

CHAPTER 1

Introduction



1.1 Thesis Background

The company in this case study is a textile factory doing commission dyeing and finishing of knitted fabric for knitting industries. The company provides dyeing and wide ranges of finishing services for various types of fabric of different fiber blends, for instances, polyesters, nylons, cottons, polyester-cotton blends, etc. The order of specific colors and types of finishing will be placed simultaneously. Color and finishing samples may also be provided. The requested colors are then tested in the company laboratory. When the best possible result is gained from the laboratory, the tested color samples are dispatched for approval to the customers before actual production will take place. The finishes such as brushing, shearing, or setting are frequently requested as well as control of fabric width, shrinkage, softness, color fastness, fire resistance etc. are always emphasized. After thorough examination and confirmation of the order, the processes start from dispatching fabric from the warehouse into the Dyeing house. Dyeing machines consist of three different types: High Temperature & High Pressure Dyeing Machines (12 machines), Rapid Winch Machines (10 machines), and Winch Machines (10 machines). Each type of machines contains various ranges of capacities and operating temperatures. Proper selection of machine types and capacity is therefore vital and play significant role for the final quality result. Moreover, where efficiency of production is concerned, careful and accurate production sequencing especially taking colors in consistency must be achieved. Changes the shade of color will result in necessary resetting up of machines and consequently causes waste in water and energy. The dyed fabric is then pre-dried by Wet Fabric Spinning Machines (2 machines). Drying process is the next procedure which involve two different types of machines which are the Tube Drying Machine (3 machines) and the 24 Drums Drying Machine (1 machine). Occasionally, some fabrics can be proceeded to the next process bypassing these machines. The Finishing processes are the final procedure. The fabric flow will be designated by customers' requirements of final fabric qualities. If Uncut fabric is specified, the fabric will be sent directly to the Uncut Fabric Setting Machine (4 machines). Should Cut fabric be

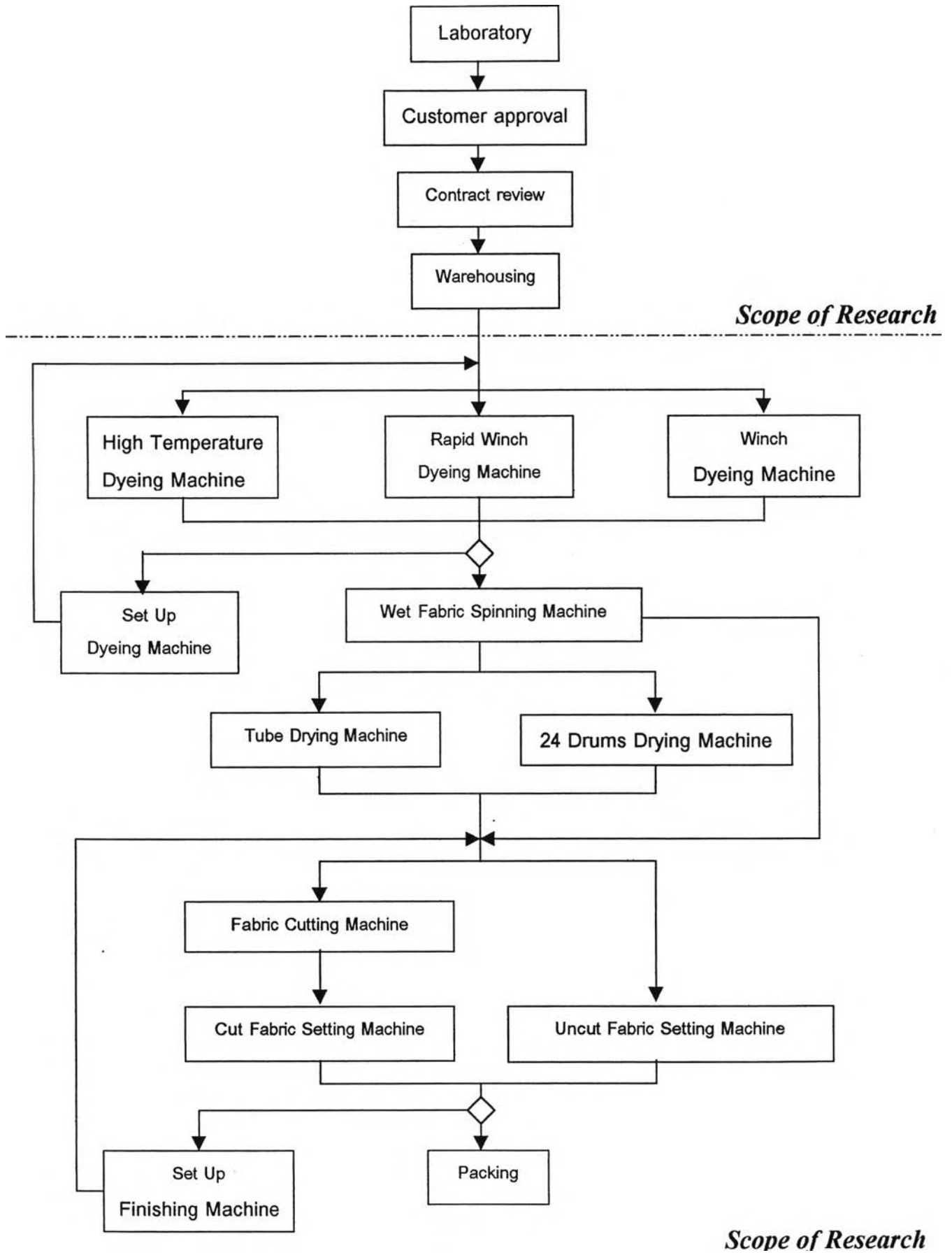


Figure 1.1 Dyeing and Finishing Processes

required, it will subsequently go through a Fabric Cutting Machine (1 machine), and then proceeded to the Cut Fabric Setting Machine (2 machines). At this stage, fabrics of the similar characteristic should be sequenced respectively to avoid resetting up of the machine. These processes are shown in Figure 1.

Today, Dyeing industry, like other modern globally competitive businesses are driven by short production lead times, optimum quality assurance and low production costs. The successful market presence can only be achieved if the relevant production quality is guaranteed. The crucial key to this quality assurance and guarantee high rate of efficiency is the method used for scheduling. The factory in this study is encountering many different kinds of production problems stemmed from inefficient production planning.

1.2 Statement of Problems

Presently, a proper production schedule does not exist in the factory in study. In the Dyeing section, floor supervisors plan production schedules accordingly to their experiences. The factors controlling the planning schedules are only the batch sizes, colors and the availability of the machines. In the Finishing section, there is not any clear planning. Machine operators taking into account merely the similarity of requirements to its precedent and the waiting work in process designate the sequences of orders. Production planning both in the Dyeing process and the Finishing process is executed independently. Coordination of the two main processes has never been materialized and thus results in an unrealistic and inefficient planning. Sequences of productions are determined uncontrolled by machines, operators and floor supervisors. Their decision making is based on limited and insufficient information

The lack of efficient production schedule impairs the ability to designate due date for the finished products and occasionally causes fluctuation in the commissioned works exceeding the plant actual capacity. Consequently, warehouse problems are also inevitable. Problems are also found in dyestuffs inventories where expensive dyestuffs are sometimes overstocked or lacked when accurate consumption cannot be forecasted due to the lack of efficient production planning. Production control within the shop floor is difficult to monitor. Planning for machines periodic maintenance seems to be impossible

In addition, the present production planning pays neither attention to the processing times nor the machine load balance and production workload balance. Each section works independently ignoring the relevant processes. This leads to bottleneck where some machines are overloaded while the others stand idly. The bottleneck also causes insufficient waiting space for work in process as well as obstructing product circulation and consequently results in chaos among the process lines. The bottleneck also causes insufficient pushcarts. These problems also generate stresses on machine operators and workers and thus result in low morale and high labor turnover.

In conclusion, the major problems are as follow:

- 1) The product due date cannot be designated and made available for customer information.
- 2) Long manufacturing lead-time.
- 3) Unbalance in the process lines and workforce.
- 4) Difficulty in shop floor control.
- 5) Problems in the material handling and warehousing.
- 6) Inefficient inventories both in work in process and dyestuffs.

The key factor to eliminate these problems is the efficient production planning. The urgency of the present problems thus justifies the selection of this thesis.

1.3 Objective

To develop a production scheduling method for knitted fabric Dyeing and Finishing processes in the studied factory.

1.4 Scope and Assumptions of the Research

The scopes and assumptions of this research are concluded as follows:

1.4.1 This research will propose a method for scheduling the dyeing and finishing operations in the studied factory. The operations will be covered, start from the Dyeing process to packing as shown in figure1.

1.4.2 A database of necessary data, which will be used for scheduling, will be created.

1.4.3 The criteria for considering the production improvement in the scheduling method will be:

- The production lead-time: The amount of time, from the order is confirmed and the fabric is sent, to the time that the fabric is produced completely.
- The quantity of work in process inventory: The amount of work in process in each operation and the amount of time that each order has to wait in the process.
- The machine utilization: The amount of time that the machines are loaded compares with the available time.

1.4.4 This research will maintain floor supervisors' determination to adjust the schedule accordingly to the process constraints such as maintaining color consistency and fabric characteristic.

1.5 Methodology

In Dyeing and Finishing process, there are many types of operations in series with a number of machines, which may be of the same or different types, at each stage. A job has to be processed on a specific machine and may not need to be processed at all stage. Work in process also exists in each stage. It is the flow shop manufacturing with a number of stages in series with a number of machines in parallel and the buffers at each stage. This research will develop a scheduling method for this environment. The methodology consists of:

- 1) Study the existing scheduling method in the studies factory.
- 2) Add some heuristics or algorithms from the related literatures and theories, in the existing scheduling method to improve the effectiveness in the scheduling.
- 3) Compare the production improvement from the new scheduling method with the existing method, using the criteria specified in 4.3

1.6 Research Procedure

- 1) Study related literatures and the process of dyeing and finishing in the studied factory.
- 2) Develop the plan for collecting data and do it.
- 3) Analyze the data to be database information.

- 4) Develop a production scheduling method.
- 5) Schedule the production.
- 6) Compare the production improvement in the existing method with the new production from this new scheduling method using the criteria specified in 4.3.
- 7) Write up thesis and submit thesis form.
- 8) Prepare for the presentation in final examinations.

1.7 Expected Results

The results of the thesis will be:

- 1) Scheduling method for knitted fabric Dyeing and finishing factory, consist of:
 - 1.1) Work procedure for scheduling orders.
 - 1.2) Scheduling algorithm.
 - 1.3) A database for scheduling.
- 2) The improvement of the criteria specified in 4.3 in the production during the study.

1.8 Expected Benefits

This research supports the method for doing the production scheduling. The company will have the clear and complete schedule that can make a significant contribution to:

- Give the clear timetable in the production to due with the customers and appoint the due date, and to monitor and control the shop floor.
- Reduce the manufacturing lead-time.
- Minimize work in process inventory
- Improve machine utilization and productivity.