matrix; and
4. Making a conclusion

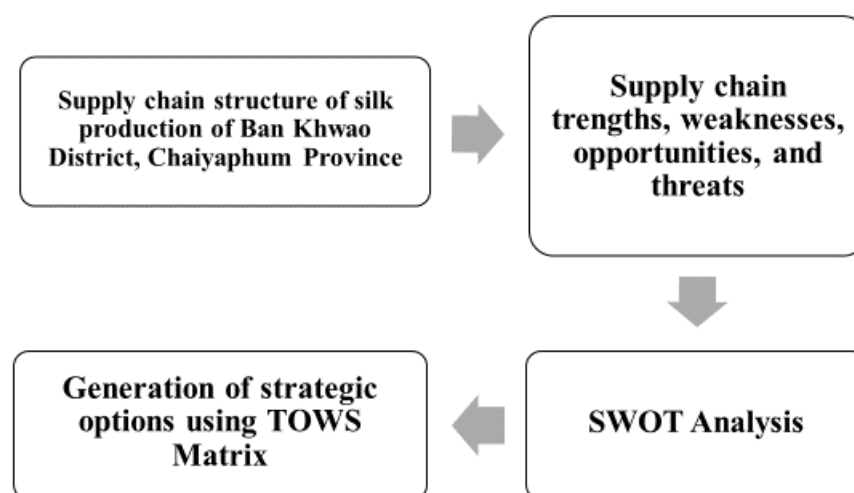


Figure 1 Research framework

4. Results and Discussion

The research conducted in-depth interviews with 30 groups of participants in the supply chains, including silkworm farmers, silk thread producers, weavers, and producers of silk products who were the members of the silk women's group, Ban Khwao New Power Women's Group, or small entrepreneurs. Projects aimed to promote community income were supported by Ban Khwao Cooperative. The cooperative supported 30 silk weaving groups, resulting in the invariability of the supply chain forms. The results in terms of the value chain and SWOT obtained from the interviews are summarized as follows:

4.1 The supply chain structure of the silk production was determined by the production process starting from silkworm farming (upstream), silk reeling (internal), to pattern design, bleaching, and weaving (downstream). Silk fabric is domestically distributed in the form of fabric pieces or finished products, namely women's sarongs, blouses, and shirts, scarfs, bags, and neckties. All stages in the supply chain are explained below.

Upstream Supply Chain

In Ban Khwao District, silkworms were farmed for the production of home handicrafts. Farmers emphasized the farming of local species. The silk farming process started from hatching eggs to form silkworms. Silk eggs or silkworms (1st or 2nd molt stage) were sometimes obtained from the Queen Sirikit Department of Sericulture or related government offices. The obtained eggs or silkworms were then raised until they hatched into larvae. Most farmers were found to farm mulberries, the leaves of which were used to feed silkworms. Sometimes, they borrowed mulberry leaves from their neighbors if they encountered a shortage of mulberry leaves. Silk farmers were found to always maintain the quality of silk farming by feeding diets appropriate to each stage and keeping the farming areas clean. Besides, it was found that farmers exchanged information on the supply of silkworms with silk egg farmers and the supply of cocoons for silk thread production with silk thread producers.

Internal Supply Chain

Silk thread production was undertaken by two groups including silkworm farmers and those who purchased warps and wefts. The first group, silkworm farmers, raised silkworms and, sometimes, bought cocoons from other farmers for the production of silk threads; however, the quality and quantity of silk threads depended on the quality of the cocoons and reeling skills. Silkworms farmers raised were called

[209]



local or yellow silk. By hand, farmers might reel threads themselves. Silk threads were then sold to weavers in the same village or nearby villages. The second group of thread purchasers bought warps and wefts (white threads) from Chul Thai Silk Company. The threads bought were unbleached, bleached but undyed, or bleached and dyed. Silk could be dyed using either chemical or natural dyes depending on customers' needs and entrepreneurs' expertise. Besides, it was found that natural dyeing requires different techniques and methods.

Downstream Supply Chain

Silk weaving could be managed by hand or machine. Most weavers used white threads as warps and yellow ones as wefts; some used only white or yellow threads as warps and wefts depending on customers' needs. Prior to weaving, weavers always decided the number of threads in each color and dyed them. They probably employed others to dye threads as well, especially wefts, to ensure the sufficiency of threads for weaving and the similarity in color shades in the same piece. For warps, weavers always placed orders from a store specializing in producing warps by tying white threads across reeds in different sizes to suit certain sizes of mouthpieces. The finished threads then were woven into silk fabric pieces with different patterns or products before delivered to customers or distributed. The chart in Figure 2 displays the relationship of each participant in each stage of the supply chains of the handwoven silk production of Ban Khwao District, Chaiphum Province.

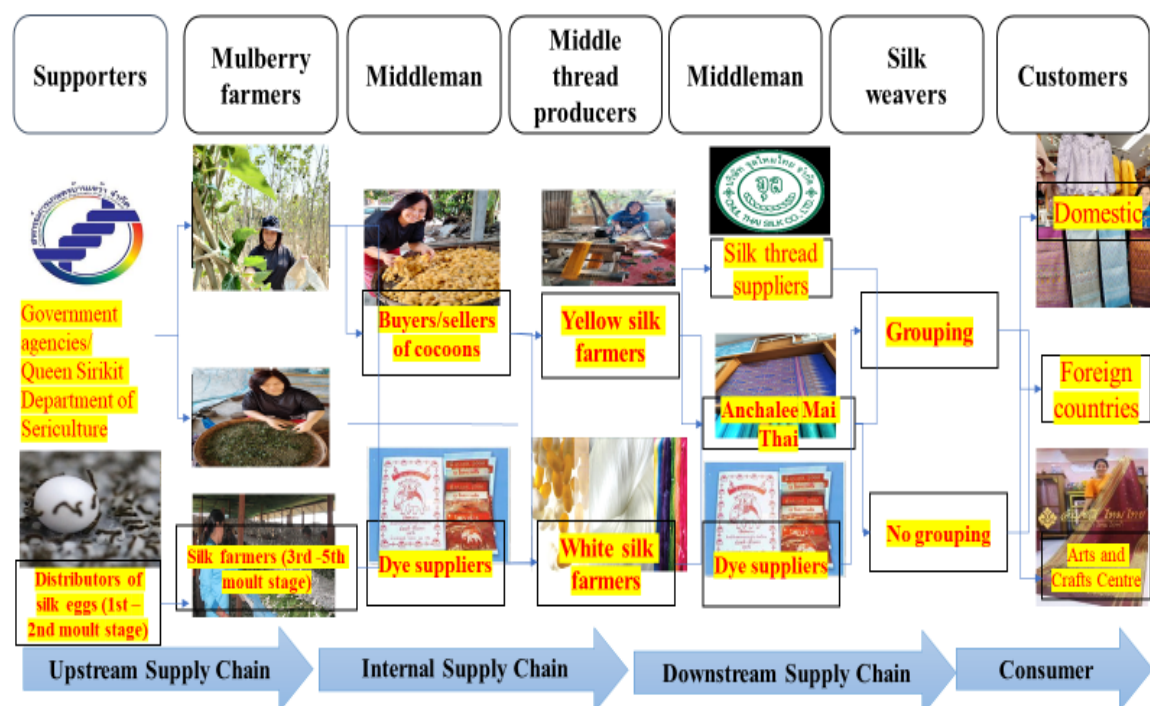


Figure 2 Supply Chains of Silk Production in Ban Khwao District Chaiphum Province



4.2 Result of SWOT Analysis (Leigh, 2009).

Table 1 SWOT analysis result

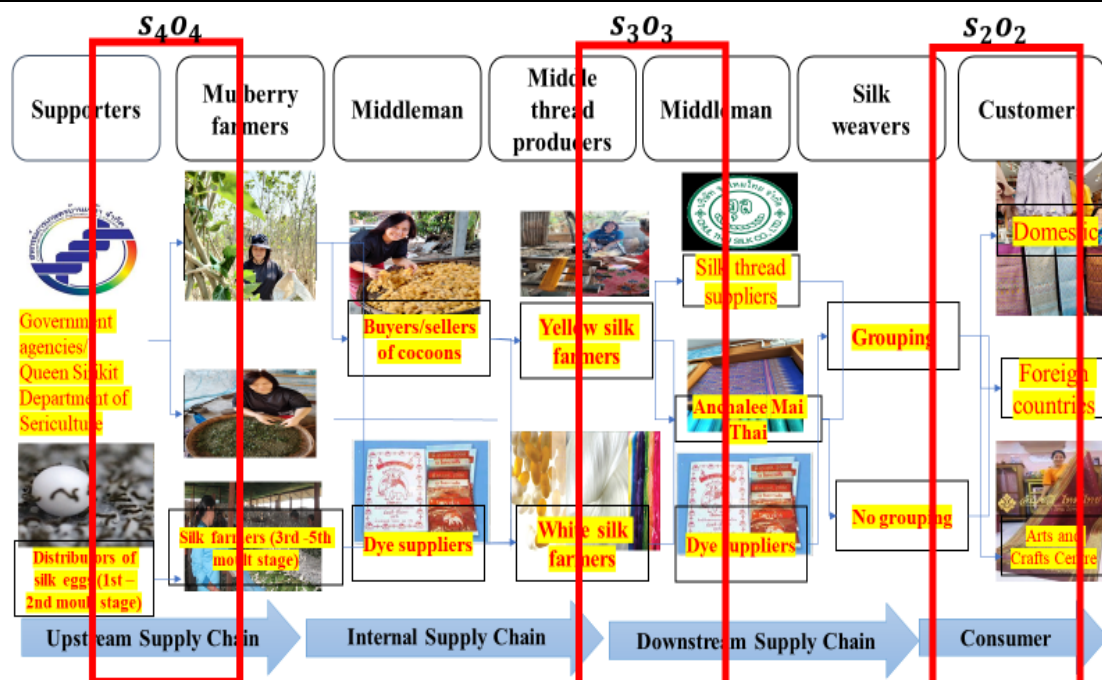
Strengths (S)	Weaknesses (W)
S1- Silk products are of quality. (supervised for quality)	W1- Silk weaving is a secondary job after rice farming; consequently, in the rice-planting season, the production can be delayed leading to loss of business opportunities.
S2- Silk entrepreneurs group together.	W2- In some durations of the year, entrepreneurs cannot afford raw materials when their prices decrease, e.g. during a few weeks before and after Buddhist Lent. In addition, in some festivals when the demand for silk clothing is high, the production can be delayed.
S3- Silk products can meet customers' needs.	W3- A lot of entrepreneurs lack experience and skills in processing silk fabric into different products, and are not knowledgeable of business administration including production and marketing. In addition, they have no business visions of active marketing.
S4- Silk products are OTOP registered products.	W4- Weavers still follow their own ways, never changing their behavior, and lack information of customer behavior leading to dead stock and liquidity risk.
S5-Entrepreneurs are skilled and have experience.	W5- There is insufficient research for the development of innovation or the design of new patterns.
Opportunities (O)	Threats (T)
O1-The business is supported by Ban Khwao Cooperative.	T1- The number of silk threats produced cannot meet the demand; entrepreneurs need to depend on the import leading to an increase in the production cost and silk product prices.
O2- The handwoven silk products are nationally accepted which can lead to the growth of the national silk industry.	T2- Due to the outbreak of COVID-19, entrepreneurs encounter the delay or the cessation of thread delivery from Chul Thai Silk Company located in Petchabun Province.
O3- The market still needs silk fabric with modern patterns.	T3- Many Thai competitors, e.g. those producing local fabric made from other materials (e.g. cotton) and foreign competitors (e.g. China, Italy, etc.) exist on the market.
O4- The Thai government implements policies in support of fabric industry in the provincial and the national levels, e.g. the policy encouraging officials to wear Thai costumes to work	T4- Most consumers do not know how to store and maintain silk fabric.

Strategic approaches

According to the SWOT analysis shown in Table 1, the TOWS Matrix was applied as a tool for generating strategic options as shown in Table 2 (Wehrich, 1982).

**Table 2** Strategic approaches determined by TOWS MATRIX

Strengths/Opportunities (SO)	Weaknesses/Opportunities (WO)
<ul style="list-style-type: none"> - Increase the potential for online marketing for the Thai silk community enterprise in Ban Khwao District, Chaiyaphum Province (S_2O_2) - Encourage new design learnings among new generations to ensure the products can meet the needs of different ages (S_3O_3) - OTOP support policy implemented by the government (S_4O_4) 	<ul style="list-style-type: none"> - Seeking new foreign markets, especially in Europe, Middle East, and Japan (W_3O_3) - Effective training on business administration and management including production and marketing (W_3O_3) - Encouragement of more marketing research on consumers' behavior and (W_4O_1) - Encouragement of participation in product exhibitions at regional and international levels (W_2O_2) - Promotion of value addition in Thai silk industry through creativity and eco-friendliness in all stages (W_5O_1)
Strengths/Threats (ST)	Weaknesses/Threats (WT)
<ul style="list-style-type: none"> - Creation of the regional brand for Thai silk products (S_5T_3) - Development of Thai silk quality in terms of beauty and maintenance methods (S_7T_3) - Promotion of more production of silk threads through bilateral collaboration, e.g. Thai technology may be adopted to silk farming in Laos with appropriate climate and soil fertility (S_7T_1) 	<ul style="list-style-type: none"> - Establishment of training centers for those interested in silk production for the preservation of culture, wisdom, traditional weaving methods passed through generations (W_2T_2) - Promotion of jobs in silk thread production and silk weaving as well as increased job income (W_1T_1)

**Figure 3** Strengths/Opportunities (SO) Weaknesses/Threats (WT)

*Strengths/Opportunities (SO)*

1. Increase the potential for online marketing for the Thai silk community enterprise in Ban Khwao District, Chaiyaphum Province (S2O2)
2. Encourage new design learnings among new generations to ensure the products can meet the needs of different ages (S3O3)
3. OTOP support policy implemented by the government (S4O4)

Weaknesses/Threats (WT)

1. Establishment of training centers for those interested in silk production for the preservation of culture, wisdom, traditional weaving methods passed through generations (W2T2)
2. Promotion of jobs in silk thread production and silk weaving as well as increased job income (W1T1)

4.3 SCOR Model Analysis

SCOR-Model Level 1 Main activity Including Plan Source Make Deliver Return

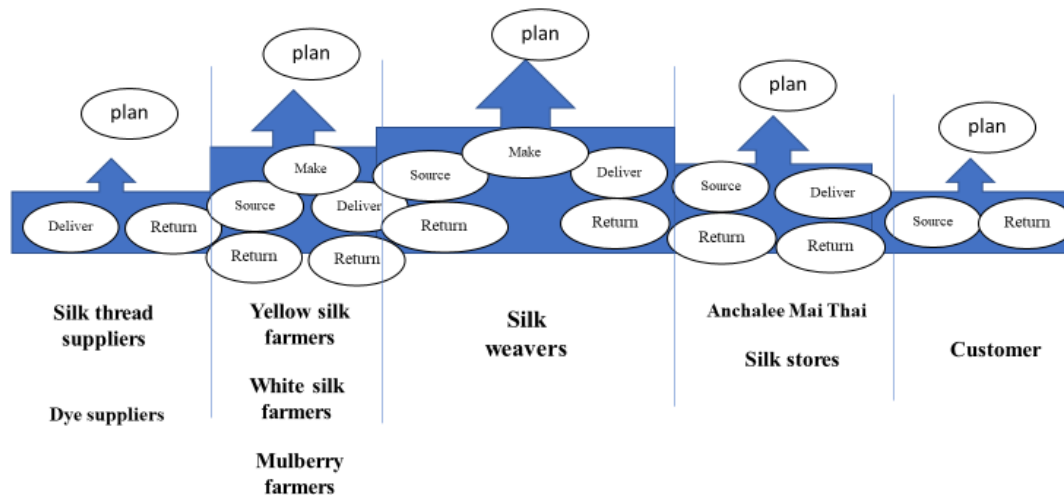


Figure 4 SCOR Model in Ban Khwao District, Chaiyaphum Province



SCOR-Model Level 2

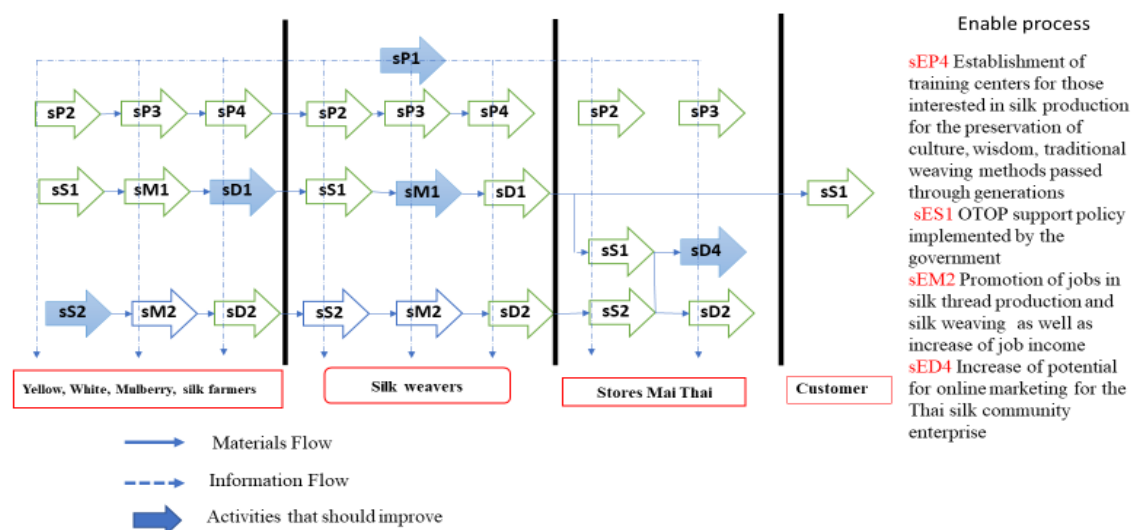


Figure 5 Approaches for the management of the handwoven silk of a silk business in Ban Khwao District

The main Process SCOR-Model Level 2 that should be improved included supply chain planning; (sP1) Silk delivery for storage, (sD1) Supplying threads according to the order, (sS2) Silk production for sale, (sM1) Increase of potential for online marketing for the Thai silk community enterprise, (sD4) Enable processes that should be improved, (EP4) Establishment of training centers for those interested in silk production for the preservation of culture, wisdom, traditional weaving methods passed through generations, (ES1) OTOP support policy implemented by the government, (EM2) Promotion of jobs in silk thread production and silk weaving as well as increased job income, and (ED4) Increase of potential for online marketing for the Thai silk community enterprise.

5. Conclusion

The supply chains of the handwoven silk production of Ban Khwao District, Chaiyaphum Province, have been supported by government agencies, one of which is Ban Khwao Cooperative. Despite its support, the silk business in the district does not earn a satisfactory income due to its ineffective and unsustainable forms of support.

One of the most effective strategies is to preserve Thai silk production culture and Thai wisdom through the promotion of silk production jobs to increase community income sustainably. Besides, silk production requires modern dyeing technology that uses only natural dyes to ensure the silk products will be of quality, beautiful, and eco-friendly, which can add value to silk products and attract new markets based on the WO strategies. Another challenge is Thai entrepreneurs cannot meet the quantity as required by customers when demand for silk is high because Thai silk production encompasses a complex process, including planting mulberries, breeding and raising silkworms, and weaving, resulting in their refusal of substantial orders urgently needed by the customers.

An external factor involving the production process is seasons. Seasons can affect the quality of silk threads. For example, in the rainy season, the moisture content exceeding 90% affects the quality of silk threads and yields low silk threads since they were weakened and damaged by fungi. The other external factor is the determination of product standards. Silk threads need to be improved to meet the requirements of standards. However, the quality specifications of silk threads are not determined by regional standards.

The researchers, hence, recommended the establishment and determination of standards according to the SO strategies. Besides, the research found that most weavers were old people since most young people did not want to be weavers. To resolve the decline in the number of Thai weavers, related



government agencies were recommended to support silk production jobs as well as preserve this Thai wisdom reflected through patterns of silk fabric uniquely different according to the culture of each area. If new generations do pass through this wisdom, the nation can preserve the culture and wisdom of Thai silk, and silk production jobs can bring satisfactory income to their families sustainably according to the WT strategies.

Recommendations for further studies

1. Further research may investigate the consumers' behavior at different age ranges as well as different approaches for encouraging the use of silk fabric to meet the needs
2. Development of innovation that improves silk maintenance methods
3. Improvement of natural dyeing methods and reduction of pollution caused by dyeing

6. Acknowledgements

The researchers would like to extend their gratitude to all silk entrepreneurs in Ban Khwao District, Chaiyaphum Province for their cooperation in providing useful information and data as well as Asst. Prof. Dr. Alongkorn Mueangwai, for his supervision of this research.

7. References

- Ministry of Agriculture and Cooperatives. (2020). *Knowledge of Mulberries and Silk*. Retrieved February 2, 2021, from https://www.moac.go.th/knowledge_moac-knowledge
- Liangchanthorn, R. (2020). New Global Value Chain after the Epidemic of COVID-19. Retrieved February 2, 2021, from https://www.krungsri.com/getmedia/f2a821bc-d863-4175-b495-b587417bf509/RI_Supply_Chain_201007_TH.pdf.aspx
- Office of the Permanent Secretary, Ministry of Industry. (2020). Modern Heritage of Thai Textile to the Global FashionII. Retrieved February 2, 2021, from <https://www.thaitextile.org/th/service/detail.1435.1.0.html>
- Leigh, D. (2009). SWOT analysis. *Handbook of Improving Performance in the Workplace*. (1)3, 115-140.
- Lorchirachoonkul, V., Atthirawong, W., & Leerojanaprapa, K. (2018). SWOT and TOWS Matrix Analysis for Strategic Development to Increase Thai-Laos Silk Supply Chain Efficiency. *WMS Journal of Management*, 7(3), 15-26.