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4 PRODUCTION ANALYSIS

4.1 Production Overview

Silk is the natural fiber from animal that claimed the one of strongest natural fiber. Silk production in Thailand is a traditional family skill and industry that pass through generations from ancient time until present day. Because of the outstanding beauty compare to another source of silk, Thai silk could get into the heart of silk users all over the world as the queen of all cloths. Thai silk has many different types, each type has their own special characteristics to attract and impress customers. The popular types of silk from different region of Thailand are as follow:

4.1.1 Plain Silk

Plain silk, made by general weaving process, use general silk yarn both longitudinal and transverse lines. These lines could be same or different color because the weaving process itself finally will produce the plain silk sheet from the seating of longitudinal and transverse lines. This type is the one of most favorite type.

4.1.2 Mud Mee Silk

Mud Mee silk, the good old traditional weaving process, normally all are originated from north-eastern region of Thailand or E-sarn and then distributed to some central provinces. The methods of making mud mee silk are, at first making pattern on silk yarn then use that patterned yarn to weave. By those methods the silk sheet pattern is very attractive.

4.1.3 Khit Silk

Khit silk, need special method of weaving. Identical pattern can be seen after finish.

4.1.4 Yok Silk

Yok silk, similar to Khit silk but use special gold or silver yarn for some special pattern.

4.1.5 Jok or Teenjok Silk

Jok or Teenjok silk, also similar to Khit silk but add special horizontal line at some positions to get more various pattern.

4.1.6 Praewa Silk

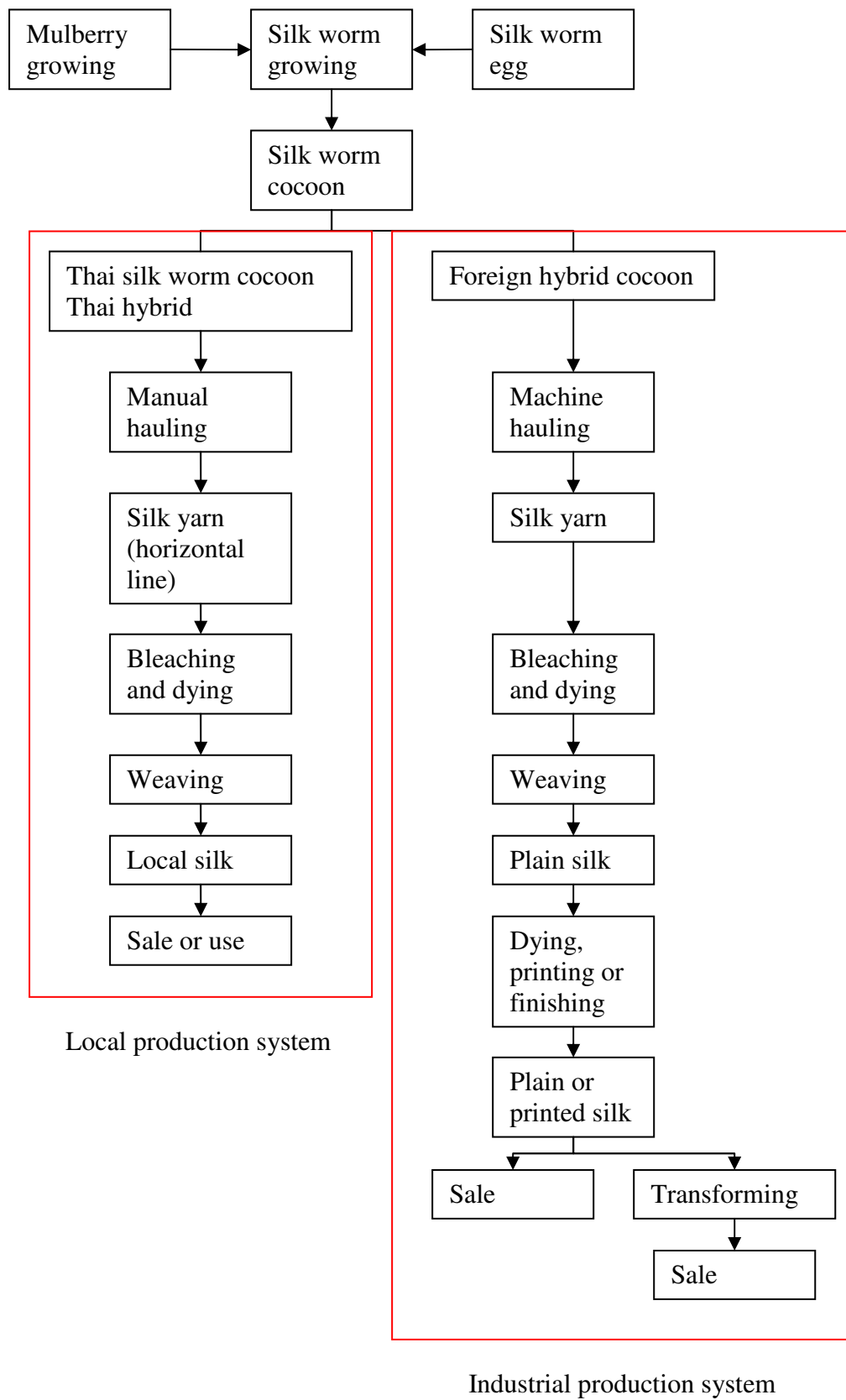
Praewa silk, has a combined pattern between Khit and Jok. The Praewa name is from the length of silk sheet “Wa” equal to 2 meters in metric scale. In the past, use

red color as base color but in present already change to many colors as cultural change

4.1.7 Batic Silk

Batic silk is produced from plain silk. Use melted wax to make some pattern then dye after that boil the dying silk in water the wax will be melted and leave undyed as pattern.

Moreover, there are other subcategories such as printed-plain silk, applied mudmee silk. All different silks have almost similar production process except for weaving process only. The overall silk production processes are shown in Figure 4-1



Source: Ministry of Industry

Figure 4-1 Silk production system

For our report as Jolie Femmes study we will point to the industrial production system.

4.2 Silk Yarn Preparation

4.2.1 Mulberry tree growing

Root of the silk quality come from the good production of Mulberry leaf as it is the favourite food for silk worm. Mulberry tree growing depend on weather, temperature and soil condition. In tropical zone, another effect is quantity of rain or water. In Thailand Mulberry growing season start from May to September. Mulberry leaf can be gathered after 9 months.

4.2.2 Silk worm growing

Silk worm has a, scientific name as “Bombyx-Mori”, complete metamorphosis while growing. The phases of life are egg, worm, cocoon, and adult as butterfly. The silk fiber we get is from the cocoon phase that silk worm build cocoon from their fiber before they turn to be a butterfly.

Silk worm can be grown up for all region of Thailand which has optimum weather condition. Normally the temperature for growing silk worm is 26 to 28 degree Celsius, relative humidity 70 to 85 %

In present, we can separate the favorite silk worm type in Thailand into 3 types:

- Native Thai silk worm
Has yellow small cocoon, low fiber quantity.
- Thai hybrid, combine between Thai and foreign breed
Has yellow big cocoon, can be used for machine hauling.
- Foreign hybrid, combine between foreign type
Has white biggest cocoon, high fiber quantity. Use higher cost for growing, normally use for industry.

Cocoon	Color	Appearance	% Floss fiber	% Fiber	Avg. fiber length (m)
Native Thai	Yellow	Egg shape, tapering ellipse	10-15	8-13	180-400
Thai hybrid	Yellow	Egg shape, rounded ellipse	2-3	13-17	600-800
Foreign hybrid	White	Egg shape, rounded ellipse	1-2	17-22	800-1200

Source: *Silk and silk product*, 2539, Ms. Aree Ngamsiripatkul, p.16

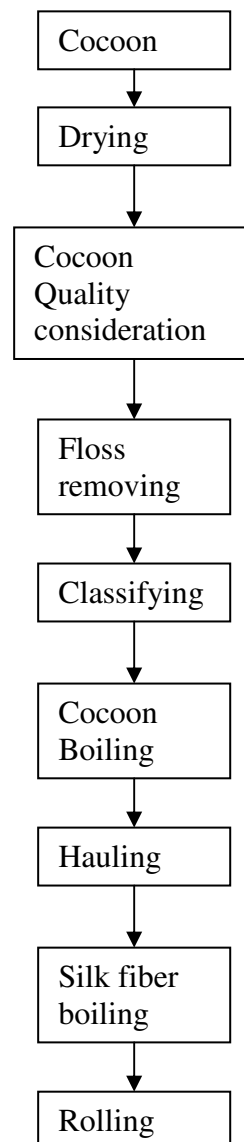
Table 4-1 Comparison of silk worm cocoon

Silk cocoon grade can be considered from

- Length of fiber
- Quantity and weight of fiber after hauling per one cocoon
- Size and shape of cocoon
- Thickness of cocoon's shell or percentage of fiber layer
- Color

4.2.3 Silk fiber hauling

Hauling is the method of pulling silk fiber out from silk cocoon. In present , the hauling machine play important role in this process instead of human because of the speed and the consistency of the hauled silk quality. Detailed processes are as shown in the chart below.



Source: *Silk and Silk product*, p.22, Aree Ng, 2539

Figure 4-2 Silk hauling process

Hauling process is separated into 2 main operations.

Manual hauling

Normally use with native Thai silk cocoon because of the small size of cocoon and the thin size of fiber that make native Thai silk cocoon can not be hauled by machine. Native hauling productivity is around 200 m/ 8 hrs.

This kind of this hauling is still well promoted because the workers have more chance to take care of all selection process, size and appearance of silk yarn. From manual hauling we can get 3 types of silk:

1. *First grade*, get from inside fiber layer, has fine appearance. Use for vertical line.
2. *Second grade*, get from hauling inside fiber and outside floss together, has rough appearance and thicker than first grade. Use for horizontal line.
3. *Third grade*, get from outside floss, has rough appearance and thicker than second grade. Use for horizontal line of thick sheet and rough sheet.

Machine hauling

Use in hauling factory, mainly for industrial use. Foreign hybrid can be used for hauling machine. The speed and consistency is better than manual. Normally, this kind of silk yarn is used as the vertical line because of its thickness and smoothness. It is separated into 4 types:

1. *Raw Silk* (equal to first grade in manual hauling)
2. *Doupion Silk* gets from double cocoon, inside and outside hauling.
3. *Spun Silk Yarn*, get from combining the silk with silk shell or cotton.
4. *Silk waste*

Silk yarn size classification

Use the length per weight unit as reference. That unit calls “Denier”. 1 Denier mean 9000 meters of silk has 1 gram weight. Silk size is different between types, foreign hybrid has average size 2.2 to 1.8denier, Native Thai or Thai hybrid has average size 1.5 to 2.1denier.

To get high quality silk yarn, it depend on some factors as follow:

1. Cocoon Quality that can make hauling process easier, has less fiber size deviation and give more consistency for silk yarn quality.
2. Hauling method including all process, even speed of reeling, quantity of cocoon per one time.
3. Reeling condition must be arranged perfectly to avoid knot or stuck.

Silk yarn quality

Silk yarn quality can be separated from silk yarn type:

1. Raw silk type has fine, thin and smooth. Size is from 15 to 45denier.
 - Lower than 18 denier has 9 level as follow 6A, 5A, 4A, 3A, 2A, A, B, C, D
 - Size 19 to 33 denier has 10 level from 6A to E
 - Bigger than 34 denier has 8 level 4A, 3A, 2A, A, B, C, D, E
2. Doupion silk type has size between 50 to 250denier, thick and rough appearance. Can be separated into 4 levels as follow Double extra, Extra, 1st and 2nd

4.2.4 Bleaching and dying

Bleaching process will remove natural glue from raw silk and make raw silk softer. At the same time it can increase color absorption ability. Dying process make colorful silk instead of yellow and white silk. Quality and shade of color need to be consistent over time among production process. Moreover the durability of color also important to avoid fading of color.

4.2.5 Weaving

Two main types based on silk yarn percentage of whole sheet

1. Thai silk: use 100% of natural silk for weaving
2. Thai Juri silk: use natural silk more than 20% of whole weight

General classification that weaving factory usually use are

1. Light weight Thai silk uses single horizontal line when weave
2. Medium weight Thai silk uses 2 horizontal lines
3. Light heavy weight Thai silk uses 3 horizontal lines
4. Heavy weight Thai silk uses 4 horizontal lines

4.2.6 Tailoring or transforming

All mention above are about natural silk fiber process. In present, there is a substitution material that tries to copy the goodness of silk fiber that is called artificial silk.

Artificial silk is normally made from Cupramonium Rayon, one of the semi-synthetic Regenerated Cellulose. It has similar property to natural silk. When dry, it has very high ductility but will decrease after wet. Good humidity absorb, shiny and easy for dying and printing. Moreover it has high internal humidity around 13% that make users feel good when wear cloth made from artificial silk. The weaknesses are durability under sun light and easier damage when wet.

4.3 Products and Production Activities

Currently, various products have been produced and distributed. We would like to divide their product into categories as follow:

- Silk sheet.
- Clothes including all men's wear, women's wear, children's wear.
- Accessory such as necktie, handkerchief, scarf, wallet.
- Home-used products such as pillow case, decoration silk sheet, table ware.
- Others such as key-holder, notebook, etc.

4.4 Jolie Femme Production Process

The Jolie Femmes production activities at the site that we visited are mainly about silk fabric production. Only demonstration of silk yarn preparation is shown as a tourist attraction. The production processes in this site are

4.4.1 Dying process

In back side of Jolie Femmes there are 2 boiling vessels for dyeing process. Dyeing normally start in the morning take around 2 hours for boiling and dyeing. The colour for dyeing process is non-toxic type diluted by water to avoid effect on human skin or allergy. After dyeing silk yarn will be washed and rinsed before let those dyed yarn dry under shade to keep bright colour for the rest of the day.



Figure 4-3 Dyeing process (dyeing pot)



Figure 4-4 Dyeing process (Washing Bath)

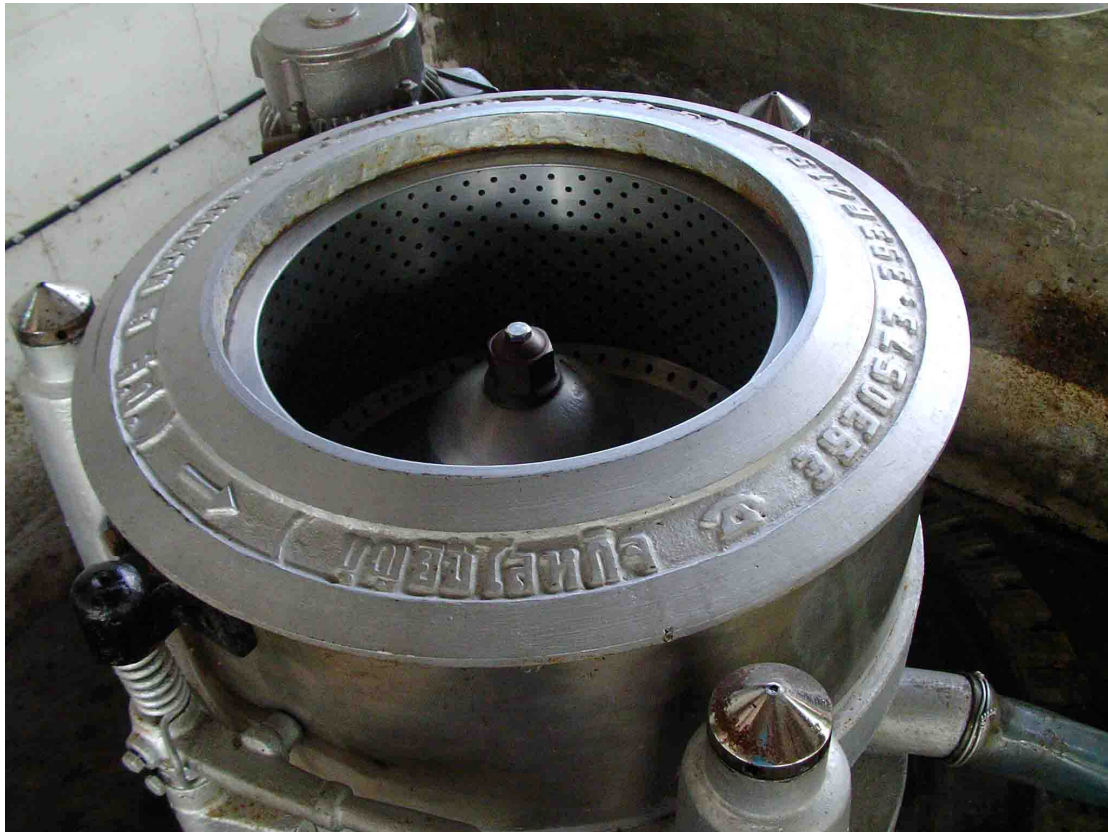


Figure 4-5 Dyeing process (Rinsing Pot)



Figure 4-6 Dyeing Process (Drying)

4.4.2 Rolling and reeling process

Rolling and reeling processes are done by machine, the most hi-technology in factory. First of all bleached yarn will be reeled into big reels after that those big reels are reeled by another machine to make small reel. The small reel will be used for our hand loom as horizontal line. These 2 reeling machines are controlled by only 1 worker.



Figure 4-7 Reeling Process (Big Reel)



Figure 4-8 Reeling Process (Small Reel)

4.4.3 Weaving process

Skill workers will make unique pattern and normal workers will make standard silk sheet. All silk sheets are made by hand loom. This kind of production system can create more value to the product. Since customer can see how difficult or which technique are used to make silk product. Cost of labour is paid by output quantity at different rate between sophisticated pattern and standard pattern. To control the quality of silk sheet, there are supervisors staff who will check the silk sheet condition while weaving and also after weaving 70% of silk yarn are produced in-house and the rest is bought from outside to use as vertical line since manual hauling yarn quality is not good enough.



Figure 4-9 Weaving Process

4.4.4 Tailoring process

Back side of weaving factory, there is a transforming factory that produces all transformed products. New product design is also done in-house as their own creativity or sometimes from foreign fashion magazines. This process starts from making design, cutting pattern, sewing, and detail sewing. Quality control is done at detail sewing process by sewer.



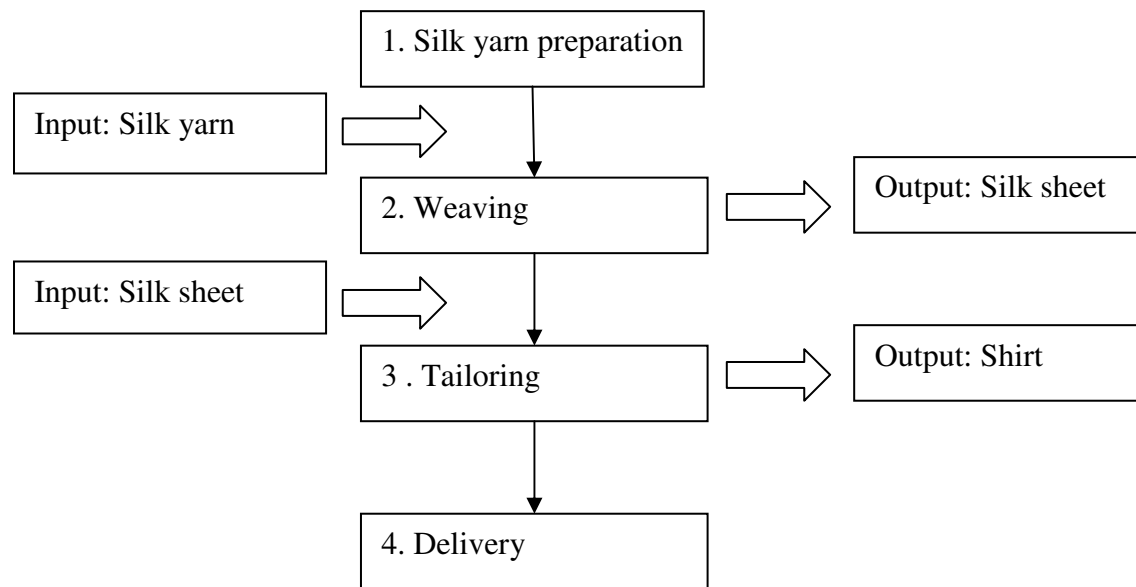
Figure 4-10 Transforming Process (Pattern Making)



Source of Figure 4-3 to 4-11: Site visit Jolie Femme

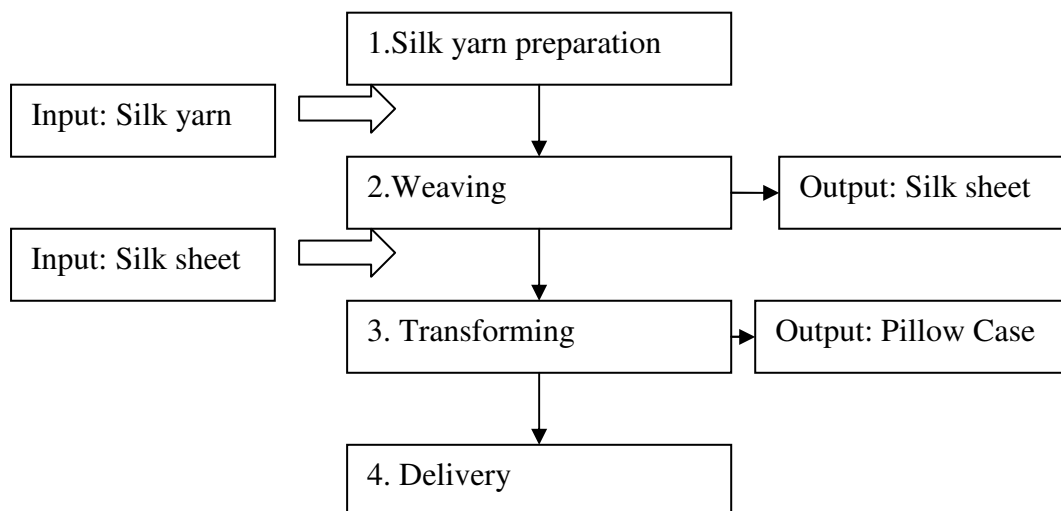
Figure 4-11 Transforming Process (Sewing)

The production flow chart of sample product is shown below.



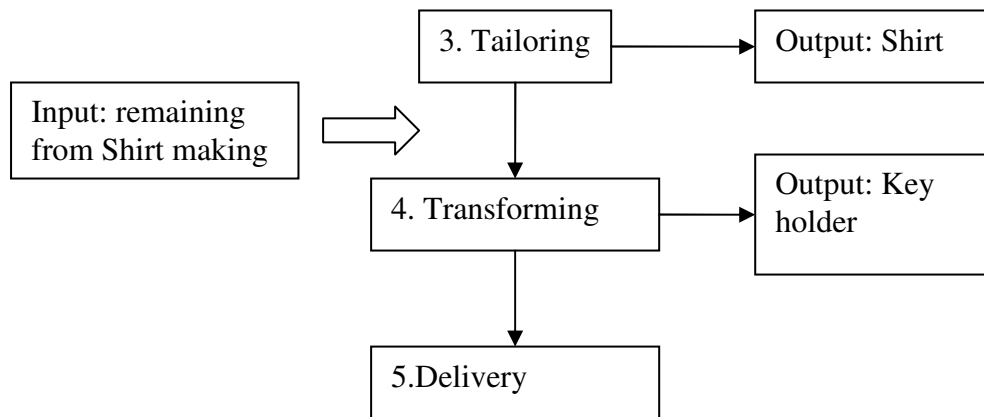
Source: From interview

Figure 4-12 Silk Shirt production processes



Source: From interview

Figure 4-13 Pillow case production process

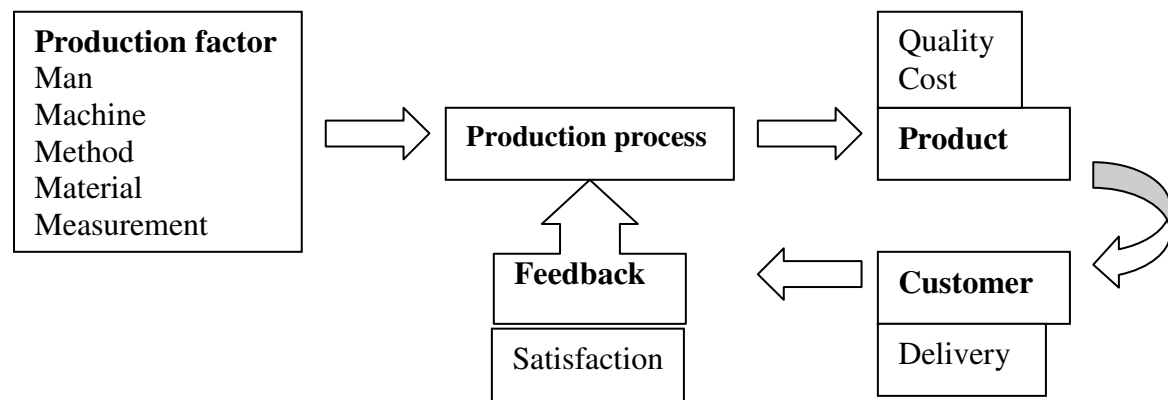


Source: From interview

Figure 4-14 Key holder (use material from remaining of shirt)

4.4.5 Production Resource

We will use 5M technique to analyze Jolie Femmes production system.



Source: From analysis

Figure 4-15 5M concept

Man

Currently Jolie Femmes has around 100 employees half of them are in Production department. These production people are the most important because of craft-like characteristic of the company's product. The development of manpower is really necessary. Whole production system including transformation from silk sheet into clothes depends on worker's skill. The skill of worker is the indicator for their income. Skill worker who can make a sophisticated pattern will earn more than general worker who can make just standard pattern. The Jolie Femmes normally recruit workers that have weaving skill from other places before. Some of workers are local northern, some are from north-eastern.

Currently the Jolie Femmes does not face any problem about man-power because they can satisfy their key workers. As long as this situation maintain their business can run stably. The potential problem could happen from this view because if there are new comers who can pay more for skill workers then it is difficult to protect and cost of production will rise.

Machine

The most out-of-date machine is valuable here because it can attract tourist. More tradition mean more attractive especially for US and European tourist. They main machines are manual weaving machines. The important support machines are electrical yarn rolling machines which use to prepare yarn rolls for weaving. Almost all processes are manual control; because of their production concept “Hand made natural silk”. This is one of their strength in tourist’s view. They have 20 manual weaving machines which can produce around 1 meter per 8 hours per machine if they make standard pattern.

Method

All weaving methods are same for standard pattern. Set vertical lines and bind all together with horizontal lines locating between vertical lines. For special pattern, the complexity of vertical lines is necessary and line arrangement adjusting by step pedal is needed. The methods of production are almost same for this industry. Method of making silk makes the Jolie Femmes different from another in same industry. New pattern creation can make any producer to become popular so the weaving method and technique need to be developed to increase that chance.

However, after become popular the copy cat will happen to duplicate all popular things then the company must be differentiated by creating new weaving pattern.

Material

This is the important factor for good quality production. Jolie Femmes produce 70% of silk fiber by themselves and buy 30% from outside. The manual threading yarn is the majority for their production. Smoothness of silk yarn will effect to smoothness of silk sheet. The silk yarn quality relate to the silkworm cocoon quality which resulted from good treatment while silkworm start to make cocoon. The Jolie Femmes use Thai hybrid silkworm as source of their production.

This issue can be considered as another opportunity to reduce cost of production. Currently they buy some percentage of material. If they can cover all order by their in-house material it is better for cost and quality control.

Measurement

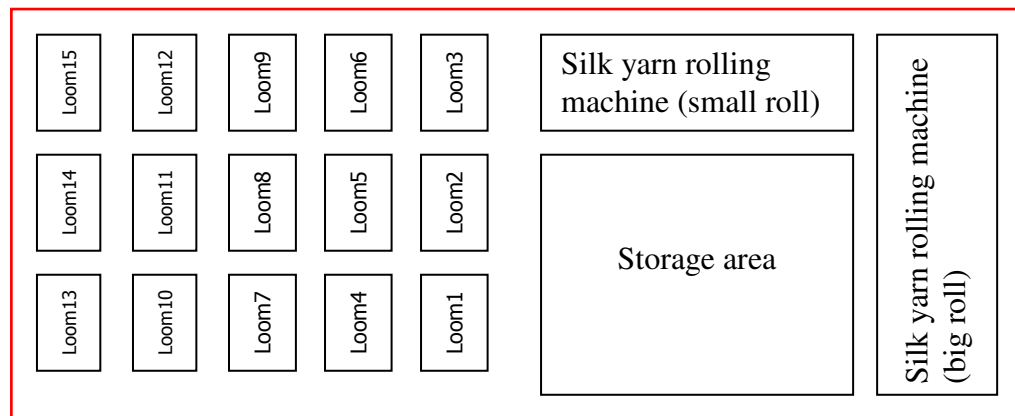
In every production that has to classify the production resource or control the production process need measurement. In Jolie Femmes, their silk yarn needs to be classified before sending to production to separate the silk class. Measurement is also necessary in the transformation process. They have to make pattern from silk sheet

and sew them into shirt. The precision of pattern cutting is important for shirt's quality.

4.4.6 Production Process

Process Layout

The Jolie Femmes use intermittent production strategy for their silk weaving process

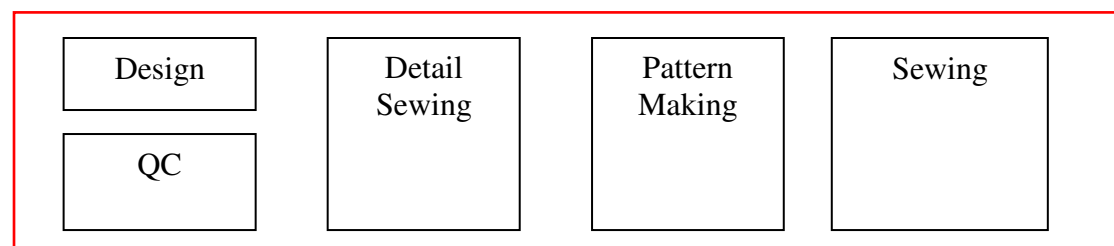


Source: From own analysis

Figure 4-16 Process layout of Jolie Femmes

For some reasons, this kind of layout is good for current company situation and concept. One strength of this layout is flexibility. After finish one batch, the change can be arranged easily because of manual operation. This can support the variety of company's product as well because the production setup is easier and need less time than big automatic machine. General Textile Company normally use automatic weaving machine that produce the continuous product for some lengths to overcome break-even point before change to another production. Productivity is lower but flexibility is better.

Process and job shop strategy for tailoring process.



Source: From own analysis

Figure 4-17 Tailoring process layout

For tailoring process, the Jolie Femmes use job function as layout. They have both made-to-order and standard products. The first one need so many details, some of them use almost 3 months to finish. For standard products such as suit or pajamas need less detail but have more complication in forecasting. How many units of this size, or this type should be produced to avoid too much sunk cost of dead-stock.

Production planning

The production planning is issued order by order. Company has regular customers who issue the purchasing order every month or 2 months. Customers rarely order emergency production because all realize about the hand-made limitation. Some customers are willing to wait for 3 or 4 months to get the best quality product they order. The production planning is not a big issue for Jolie Femmes right now.

4.5 SWOT Analysis

Strength

- Flexible production because of manual operation, easy to change to another color or requirement.
- Traditional image production, have higher tourist attraction.
- Variety of products can make efficient use of material such as the remaining silk from making shirt can be used for making key holder.
- Can create their own design; make them get their own identity.
- Art-liked because of manual production limit capability

Weakness

- Limited productivity because of manual operation, loss opportunity to increase sale volume.
- Quality control system, all quality control bases on supervisor's eyes. No master sample as reference then the judgments of quality will have different standard among all products. Good product for one might be not good for another.
- Imperfect products because of limitation of manual production make the product classification down in customer' view.

Opportunity

- Can generate more attractive pattern because of this flexibility.
- Get more profit from tourist promotion.

Threat

- If customer can find out another fast producing with same style of products, company might get into trouble.
- Lost order because of limited production capacity.

4.6 Conclusion

The Jolie Femmes has stable production operation right now. We have seen the potential of this company so far. As long as they can maintain the opportunity from tourist promotion and show the traditional Thai silk production system. Show the identity of Thai silk, especially their own design pattern that can make their silk be popular in many places around the world.

The production processes are base on workers' skill. The company products are in their hand and also their knowledge about making pattern and limitation of working. Two main costs for production, material and labor, must be controlled to avoid over expense. Good quality control system is also important for creating of reputation in market.