

CHAPTER 2

Case study: Background and Problem Analysis

2.1 Background

2.1.1 Company Profile

In this research, a real life production situation has been studied and the best possible policy for production scheduling for knitted fabric Dyeing and Finishing production. The name of the company has been kept confidential. This company has three sections

- 1.) Polyester and Nylon Textured Yarn
- 2.) Commission Dyeing and Finishing Service
- 3.) Knitting

This Dyeing and Finishing section is supported for the others in dyeing. This section works 24 hours per day with 3 shifts and has about 300 staffs.

2.1.2 Product Description

The factory used in this report is the commissioned Dyeing mill for knitted fabric. Its main products can be categorized into different aspects. In term of activities, there are 5 different basis;

- 1.) Sample making is to make the color as requested by customer (before-production)
- 2.) Commissioned Dyeing is to dye the same substrates as the lab, which is approved by customer
- 3.) Commissioned Finishing is to finish the same finished fabric as the requirement specified by customer
- 4.) Re-dyeing is to correct the color to the shade that satisfy the customer
- 5.) Re-finishing is to correct the specification into what is required by customer

In term of customers, there are 2 main markets.

1.) Domestic market

The customers in this market are garment manufacturers. They normally have simple requirements that focus mainly on color, finishing touching, width, and controlled weight. This group use narrower fabric less than 50 inches in width.

2.) Export market

The customers in this market have very strict requirements mainly on color, width, controlled weight and various types of fastness, which allow only very small tolerances. They use wider fabric more than 60 inches in width

In term of products, there are 3 main types of services

1.) Fabric dyeing: are substrates are dyed to the same color as the samples approved by customers.

2.) Fabric bleaching: the substrates are pretreated and dyed to the same white color as sample approved by customers

3.) Yarn-dye scouring: the dirtiness and oil are scoured out of the dyed knitted yarn.

2.1.3 Process Description

Dyeing and Finishing industry is in the mid-stream of the wide textile industry. It changes fabrics from raw material forms such as greige yarn and fabric to be the finished products for either end users or next down-stream sector. Most of Dyeing and Finishing processes are related to the use of suitable chemicals and dye stuffs with the water as a medium. Therefore, this industry uses a large amount of water.

The production process consists of 3 main steps as shown in Figure 2.1.3

1.) Preparation process is to pre-treat the yarn and fabric to suitable qualification and to be ready for Dyeing Singeing, desizing, scouring, bleaching, or mercerization are used to prepare raw materials depending on the type of products.

2.) Dyeing process is to add colors into the substrates. There are different types of Dyeing processes depending on the dye stuffs used which vary for each type of fabric.

3.) Finishing process is to improve the product characteristics. It divides into 2 main types

3.1) Mechanical Finishing is to use machine to produce the desire qualities such as shrinkage control, raising, shearing, compacting and setting

3.2) Chemical Finishing is to add some features through the use of chemicals such as stiffening, softening, anti-crease, coating, protection, soil release, flame retardant, bacteria & Fungi resistant, etc.

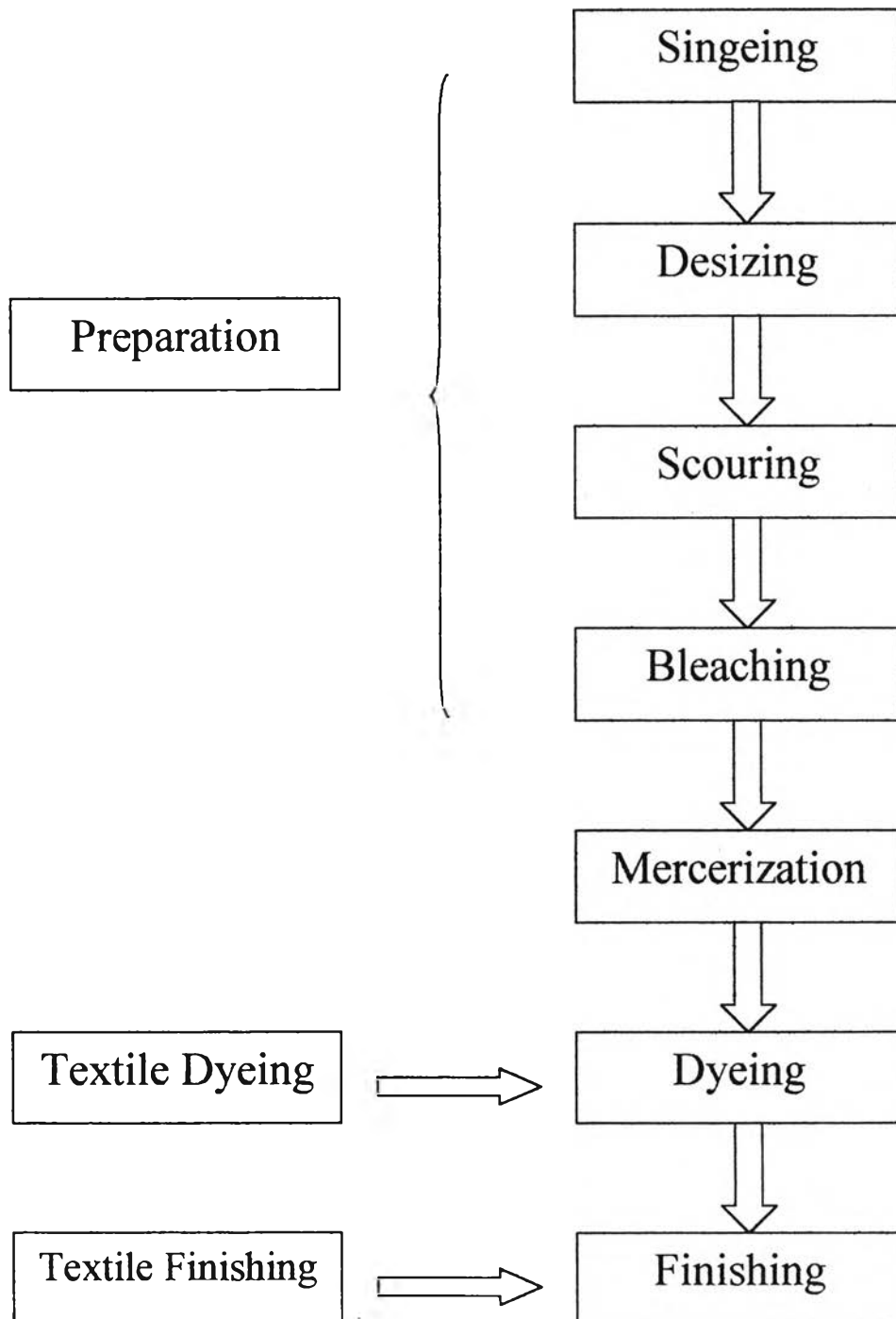


Figure 2.1.3 Dyeing and Finishing process chart

From the figure 1.1 the Uncut Fabric Finishing machine can separate in two types as Gas Finishing machine and Steam Finishing machine as figure 2.1.4.

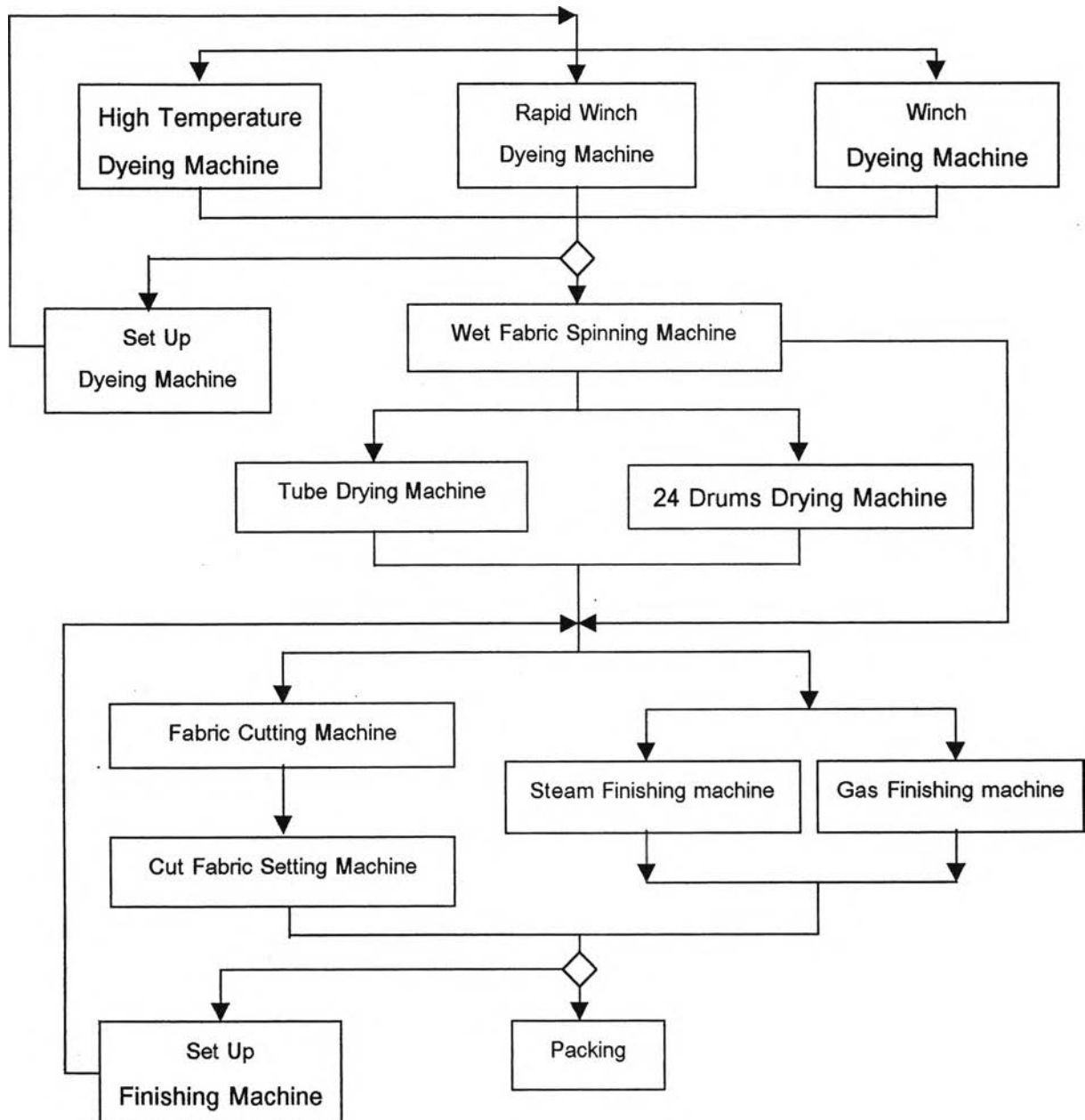


Figure 2.1.4 Dyeing and Finishing Process

2.2 Problem Analysis: Existing Situation

2.2.1 Existing Scheduling Method

The existing scheduling uses the forward scheduling method. Jobs are scheduled segmentally from the first to the last process. The floor supervisors in each section are responsible for the planning of production schedules according to individual experiences. The constraints controlling the scheduling are the characteristics of fabrics, batch sizes, colors, the required qualities, the final finishes of the fabric and the availability of the suitable machines.

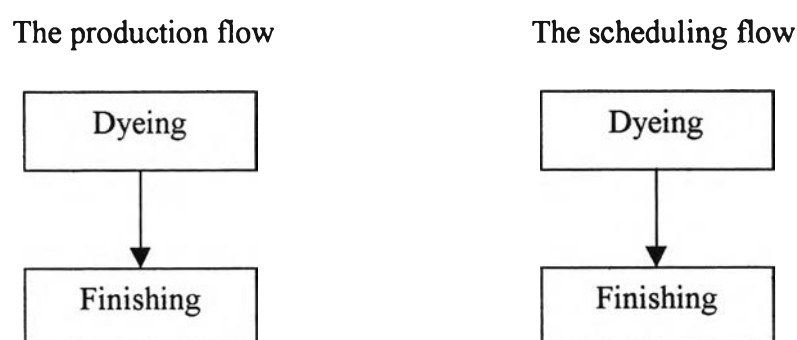


Figure 2.2.1 Forward Scheduling

Two main heuristics are being used. They are First Come First Serve (FCFS) and the minimization of the setup time. In the orders, which are the fabrics that are delivered to the plant and have been approved and confirmed of the lab samples by the customers, will be scheduled on first-come-first-serve bases. Then, the floor supervisors try to adjust the schedule to minimize set up time by resequencing the orders to suit the machine constraints.

Scheduling in the Dyeing section and Finishing section is significantly influenced by a number of constraints. Scheduling in these two sections is planned independently from each other. In the Dyeing section, its supervisor plans the schedules from the production bills, but in the Finishing section, where the process takes place after dyeing, there are virtually no scheduling being planned ahead. The floor supervisor plans the schedule from the works in process, which are already awaiting in front of each type of Finishing machine.

2.2.1.1 Scheduling in Dyeing Section

Orders ready for production are written in detail onto the production bills and sent to the floor supervisor. The morning shift (8.00-17.00) personnel prepared the production bills. The floor supervisor examines the order contents containing in the production bill and designates the appropriate Dyeing machine for each bill. The scheduling procedures in the Dyeing section are as follows:

- 1) Classify the orders accordingly to its nature, for instances, types of fabric, fabric weight, Dyeing qualities. The Dyeing machines will then be designated to process these orders.

- 2) Sequence the orders in each machine accordingly to the FCFS heuristic. This is possible only after the floor supervisor receives the production bills stating the Dyeing formula. The earliest order that the lab samples have been prepared and confirmed will be listed first in the sequence followed by the later one respectively. In order to minimize setup time, the floor supervisor designate the Dyeing machines taking into account color sequencing within the same production line. This is substantially significant due to the loss of time for cleaning the machine when orders containing different colors are processed within the same machine. However, should the situation is inevitable, it is possible to process orders of darker shade after orders of lighter shade.

The remaining production bills unprocessed from the previous day will be rescheduled together with the fresh production bills in the next day.

2.2.1.2 Scheduling in Drying and Cutting Section

Orders, which go through this Drying and Cutting section, will be distributed to different process lines accordingly to the nature of the fabric and the required Finishing qualities. There is not any critical constraints controlling the planning of order sequences for the machines at this stage. FCFS heuristic is therefore employed. At the end of this section, the products, inside the pushcarts, will then be distributed to the appropriate processing lines in the Finishing section. The status of these products is identified as work in process for scheduling in the next production lines.

2.2.1.3 Scheduling in Finishing section

At this section, the awaiting work in process will be sequenced accordingly to its final Finishing requirements. The floor supervisors will spend the first hour of their daily work planning these schedules. Scheduling work in this section has greater

complications than scheduling Dyeing works. Similar criteria are considered, for instances, the type and width of fabric and the color, as to minimize machine setup time. However colors of the work in process is less critical in Finishing process than it is in the Dyeing process. Usually, the processing machines in this Finishing section will stand idly until there is sufficient works in process waiting. This dues to the great amount of time required in starting up the machine. This is very obvious in the case of heat related machines such as the Gas Finishing machines and the Cut Fabric Finishing machines.

The existing scheduling only allocates orders in the sequence. Nevertheless, the releasing time of the finished fabrics cannot be forecasted. Presently, time table for the production lines in this section does not exist.

2.2.2 The Related Policies for Scheduling

There are criteria which are also accounted as the company policies controlling scheduling, such as,

- 1.) The rework orders must be processed urgently.
- 2.) All orders under the same group of order should be dispatched simultaneously.
- 3.) All orders under the same group of order should be processed continuously in the Finishing line. To achieve the same final quality, it is very important to process all fabrics within the same order under the same production condition.

2.2.3 Advantages and Disadvantages of Existing Scheduling Method

2.2.3.1 Advantages

1. High quality in Dyeing section can be achieved if suitable machine is allocated and sequencing color sequencing can be controlled.
2. High machine utilization and productivity in Dyeing section can be achieved.

2.2.3.2 Disadvantages

- 1) Only experiences of individuals are used to justify planning of scheduling. There is no formal theoretical basis in the production planning.
- 2) Dyeing and Finishing sections are scheduled independently.

3) The introduction of forward scheduling from the Dyeing section, which has to the Finishing section, which has many more constraints, induces obstacles in the latter processes.

4) It has no schedule timetable.

5) It causes unbalanced workload and bottle necks in various production lines.

6) It causes high setup times in the Finishing section

7) Low efficiency is inevitable in the Finishing section

8) It has low response to the policies of the company in Finishing quality and delivery

9) When Dyeing machines are working in full capacity, it is difficult to insert the rework orders or urgent orders.

2.2.4 Problems Analysis

2.2.4.1 Problems from inefficient method

1.) Unbalanced workload in production lines

Scheduling in Dyeing section and Finishing section are completely separated and independent from each other. The concerned floor supervisors in each section who are working in the relevant processes do not coordinate in the planning work. This causes unbalanced loading in production lines and causes a lot of problems

1.1) Overloaded machines and idle machines in Finishing section

Dyeing section has the capacity twice greater than the Finishing section. Nevertheless, all Dyeing machines are scheduled to operate to its highest capacities ignoring the actual capacity of each type of Finishing machines. This practice causes overloading to some types of Finishing machines and underloading in others. Frequently, the Cutting machines are overloaded because it is demanded the most in the Finishing section for most orders whereas the Uncut fabric machines stand idly. The Uncut fabric Finishing machines will be operated only when there are suitable amount of accumulated work. This is to reduce the starting time when the machines are restarted.

1.2) Insufficient waiting space for work in process

The overloaded machine builds up bottleneck in the production line. When this incident takes place, obstruction in the production flow or product

circulation is unavoidable. The bottleneck also causes insufficient waiting space for work in process for each machine. Eventually, some works in process are unintentionally left in the remote areas causing difficulties in shop floor control.

1.3) Insufficient pushcarts

Build up of work in process in the bottleneck areas also cause insufficient pushcarts. All pushcarts are shared by all sections. Because of this problem, processing work in the drying machines are interrupted while the dyed fabric cannot be taken out of them. This occurrence also causes overloading of dyed fabric into the open-top pushcarts resulting in the dropping of fabric onto the ground as well as damaging the fabric.

2.) High setup time in Finishing process

In the Finishing section, the floor supervisors plan the work schedule from the awaiting work in process. These works in process are produced from dyeing with the schedules that are made without considering the schedule of the following process which is finishing. At the Finishing Section, the schedulers are inevitably forced to plan their works with no control of their in-coming sequence. Thus, it is difficult to group the orders to match the Finishing constraints especially to accumulate work in process to a certain suitable quantities for operation. This results in frequent resetting up of machines, and thus causes high production cost.

3.) Low quality in Finishing products

The quality in Finishing products is uniformity. It depends upon processing the same group of orders under the same single condition. There is not at present any plan to dye the same group of orders continually to facilitate this quality requirement. This problem is worsen when the flow of the job orders of the same group are splited up and come sparsely.

4.) High Inventory of Finished goods.

The policy of one single dispatch of finished goods under the same main order causes high inventory of finished goods. Although this is most welcome from the customer's point of view, the existing scheduling method does not cater for this policy. A lot of finished goods cannot be dispatched simultaneously. Especially, those

finished goods are built up in the area behind the machines. When this happens, production lines as well as finished goods are obstructed.

5.) Low morale of the workforce

These problems of inconvenience in the production lines result in low productivity which generate stresses on workers and thus result in low morale and high labor turnover.

6.) Long production lead-time and high production cost

All the problems as mentioned above cause long production lead-time and high production cost.

2.2.4.2 Problem from having no timetable

1.) Difficulty in shop floor control

1.1) Inefficient production preparation.

There are no advance schedule for the workers to prepare for production both in the raw fabric and dyestuffs. Presently, the workers can prepare for the next order only when the processing order is almost finished in each stage. This is sometimes too late when there are problems in locating the raw fabric or shortage of dyestuffs.

1.2) High inventory of dyestuffs.

Nowadays, the company orders the dyestuffs by using the information of usages in the previous months. This information is incorrect since customers' orders in each month vary greatly. This practice causes the company to hold a lot of dye stuff inventory, sometimes for a long period.

1.3) Difficulty in monitoring the production

There are no timetables of production for the floor supervisor to monitor each order, especially in the Finishing section, which always have insufficient waiting space. This causes some orders to be lost

2.) No provision of due date information for customers.

The product due date cannot be designated and made available to customer.

3. High inventory in fabric warehouse

It is impossible to forecast the time required for processing the remaining orders as well as the delivery time. The marketing department cannot make justification in accepting new orders. Now that all orders are received as fast as possible, This creates high inventory in raw fabric warehouse. Sometimes, some orders must be stocked in various available spaces in the production floor. This is difficult to control the inventory of raw fabric as well as to prepare fabric for production.