SHOP FLOOR CONTROL SYSTEM FOR PLASTIC PACKAGING FACTORY

Mr. Wattana Krisnavarin

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Master of Engineering in Engineering Management
The Regional Centre for Manufacturing System Engineering
Faculty of Engineering Chulalongkorn University
Academic Year 2009

ระบบการควบคุมพื้นที่การปฏิบัติงาน สำหรับโรงงานบรรจุภัณฑ์พลาสติก

นาย วัฒนา กฤษณาวารินทร์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรมหาบัณฑิต
สาขาวิชาการจัดการทางวิศวกรรม ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต
คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2552

Thesis Title SHOP FLOOR CONTROL SYSTEM FOR PLASTIC PACKAGING FACTORY

By Mr. Wattana Krisnavarin

Field of Study Engineering Management

Thesis Advisor Associated Professor Parames Chutima, Ph.D.

Accepted by the Faculty of Engineering, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

....Dean of the Faculty of Engineering
(Associate Professor Boonsom Lerdhirunwong, Dr. Ing.)

THESIS COMMITTEE

....Chairman
(Professor Sirichan Thongprasert, Ph.D.)

....Thesis Advisor
(Associate Professor Parames Chutima, Ph.D.)

....Examiner
(Associate Professor Jeirapat Ngaoprasertwong)

……………..External Examiner
(Associate Professor James Wallbank, D. Eng.)

วัฒนา กฤษณาวารินทร์: ระบบการควบคุมพื้นที่การปฏิบัติงาน สำหรับโรงงานบรรจุภัณฑ์พลาสติก (SHOPFLOOR CONTROL SYSTEM FOR PLASTIC PACKAGING FACTORY)
อ.ที่ปรึกษาวิทยานิพนธ์: รศ.ดร. ปารเมศ ชุติมา, 150 หน้า

วิทยานิพนธ์ฉบับนี้เป็นงานวิจัยระบบการควบคุมพื้นที่ปฏิบัติงาน โดยนี้มีวัตถุประสงค์เพื่อลดปัญหาภายในโรงงานบรรจุภัณฑ์พลาสติก โดยใช้วิธีการต่างๆที่เกี่ยวข้องกับการควบคุมพื้นที่ปฏิบัติงานในการศึกษาแก้ปัญหา ของสายการผลิตบรรจุภัณฑ์ถุงพลาสติกประเภทพอลิโพรไพลีน (Polypropylene)

งานวิจัยเริ่มต้นจากการรวบรวมและวิเคราะห์ข้อมูล เพื่อหาปัญหาต่างๆที่เกิดขึ้นทั้งหมดในขั้นแรก โดยใช้วิธีการสำรวจความถี่ของปัญหาที่เกิดขึ้น พบปัญหาหลักสองประการที่มีส่งผลกระทบมากที่สุด คือปัญหาของเสียและปัญหาสินค้าค้างส่ง ทั้งสองปัญหาได้ถูกวิเคราห์หาต้นตอของสาเหตุ โดยพบว่า ปัญหาของเสียเกิดจากวิธีการทำงานของคนงานทำให้เกิดของเสีย และปัญหาของสินค้าค้างส่งเกิดจากระบบการสั่งงานที่ไม่มีประสิทธิภาพ การแก้ปัญหาของทั้งสองปัญหานี้ใช้วิธีการตามขั้นตอนดังต่อไนี้ การจัดผังองค์กรใหม่ ปรับปรุงขั้นตอนการทำงาน จัดทำแผนผังของกิจกรรมและเอกสารของฝ่ายผลิต เพื่อให้การทำงานของแต่ละหน่วยงานในพื้นที่ปฏิบัติงานมีการประสานงานเป็นระบบ

ผลลัพธ์ที่ได้หลังจากการดำเนินการปรับปรุงทำให้ของเสียที่เกิดขึ้นในกระบวนการผลิตทั้งหมด จากเดิม 3.07% หลังดำเนินการ 2.03% ลดลง 1.04% และจำนวนสินค้าค้างส่งลดลงจากเดิม 2.63% หลังดำเนินการ 1.11% ลดลง 1.52%

ศูนย์ระดับภูมิภาคทางวิศวกรรมระบบการผลิต ลายมือชื่อนิสิต:..

สาขาวิชา.....การจัดการทางวิศวกรรม............ ลายมือชื่ออาจารย์ที่ปรึกษา:...

ปีการศึกษา..2552...

497 16419 21: MAJOR ENGINEERING MANAGEMENT
KEYWORDS: SHOP FLOOR CONTROL SYSTEM / PLASTIC PACKAING FACTORY

WATTANA KRISNAVARIN: SHOP FLOOR CONTROL SYSTEM FOR PLASTIC PACKAGING FACTOYRY THESIS ADVISOR: ASSOC.PROF.PARAMES CHUTIMA, Ph.D., 150 pp

The objective of this research to study shop floor control system principle in order to improve shop floor management in plastic packaging factory, which focusing on the polypropylene production.

The research was started from current problems and then investigates on the frequency of each problem. This is to show the problem that will be focusing. The analysis found out that there are two main problems of this case company that should be solved, which are problem of product backlog and product defect. Then, cause & effect diagram and why-how analysis show that the root cause and solution of problems, which product backlog is ineffective job order and method of working is generate waste and product defect. The solution of these problem start from reorganisation structure, implementation of work instruction, redesign of shop floor functional activity and document.

The result after implementation shows that the number of defect is reduced by 1.04% from 3.07% to 2.03%. For the problem of product backlog, after implemented the number of back log is reduce by 1.52% from 2.63% to 1.11%

The Regional Centre for Manufacturing Systems Engineering Student's Signature........................

Field of Study : ..Engineering Management………………… Advisor's Signature........................

Academic Year : ..2009…………………………………………..

ACKNOWLEDGEMENT

This thesis is completed by assistance of the thesis advisor, Associate Professor Parames Chutima. Author is very deeply appreciated and gratitude to the advisor for his sacrifice, superior advises, best recommendations and prompt supports on every question and problem that occur during research through the completion of the thesis.

The author is very appreciate and gratitude to Professor Dr. Sirichan Thongprasert, the Chainman of the Thesis Committee and Associate Professor Jeirapat Ngaoprasertwong, member of the Thesis Committee, for their valuable suggestion on the thesis.

The author is gratitude to my staffs and workers who had contributed their times, share their experience, and provide necessary data for the thesis.

The author is great gratitude to parent, brother and friends for their support and encouragement during the research through the completion of the thesis.

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CHAPTER I

INTRODUCTION

This chapter is going to describe the background of the research and the case company. It is to show the current situation of the company. The lactic section on this chapter is statement of problems, which will pointed out the problems occur in the case company.

1.1 Background of the research

The modern environment of manufacturing is sophisticated and intensely competitive. It is characterised by short product life cycles, high product diversity, and customer's demands for both excellent quality and timely delivery. (Bowden, 1994) For manufacturers, the challenge is to develop a finely process, capable of meeting the cost, quality, and variability and time pressures forced by the market place. Beside, the crucial objectives must include the reduction of manufacturing lead-time to the minimum possible, as well as an achievement of a high level of process control. In additional, the benefits increasing from a greater flexibility and responsiveness, better use of manufacturing resources, reduced inventory levels, and faster repeating on customer.

According to manufacturing industries in Thailand, they are now not only competing themselves in the domestic market place. They are all adapting to be modern and advance in manufacturing system to be able to complete with the international market place. To adopt a new modern manufacturing system is not an easy task to implement for manufacturing industries especially for background of Thai's manufacturer. The manufacturing businesses in Thailand generally are small business and most of them started from family business. The operation of family business is simple and close control by the owner of the company and their relatives. The organisation of the company is usually small and simple. The problem about managing the business is not complicated and effortless to solve by the owner. The information and document system is simple and most of the times unnecessary because of the orders are made directly from the owner to the workers, and again very close monitoring has done by the owner.

At some point of the time, most of family businesses has grow up and expand over time, so that the existing management style could not be able to handled and monitored all operations. According to the cast company, an existing organisation structure and old-fashioned management are not support the manufacturing improvement. Thus, the organisation needs clear and good productions plan to serve customer without delay. It is obviously not only time to consider, cost is also important because in business competitors will reduce cost and increase their capacity and quality. Moreover, the activities and information across the shop floor in the factory are more complicated and tend to increase day by day. The improvement is also should focus on internal production system and it is helpful to have clearly job assignment and standard process.

Therefore, Shop Floor Control (SFC) is the system monitor directly on production order, analyses efficiency and production problems. It is focus on tracking and reporting against production orders and schedules. As well as, SFC evaluated and updated resources status, labour, machine hour to support production planning, cost and lead-time estimation. SFC can monitor and track production order from starting to finished product. Basically, The company will gain benefits from adopting SFC theory to initially track problem that occur from machine and human work force in order to optimise resources, labour, and machine performance. Further more, lead time is a timeline that products are in production line, and that include set up time, process, queuing, and transport time. Consequently, SFC assists planner to reduce all waste in lead-time with the quality control, tracking system of production order, reduce work in process. To adopt a Shop Floor Control theory, the family background manufacturer will gain most benefits. Herein, SFC will be study and apply to improve the case company shop floor control.

1.2 Background of the case company

The case company is a plastic packaging company established over 20 years. As a high demand of plastic packaging spread over every industry, the case company has been versify their product including enlarge ability of production to supply needs of plastic packaging, from the traditional plain shopping bag to printed laminated packaging. The company is in plastic packaging manufacturer sector, which has Food, Dairy, Agriculture and Meat industries as a key markets. Most Customers are small to medium retailer, wholesale, and trading company. They are also medium to large enterprise in food industry. With hundreds of machinery and over 400 workforces in two locations, the production during five years of daily plastic resin consumption has jumped up 50 percentages in average. The classification of raw material has classified according to the four main products, which are polypropylene (PP), high-density polyethylene (HDPE), low-density polyethylene (LDPE), and low linear density polyethylene (LLDPE). The table following shown the number of average raw material consumption monthly for each product. According to table 1.2.1, it is show that raw material of PP is the main production of the case company.

Table 1.2.1: The average of raw material consumption monthly.

Raw Material	Monthly Consumption	%	Units
PP	400,000	51.61%	KG / Day
HDPE	260,000	33.55%	KG / Day
LDPE	45,000	5.81%	KG / Day
LLDPE	70,000	9.03%	KG / Day

1.3 Statement of problems

Since polypropylene is the main product, which already half of the case company production 51.61% according to Figure 1.2.1, this study will focus on the PP production. It is because of emphasise on the PP production will reduce the overall number of defect and backlog of the case company. Once the focused area in the case company has been set, the research start to find what are the problem in this case company. This study starts from list the problem from interviewing and investigates at the factory site and found 8 problems. Since the problems occurring have been listed, the study then creates the check sheet as Table 1.3.1 to research on the frequency of the occurrence. The investigation of check sheet procedure was collecting the data since October 1st of 2008 to November 30th of 2008.

According table 1.3.2, the research found out that the first three highest occurrence problems are High number of defect waiting to recycle, Plastic resin fall over shop floor, and finished goods out of stock. The rest of problems are Dirt on product, Side leak, Unshaped, Clarity respectively in number of occurrences. These problems can be classified into two main groups, which are problem of defect and order backlog.

Table 1.3.1: Problem check sheet

Problems Check Sheet Period of collecting data: October, 1st - November, 30th 2008		
Type of Problems	Count	Score
Dirt on product		30
Side Leak		17
Seal Leak		14
Unshape		9
Clarity		22
FG out of stock		45
Plastic resin fall over shopfloor		48
High number of defect waiting to recycle		50

Table 1.3.2: Problems check sheet summary

Problems Check Sheet Summary				
No.	Problems	Frequency	%	Accumulated %
1	Dirt on product	30	12.77%	12.77%
2	Side Leak	17	7.23%	20.00%
3	Seal Leak	14	5.96%	25.96%
4	Product Unshaped	9	3.83%	29.79%
5	Clarity	22	9.36%	39.15%
6	FG out of stock	45	19.15%	58.30%
7	Plastic resin fall over shop floor	48	20.43%	78.72%
8	High number of defect waiting to recycle	50	21.28%	100.00%

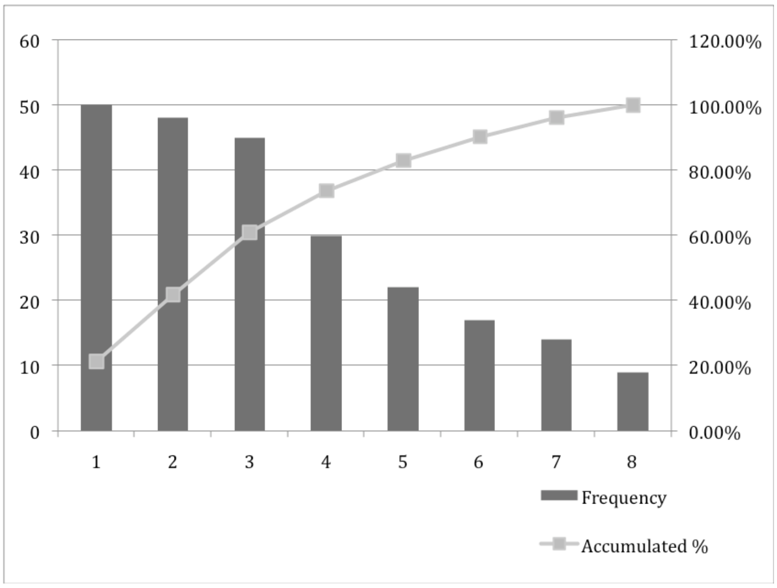


Figure 1.3.1: Pareto diagram of problems

The problem of defect is become the crucial problem since the case company raw material consumption increasing every year. According to Table 1.3.2 below, it is show the number of defect in focused process, which are resin mixing, film blowing, and cutting & sealing process. The number of defect in film-blowing process is approximately at 26,000 kilograms per month or 900 kilograms per day in average. In the cutting and sealing process, the defect is 13,000 kilograms per month in average or approximately 430 kilograms per day. The case company totally loss opportunity to generate income from this defect up to 19,350 Baht per day.

Table 1.3.3: The number of defect in the focused process

Process	Dec 2008	Jan 2009	Feb 2009	Mar 2009	Unit
Mixing					
Input	353,250.00	283,750.00	334,500.00	354,625.00	KG
Defect	347.00	402.40	372.20	286.10	KG
Blowing					
Output	348,958.10	300,156.00	348,298.70	379,498.40	KG
Defect	10,665.10	11,313.00	10,105.40	11,364.00	KG
Cutting & Sealing					
Output	335,996.00	294,355.00	321,720.00	362,837.50	KG
Defect	682.30	677.70	827.30	811.70	KG
Total	11,694.40	12,393.10	11,304.90	12,461.80	KG

The high number of backlog is another problem that the case company is facing. The case company cannot supply the finished good that customer ordered. This problem seems like the case company run out of product stock, but the warehouse still holding finished goods. For further study, warehouse holding finished good that are not what customer ordered. This is indicated that the backlog problem in the case company is not about demand over capacity. The case company is facing the problem of overproduction. They are producing what customer not currently ordered. According to Figure 1.3.3, it is obviously that the problem of product backlog has not related to the capacity issue.

Table 1.3.4: Table of customer order backlog

Calendar	Dec '08	Jan '09	Feb '09	Mar '09	Unit
Actual Produced	335,996.00	294,355.00	381,720.00	392,837.50	KG
Inventory	12,025.30	10,534.97	13,661.76	14,059.65	KG
Actual Sales	315,648.00	300,533.00	366,627.00	376,535.00	KG
Customer Order	301,822.62	299,541.24	354,418.32	367,761.73	KG
Backlog	13,825.38	991.76	12,208.68	8,773.27	KG
Over production	32,373.30	4,356.97	28,754.76	30,362.15	KG

However, the both problems of product defect and order backlog initially because of non-system to control the activity through the shop floor. It starts from the formal organisation structure is not exist. They are lack of document system based through shop floor, standard work instruction and no collaboration between functions. The consequences of those none standard activity brings two major problems, which are high number of defect and backlog. In addition, the experience and feeling of owner are using to create rough plan and approximate outcome for production planning, and that resulting in span of control problem.

1.4 Objective of the research

To study a shop floor control system principles to improve a shop floor management for the company.

1.5 Scope of the study

This thesis will study on the plastic packaging company and will focusing on the PP production. There are principles of Shop Floor Control, Production Activity Control (PAC), and Factory Coordination (FC) will be adopting in the case company. In detail, there are scopes as follows.

- Design work flow and procedure for each department
- Create work Instruction
- Create Job description

1.6 Expected Results

1. The improvement of shop floor control can improve effectiveness and efficiency of the case company
2. Clearly job assignment and work instruction.
3. Standard activities for shop floor control system
4. The effective and efficiency of factory data collection
5. Waste identification data support in order to further waste elimination plan
6. Data support the manufacturing performance measurement
7. Reduce shipment delay
8. A better factory environment

1.7 Research Procedures

1. Study the comment and suggestion that related with thesis topic from literature surveys, theories, and techniques.
2. Study and collected current status and problem about the organisation such as order placement, machine capacity, workstation, material movement, document flow, and variable cost.
3. Analyse the information from collected data and identify the causes of problems
4. Develop and design shop floor control system such as work instruction, job assignment, document system and create production plan
5. Implement the shop floor control system
6. Evaluate and improve system by comparing the results,
    a. Backlog
    b. Defect
7. The summarisation of the result studied
8. Thesis presentation

CHAPTER II

THEORETICAL CONSIDERATIONS

This chapter is discussing on theories, literature review, journal, and education paper including techniques and tools that will adopting to this research. The theoretical considerations will support and guide line this study too improve and solve the problem the case company.

2.1 Check sheet

A check sheet is a sheet or from used to record data. The data from the check sheet provides the factual basis for subsequent analysis and corrective action. There are three main uses of check sheets. First, it can be used to count items, such as defects, or to show the distribution of a set of measurements. Second, it may be used to show the physical location of something such as defects on a manufactured item. This is useful for finding significant bunching of measurements, which may help to find problems. Finally, it may be used to help prompt for an action and consequently be ticked to certify that a particular action has been carried out. (Rattanakuekangwan, 2006)

The following are the main steps in constructing the check sheet.

- Determine the type of check sheet use
- Decide the type of data to be illustrated. The data can be related to number of defectives, percentage of total defectives, cost of defective, type of defective, process equipment, shift, business unit and operator.
- Decide on which features/ characteristics and items are to be checked/
- Design the sheet, it should be flexible enough to allow the data to be arranged in a variety of ways. Data should always be organised in the mot meaningful way to make best use of it.
- Decide the period over, which data are to be collected.
- Specify the format, instructions and sampling method for recording the data, including the use of appropriated symbols.

2.2 Pareto diagrams

Pareto diagram is a technique employed for example, quality, production, stock control, accident occurrences and resource allocation. The diagram highlights the fact that most problems come from a few of the causes and also it is an extremely useful tool for condensing a large volume of data into a manageable from and in helping to determine, which problems to solve and in what order. Therefore, the Pareto diagram is simply bar chart in which the bars sorted into size order. There are 2 types of Pareto diagram as following. (Rattanakuekangwan, 2006)

1. Pareto diagrams by phenomena

   This is a diagram concerning the following undesirable results, and is used to find out what the major problem.

   - Quality: defects, faults, failures, complaints, returned items, repairs.
   - Cost: amount of loss, expenses.
   - Delivery: stock shortages, defaults in payments, delays in delivery
   - Safety: accidents, mistakes, breakdowns.

2. Pareto diagram by causes

   This is a diagram concerning causes in the process and is used to find out what the major causes of the problem.

   - Operator: shift, group, age, experience, skill
   - Machine: machines, equipment, tools
   - Raw material: manufacturer, plant, lot
   - Method: conditions, orders, arrangements, methods

   The following are the basic steps in constructing a Pareto diagram.

   - Decide the problem, which us to be analysed.
   - Decide the period over, which data are to be collected.

- Identify the main causes or categories of the problem.
- Collect the data, using check sheet.
- Tabulate the frequency of each category and list in descending order of frequency.
- Arrange the data as in a bar chart.
- Construct the Pareto diagram with the columns arranged in order of descending frequency.
- Determine cumulative totals, which can cumulative percentage and construct the cumulative percentage curve.

2.3 Causes and effect diagrams

The cause and effect diagram is a useful tool. It uses to identify and breakdown the main causes of given problem. All of the possible causes are related to a problem under study and are hierarchical by their nature. This diagram is also called a fins bone diagram because of its shape, or an Ishikawa diagram in honour of Kaoru Ishikawa, who developed this technique in 1943. The diagram is illustrated in a clear manner the possible relationships between some identified effect and the causes of problem and in generating improvement ideas. According to Baudin (1990), they pointed out that there are three kinds of diagrams, which will be described as following.

Firstly, 5M cause and effect diagram. The main bone structure is typically comprised of machinery, man, method, material, and maintenance. The 4M and 6M also exist and use for those with those who have slight experiences of created cause and effect diagrams, and also it is useful to analyse the uncertainty events. Secondly, process cause and effect diagram. It requires flowchart and seeking to identify potential causes for the problem at each stage of the process. The process flow has sub-process or process steps that should be separately identified. Thirdly, dispersion analysis cause and effect diagram, this diagram is usually used after 4M, 5M, and 6M diagram has been created. The main causes identified by the group. It then will treat as separate branches and expanded upon by the team. The causes and effect diagrams will be used:

1. The investigating a problem and to identify a key problem causes.

2. T primary effect of a problem is known, but possible causes are not all clear.
3. Working in a group and to gain a common understanding of problem causes and their relationship

To create the cause and effect diagrams, firstly, find all possible causes of an effect and then categorised them into group and further classify into subcategories. Draw a horizontal line with arrow pointing to a box at the right end, which is named with the effect under consideration. For each main category, draw a line slanting into the horizontal arrow. The following is the example of the cause and effect diagrams.

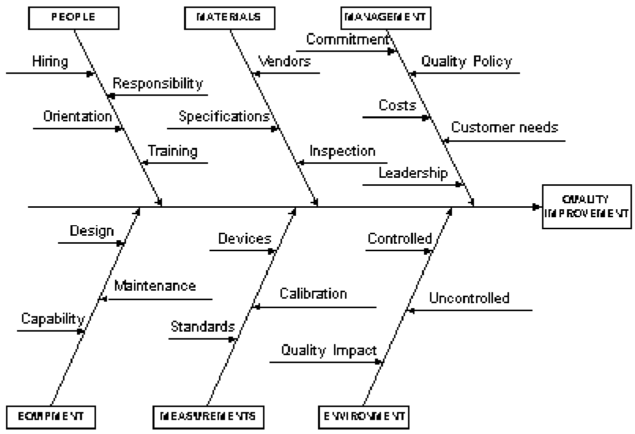


Figure 2.3.1: The example of cause and effect diagram

2.4 Why-Why analysis

Why-why analysis is an analyzing technique leading to the factor or root causes that review problems systematically step by step. It is a quality tool that is widely used to search for the cause find out, for example cause and effect diagram and relation diagram. The cause and effect diagram is used to find out the major cause in order to roughly solve the problem. The relation diagram is a technique to bridge a relationship in related factors. However, it cannot be employed to analyses the source of the problems in order to find a measure preventing the same mistakes. On the other hand, why-why analysis can analyses the source deeply to the very root, then find the solution for it.

The simply steps for creating the why-why analysis are following. First, the company needs to specify the problems by identifying the true and false precisely. Second, investigate actual location and real circumstance in order to learn to understand every detail, which are structure and responsibility or duty of the problems. Third, look at the problem as it should and set the criteria to prevent the same mistake. Fourth, by viewing an actual situation, start the analyzing step by asking “why” to the problem step by step, while you are leading to the root cause and finally, find the measure to the same mistakes. (Rattanakuekangwan, 2006)

2.5 Production activity control

Production activity control (PAC) is a technique to plan production in short term such as day-to-day. Normally, PAC has five functions, which are scheduler, dispatcher, monitor, mover, and producer. PAC focused on cell and workstations layer, which under factory layer and above device layer. Each function relates in scope of work and communicates to each other to reach target. (Bauer, 1991)

Scheduler is a basic in planning follow requirements and time schedule, which giving detailed schedule to dispatcher. Scheduler use lot of data from monitor to create schedule in practical, which have many constraints related. Firstly, scheduler should consider on capacity, requirements and environment. Secondly, analyze date to develop schedule with available capacity in each workstation. Then, push schedule to dispatcher to implement in production line.

Dispatcher is coordinator and controlling function in PAC. Dispatcher receiving schedule from scheduler then analyses for the most suitable solutions, and then implement. Dispatcher deal with practical problem that happen from uncertainty. To deal with problems dispatcher need to have data support such as shop floor current status, choice of operations and detail, performance in each process. Therefore, dispatcher is the one who giving instruction to mover and producer in the system.

Monitor is an important function, which giving consistent, accurately decision support data scheduler and dispatcher because decision making under practical case need accurate information. In addition, data collecting and analysis in the main task for monitor. There are many data, which related, product data, inspection data, defect data, rework data, workstation data, job and task status. Monitor takes tracking responsibility in production line, which monitoring on product, raw material, and quality. Data capture is a collecting process to making decision support in each level. To check work-in-process and workstation status should use different type of data such as work-in-process status collect job number, part name and location. Moreover, workstation status collects workstation name, current status and job number. Data from collecting is use in analysis for scheduler and dispatcher, which collected by monitor.

Mover is mainly responsible for material handling and movement in and between workstation. Mover also creates and adjusts routing for all transport between workstations. Transportation data from mover could lead to solution implementation from dispatcher, which reduce overlap transport waste.

Producer is the function that giving detail of work when finished in each job to monitor and working follow dispatcher instructions. Producer is an information receiver to generate in work.

2.6 Factory coordination

Factory coordination (FC) is environment and controlling task, which in the factory layer. FC relies on varieties of inputs and output. In addition, production environment task responsible for process planning and manufacturing analysis, which cover adjust layout by focusing on product or process type. Production environment task improve efficiency to support production level and concern in maintenance and environment that effect to production. In the control task, scheduler, dispatcher and monitor are doing the same task as production activity control but in the larger layer. Therefore, scheduler create suitable schedule for factory layer and send to dispatcher to implement and control workflow. Monitor is giving data in which suitable for decision-making in factory layer. FC has changing data with production activity control to making support decision data more accurately. (Bauer, 1991)

2.7 Documentation and data collection

Data collecting and documentation in SFC is useful for making decision, thus sourcing data and data analysis is important. The useful data should create on the same standard such as same type of unit, therefore people who involve with the data should understand in the same way. To get accurate data should identified exactly what information that need. There are many procedures in colleting data, mechanic automatically, operator record, counting by observer, and job order. (Bauer, 1991)

- Mechanic automatically is the data collection that machine has automatic mechanism to record data such as electric counter on the pressing machine.
- Operator recording is the direct way to collect data from operator. It is only operator that can count and record how much the job done in hour or day.
- Counting be observer, it is the information collect by observer who walking and count on the job that done in each workstation.
- Job order is the data collection that relies on job order card or command of order.

2.8 IDFE$_0$ (Integrating Definition for function Modeling)

The technique of IDEF$_0$ is a tool that used to describe the activities in the shop floor control system (Cho & Lee, 1999). It is because of the IDEF$_0$ illustrated the relationship in each activities step by step from the main task to the detailed task. The model of the IDEF$_0$ is consists of box that represented activity or process, and 4 direction of arrows, which called ICOM Code represented for input, output, control, and mechanism.

- Input is raw material or information that required for certain task or activity such as raw material, purchasing order, documents. The symbol of input is represent with arrow in the left side of the box.
- Output is result or finished product that will come out form certain task or activity such as finished goods, production planning. The symbol of output is represent with arrow in the right side of the box.

- Control is the guideline that control for certain task or activity such as delivery date. The symbol of control is represent with arrow on the top of the box.
- Mechanism is the driver that require to do the certain task or activity such as worker, machine. The symbol of mechanism is represent with arrow under of the box.

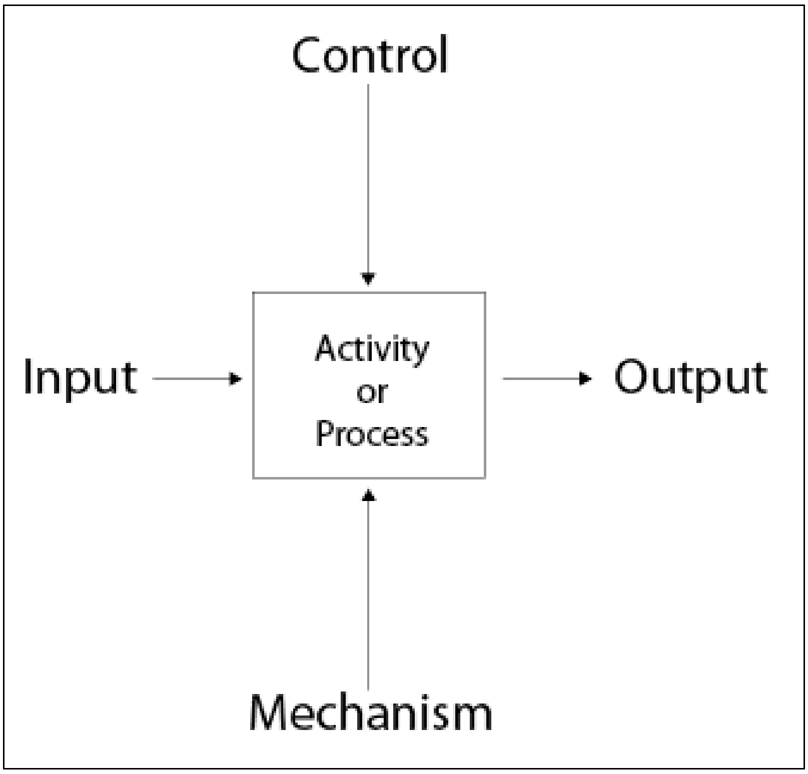


Figure 2.8.1: The components of IDEF$_0$ Model

The relationship between activities in the model is represented with 2 types of arrow, which are boundary arrows and internal arrows according to Figure 2.8.2

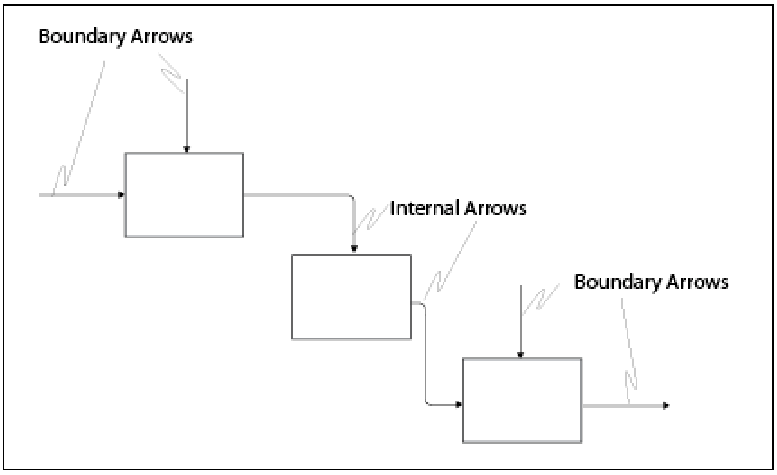


Figure 2.8.2: The example of relationship between activities

2.9 Understanding the organisation

The organisation is complex systems that purposely coordinate the actions of their members to accomplish business purposes. The interrelated of the organisation is important. Each part of the organisation must fit together to form the whole, they directly affect each other. The organisation cannot reach its goal if each part does not perform correct function.

The organisations usually try to accomplish their goal by dividing tasks and functions. People who perform these tasks are supervised through a structure of authority and responsibility. The structure aims to coordinate behaviours of employees towards achieving organization goals. System and individual goals often differ, and the differences commonly create communication problems. If the organisation is to continue to exist, however, member must work toward the system's goals. The formal organisation coordinates individuals' behaviours with the system's goal and the informal organisation manages interpersonal relationships. (Taylor, 1983:229)

The formal organisation is a structure for accomplishing organisational goals. The formal structure of authority and responsibility is hierarchical. At the 'top' are those who have ultimate responsibility for managing the organisation. From there levels of subordination range to the 'bottom', where workers have no authority over anyone else and responsibility only for their specific tasks. Titles reflect levels of authority and responsibility. (Taylor , 1983), and (Gomex-Mejia, 2001)

Organisations consist of many subgroups. Departments, units, divisions, or company are subsystems within the total. Group within organisations are interrelated and interdependent. Production cannot accomplish a task without the aid of engineering, and both depend on purchasing. The need for coordination among the subsystem creates a special need for effective communication to accomplish organisation goals, especially because of the complexity of subsystem relationships.

2.10 Designing the organisation

Designing the organisation is important because it assist to manage and to utilize limited resource of the company to be the most advantages. It assist the company achieve its goal in most effectively.

According to Gibson (Gibson, 2003:379-380), the organisation design means that the single manager or the team of managers must make some decision. However the actual decisions come about, and the content of the decisions is always the same. The first decision focuses on individual jobs, the next two decisions focus on departments or groups of job, and the four decision considers the issue of delegation of authority throughout the structure.

1. Managers decide how to divide the overall task into successively smaller jobs. Managers divide the total activates of the task into smaller sets of related activities. The effectives and responsibilities. Although jobs have many characteristics, the most important one is their degree of specialization.

2. Managers decide the bases by which to group the individual jobs. This decision is much like another classification decision and it can result in-groups containing jobs that are relatively homogenous (alike) or heterogeneous (different)

3. Managers decide the appropriate size of the group reporting to each

supervisor. This decision involves determining whether spans of control are relatively narrow or wide.

4. Managers distribute authority among jobs. Authority is the right to make decisions without approval by a higher manager and to exact from designated other people. All jobs contain some degree of the right to make decisions within prescribed limits. But not all jobs contain the right to exact obedience from others. The latter aspect of authority distinguished managerial jobs from non-managerial jobs. Managers can exact obedience, unlike non-managers cannot.

There are types in designing organisation. It depends o business strategy, requirement of the organisation, and organisation management. The organising relies on old or current pattern. It is difficult to change or reorganising because it may effect to authority or benefit of the management team. After determine in principle and analyzed, the next step in to implement organising. There are three main processes as following.

1. Consider group of work and design job to all position, this process lead to division of labour that separate by using principle above.
2. Assign scope of work and responsibility to making decision under position level. This process is important when command, target, and task come from upper level delegate to under level and avoid complexity on scope of work.
3. Establishment of relationships, this process making system in coordinate procedure between each function.

Organising process should cover objective and plans, authority of position level environment in organisation, position level suitable with labour skilled and ability.

2.11 Organisation Chart

Organisation chart shows the organisation structure about chain of command, department division, and the formal relationship of each position. Organisation chart assists workers to understand the operation in the organisation. It shows the detail in department, division and section in the organisation. It shows the relationship between each level and chain of command, communication and coordination. (Nagashima, 2003)

The advantages of organisation chart can be described as following:

- It makes the workers to know their position in the company and know their function.
- It makes the workers to know about chain of command and communication.
- It makes the workers to know about function level in the organisation.

2.12 Job Description

According to Gomes (Gomes-Mejia, 2001:71), Job description is a written document that identifies, defines and describes a job in terms of its duties, responsibilities, working condition and specifications. Taylor also mentions that the major problem about coordination between functions may come from unclear role definition. (Taylor, 1983:235), an unclear role definition may mean that job limits are not clear. In these situations, employees may be expected to do things they do not believe they were hires to do. A written job description can solve another problem such as inconsistent expectations. Employee may be expected to do one thing one time and at other times be reprimanded for doing exactly the same thing. Inconsistency may be more frustrating than excessive demands. With specified job limits, inconsistent expectations can usually be identified and eliminated.

2.12.1 Type of job description

There are two types of job descriptions as (Gomes-Mejia, 2001:71) point out as the following.

1. Specific job descriptions – it is a detailed summary of a job's task, duties, and responsibilities. This type of job description is associated with workflow strategies that emphasize efficiency, control and detailed work planning.

2. General job descriptions – it is associated with workflow strategies that emphasize innovation, flexibility and loose work planning. Only most generic duties and responsibilities for a position are documented in the general job description.

2.12.2 Element of job description

There are 4 keys elements in job description. They are identification information, job summary, job duties and responsibilities and minimum qualifications.

1. Identification information identifies the job title, location and place in the organisation structure.

2. Job summary is a short statement that summarises the job's duties and responsibilities.

3. Job duties and responsibilities are the statements that explain in detail about duties and responsibilities.

4. Minimum qualifications are the basic standards a job applicant must have achieved to be considered for the job.

2.13 Workflow

Poyssick stated that the main reason to improve workflow is t o enhance profitability. (Poyssick, 1996:12), An increase in efficiency means nothing unless it is tied to such enhancement. Even increase customer satisfaction, the purported goal of many service industries, is useless if you satisfy your clients and still go out of business.

Workflow enhances profitability by making you more productive. If you can improve specific workflows within your organisation, you will see your profit rise. For instance, minimizing rework is worthwhile because it has a direct impact on profit. Identifying the workflows that are profitable and those that are not can help focus sales efforts. Tracking equipment workflow will help you decide if future purchases will actually improve your bottom line. Inefficient process can be analyzed and revamped depending on profitability. Therefore, all employees in the company, especially if management structures things right, can begin to think of improving profitability by improving workflow.

Koulopoulos pointed out that profound effect of workflow has to do with the fact that it will significantly change the nature of communication. Therefore, workflow is a tool to help analyse the process through shop floor. (Koulopoulos, 1995:52)

2.14 Production

Production is a process to making product, which added value to raw material through process to final product. Production also divides into five main chrematistics such as make-to-stock, assemble –to-order, design-to-order, make-to-order, engineer-to-order. Therefore, production process is important to have efficient production management, controlling system and planning to maximize productivity. Productivity is an indicator to illustrated efficiency of process, which measure by output relative to input.

$$productivity = \frac{output}{input}$$

Productivity could calculate in different term such as labour productivity

$$labourproductivity = \frac{outcome}{hrs.}$$

The organisation should understand clearly on their process and target to maximize their productivity. The efficient production process should consider on internal factors, labour, machines, production capacity and scheduling, production planning, quality, timing. External factors are raw material, logistic and distribution, customer requirement. Organisation have different target on production process, which can consider by customer satisfaction, delivery due date, product quality.

2.15 Production components

There are four main components that related directly to production, labour, machine, materials, and supporting functions.

1. Labour can divide by their characteristic, direct and indirect, skilled and unskilled, permanent and temporary labour.

2. Machine divide by functions such as production machine, auxiliary machines and equipment, maintenance equipment, material handling equipment, service equipment, measurement instrument and equipment.

3. Materials are also important with production, normally divide into three divisions, which are direct and indirect material, raw material, and work-in-process (WIP), and finished product.

4. Supporting function is an assistant for production to run all the processes success as the set up target. There are many function area, which related to production such as engineering design, production planning and control that planning capacity related to

customer order, plant engineering set up plant layout, installation and maintenance machine, material handling, waste treatment, finance, inventory control.

2.16 Types of processing

There are many types of processing that introduced by gurus, differentiate is consider by productivity, flexibility, product that suit with process, variety. There are several type, which are job shop, batch, assembly, and continuous. These four processing have their own different characteristic. (Rattanakuekangwan, 2006)

1. Job shop processing – this is a process that has flexibility but can produce in small batch. Job shop is different in each lot of order and suitable with product that has a variety requirement.

2. Batch processing – this is a process that product variety but using the same process in production line. In term of production plan batch processing scheduling in easier to plan than job shop processing with larger amount of productivity but less variety when compare with job shop. Batch processing is suitable for product that have standard but still need variety in detail.

3. Assembly processing – assembly processing is a process that run flow shop with labour mostly continues. Therefore, when setting up production line is hard to change in detail but can produce in large batch.

4. Continuous processing – This process is used in product that same in every piece. The production line run by machine more than human. The characteristic of continuous processing is produced huge amount of product and automated by machine.

2.17 Defining and measuring capacity

Capacity measurement is am analysis, which consider on maximum output. There are many measurement tools, which using in the different case. It is hard to concluding on one-measurement tools that suitable for every case. Design capacity and effective capacity are two definitions that related to capacity.

1. Design capacity is that capacity of the system that design and maximum output rate in every operation could be reach.

2. Effective capacity is the allowance in each process on the system that designed.

The maximum output is an ideal number without other functions that effected to capacity such as quality (defect), machine breakdown, and lack of sources. Therefore, utilization on each process is applied knowledge to get the ideal number on capacity, which should consider on causes and effects of the problems. The measurement could discuss on many results such as variable cost, labour coat, and amount of finished goods. (Rattanakuekangwan, 2006)

2.18 Process Flowchart

Process flowchart is a tool that helps graphically analyse the manufacturing process quantitatively (time and distance). It provides a systematic examination of all the aspect of a manufacturing process to improve its functions and identify the non-productive activities. Process flowcharts identify five different processes within the overall manufacturing process such as operation, transport, inspection, delay and storage. (Nagashima, 2003)

Each of these process are represented by different symbols, see Table 2.18.1 below for details.

Table 2.18.1: Symbols used in process flowcharts

Symbol	Meaning
○	Operation
⇨	Transport
□	Inspect
D	Delay
▽	Storage

Process flowcharts need three types of information – description of process, time and distance. An example of process flowchart is given in Figure 2.18.1 below:

FLOW PROCESS CHART

Chart No.	Sheet No.	Of		Job Serial Code:	
Subject Charted:		Activity	Present	Propose	Saving
		Operation ○			
Activity:		Transport ⇨			
		Delay D			
2. operating with machine		Inspection □			
Method:		Storage ▽			
Location:	PP Cutting and Sealing Machine	Distance (m)			
Operative(s):		Time (Man-Hr)			
Clock No.:		Material Losses			
Charted By:	Date:				
Approved By:	Date:	Total (Capital)			

Description	Qty	Distance (m)	Time (min)	Symbol					Remarks
	(KG)	(m)	(min)	○	⇨	D	□	▽	

Figure 2.18.1:An example of process flowchart

Process flowcharts will help identify the non-productive activities (transport, inspect, delay and storage) so that appropriate action can be taken eliminate or reduce these activities. Production process is cover all main making product processes included quality control, packing, and manufacturing. Production process ca illustrate into flowchart that using basic square shape means process or workstation and arrow means transportation to next process. Thus, in production flow chart shows input and output between processes, machines. Production flow chart helps planner and observer easier to monitor each process. For example, there is the damage on product, observer can focus on process and transportation point, which show in flow chart.

2.19 Literature Review

Kap et al. (1996) This research pointed out the framework for scheduling and shop floor control in computer-controlled manufacturing system where each resource agent and part agent acts like an independent profit maker. They are also show the task assignment that consists of the task allocation and sequencing tasks at each work centre with the constraint of short processing time rule, earliest due date rule. Each rule indicates the different performances according to the stat of the shop floor control.

Gong and Hsieh (1997) This study show the conceptual model for guiding the integrated design and implementation of a shop floor control information system (SFCIS) in manufacturing. This paper is mentioned about the gap between design and implementation of manufacturing systems when the design model is distant from the implementation or not sufficient issues are considered in developing a model. The major purpose of this paper is to demonstrate a systematic approach that facilitates construction of the shop floor control system model in the form of $IDEF_0$, which provides a view of a manufacturing system covering its physical objects, functions, decisions and information

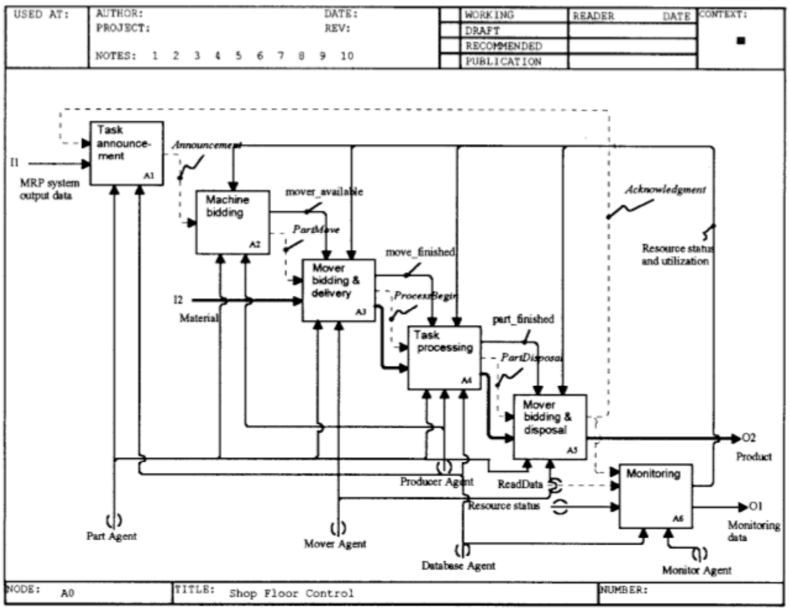


Figure 2.19.1 The Shop Floor Control System Model in $IDEF_0$

Bongaerts et al. (2000) The paper is provided five considerations for the design of shop floor control system, based on manufacturing concepts. They also presented the considerations for the design and implementation of system that are better suited to support evolution of shop floor control systems. The research initiated to focus on problems and the scope in computer integrated manufacturing. The end of this paper reveals that the important issues to drive the evolution of shop floor control system are training, management, hiring, technology, since end-user computing is likely to become more common as a part of shop floor control systems development.

Hans, Arne, and Leo (1998) The authors of this research are study on new concept and methods for developing shop floor control system. They are defines models and methods for design and implementation of computer-based control and monitoring system for production cells. The control data model and architecture has been defined in order to support engineering of cell control system. They scoped the systems that are a network of co-operating cells as opposed to individually operated cells, which co-ordinated in a traditionally manner.

Gilad and Leo (2000) They are proposed architecture for agile shop floor control systems, which illustrates the new theories and concepts of solutions that enable manufacturing systems to accommodate the increasing dynamic characteristic of the manufacturing environment. With these new concepts, they mentions that especially the Holonic manufacturing systems, there are many aspects that should be considered. One of the aspects that they emphasised is the manufacturing system and its control, commonly known as sop floor control. This paper presents the Holonic Multi-cell Control System architecture that allows for design and development of Holonic shop floor control systems.

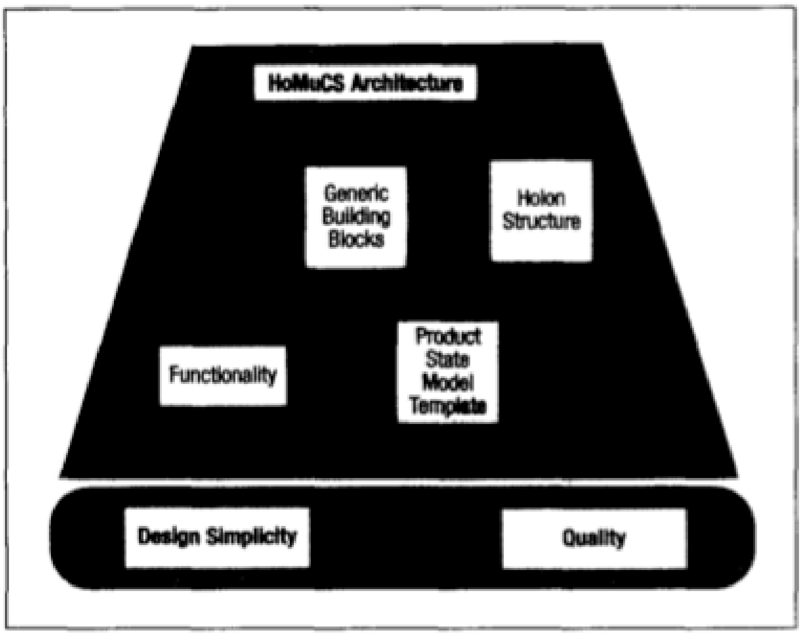


Figure 2.19.2: The overview of Holonic Multi-cell Control System architecture

Pattanajaroen (1998), This thesis involved in production planning system which using Heuristic approach to produce scheduling. Priority rule is the main method for scheduling; First In Fist Out (FIFO), Last In Fist Out (LIFFO), Shortest Processing Time (SPT), Longest Processing Time (LPT), and Earliest Due Date (EDD). The results illustrate that Shortest Processing Time (SPT) is close to the case which should be the solution for the problem that have environment and conditions as mention in the case.

Patrick et al. (2001) has proposed the pheromone based emergent shop floor control system for flexible flow shops. They are proposed a development concept for control systems that based on co0ordination mechanism of insect colonies. The pheromone-based control scheme was introduced. Basic principles of the pheromone concept, the control system architecture and a layered approach for decision-making have been discussed. This paper also pointed out that the pheromone-based control has the potential to solve the problem for flexible flow shops. The main advantages of the pheromone concept are simple coordination mechanism, the automatic guidance to the optimized solution, and the capability to handle dynamic situations.

Chiu and Luh (2004), Architecture design of shop floor information system using WWW and 3-tier architecture, they proposed a shop floor information system store the related information of the shop floor. This information issued by management in decision-making. Due to lack of complete planning, it has resulted in numerous island of automation. A shop floor information system, which is based on both World Wide Web technology and a 3-tiered architecture, is proposed in this paper to resolve the above shortcomings, Furthermore, other function modules on the shop floor also update the state information of the common database. In the other word, the function modules maintain the said information in the shop floor information system database. As well as, tier-2 retrieves data from database and generates the web page dynamically and Tier-1 displays the web page. Also, they discussed how to use the related technology to satisfy the real time requirement of shop floor information system.

Son and Wysk (2001), they proposed Automatic simulation model generation for simulation-based real-time shop floor control. They developed a structure and architecture for automatic simulation model generation based on a shop floor resource model and a shop floor control model. The generated simulation controlled the manufacturing system by sending and receiving messages using an Ethernet communication link to a high-level task executing system. The static information in the simulation was derived from a shop floor resource model. The dynamic information in the simulation was derived from the shop floor level control model.

Implementation specifics are provided for Arena simulation model generation based on the resource model and the MPSG SFCS. For six sample manufacturing systems with material processors, material handlers, and AS/RS, complete simulation models were generated on a Pentium II computer in 2–5 min. Finally, a factory level planning was performed using the generated model under a multi-pass simulation technique, and a permutation-based scheduling was performed.

The automatic simulation model generation in this research was limited to direct address discrete part manufacturing systems that operate with a single part unit loads. It was also assumed that all the movement of parts requires material handlers (e.g. robots), and the capacity of machines and robots was one. The methodology presented in this paper can be applied to various configuration of manufacturing systems (industries) as long as they satisfy these assumptions. This simulation model generation can be extended to more general cases, including indirect material handling systems and larger unit loads. This however was outside the scope of this work.

Srimandakul (2002), She has done the study in order to obtain the effective coordination and communication systems to reduce the error production in production department for a sample plastic packaging company. From the research, the coordination and communication systems are set up. The systems that set up consist of formal and informal coordination and communication. The systems use organisation structure as a guideline for coordination and communication process. So the organisation structure is changed to ne suitable for the effective systems. Job description is created the standard activity flow and document flow is set up. Document is revised and added up. From all changed the coordination and communication can processes in systematic pattern, it helps to reduce conflict and error in the organisation that come from misunderstanding in coordination and communication. The workers have a guideline for process, instruction and direction of coordination ad communication systems by using standard activity flow and document flow. And also, the documents can be used as a media to transfer the information in the pattern that everyone can understand.

Son et al. (2002), this paper presents an overview of simulation-based shop floor control. Much of the work described is based on research conducted in the Computer Integrated Manufacturing (CIM) Lab at The Pennsylvania State University, the Texas A&M Computer Aided Manufacturing Lab (TAMCAM). In this approach, a discrete event simulation is used not only as a traditional analysis and evaluation tool but also as a task generator that drives shop floor operations in real time. To enable this, a special feature of the Arena™ simulation language was used whereby the simulation model interacts directly with a shop floor term execution system by sending and receiving messages. This control simulation reads process plans and master production orders from external databases that are updated by a process planning system and coordinated via an external business system. The control simulation also interacts with other external programs such as a planner, a scheduler, and an error detection and recovery function. In this paper, the architecture, implementation, and the integration of all the components of the proposed simulation-based control system are described in detail. Finally, extensions to this approach, including automatic model generation, are described.

Manita (2004), she has concluded her thesis that involves the design an implementation of inventory management system in a motorcycle seat manufacturing company. This thesis aim to design an operational system to improve production efficiency for orders from OEM and exporter customers, reduce delivery lead time of products to wholesaler and improve responsiveness to retailer customers. The thesis classifies the customers based on order requirements and selects production and inventory management policies for each group of customers. Products for OEM and exporters require make-to-order production, while those for wholesalers and retailers require make-to-stock and assembly-to-order production, respectively. There are two proposed inventory control management system: material requirement planning for make-to-order and make-to-stock policies and fixed-order-quantity system for assembly-to-order policy. The systems were tested for one month. The test resulted in a reduction of average delivery lead time from 7 days to 1.14 days (84% improvement), a reduction of inventory investment by 28% increased sales by 13% and a complete elimination of overtime work per month which used to be average 35 hours.

Sohyung (2005), the author proposed a distributed time-driven simulation method for enabling real-time manufacturing shop floor control. A highly distributed and time-scaled simulation method for manufacturing shop floors was presented in this paper. It has been shown that the required time to simulate shop floor using a time-scaled simulation approach is a linear function of iterations, while it was polynomial in centralized simulation. This paper proposes a distributed simulation approach for scheduling discrete-events in manufacturing shop floors The proposed approach employs a time-driven method to simulate occurrence of discrete-events using distributed entities that replicate physical entities in the manufacturing previous shop floor term In specific, the proposed approach iteratively controls the timing of discrete-events occurrence using a control theoretic model. In this approach, changing the speed of the simulation clock, termed time-scaling factor, can accelerate or decelerate the simulation speed resulting in simpler synchronizations of discrete-events and faster simulation than standard distributed discrete-event simulations according to the capability of the communication networks. Computational experiments are conducted to test the performance of the proposed system with different values of the time-scaling factor, and the relationship between the system performance and the time-scaling factor is investigated through analysis of the system model. Results obtained from the computational experiments show significant successes in speeding up discrete-event simulations in such a way that the proposed approach can be used for the control of manufacturing shop floor providing real-time decision supports.

Pichetpongsa (2006), has proposed the master production planning system to support the improvement of the planning process in order to be able to confirm the available-to-promise, help the production identification before planning and generated plan that consider each production process capacity. The research shows the study of current problem using cause and effect diagram in order to analyse the problems caused by production planning. And also, it is the good example in the analysis result in the creating the new production planning system that can plan each production schedule in relate to the available capacity required in the difference manufacturing processes. Through the end of this research, it shows the new solution of production system and develops a systematic product coding that can identify the specification product and restructure the bill of material before input in the new system in order to support group production planning.

Sithitriwat (2007), he researched on develop shop floor control system for the music instrument company. He found out the solution in production plan and assignment job clearly based on process to minimise all problems in the Conga Drum Production line. There are three main problem, which are organisation management and relationship, production, expenses and due date. He was started form defining clearly about the cause of the problems by collecting necessary data. Improvement process is starting from reorganisation, production improvement, and relay out. The solutions are to applied theory, concepts and tools that related to shop floor control such as divide and assign job clearly, follow up tools, and built-in quality concept.

Pramoj Na Ayudhaya (2007), his research carried out to improve the shop floor of orthopaedic equipment manufacturing in Thailand. The inefficient manufacturing problem of high set-up time, complicated machine allocation and unorganised manufacturing flow path that was caused by inappropriate shop floor layout were address using the cell manufacturing concept to redesign the layout. As well as, the product families were established according to their process requirement. It also shows the modification of plant layout to improve overall flows in the plant, resulting in a hybrid cell manufacturing in the final design. The final design reduces the set-up time, improve quality of the product, and the material flow paths is simplified and shortened, which create more organised work atmosphere.

Pongsomboon (2008), this study proposed the efficient shop floor management and controlling system for an aluminium extrusion factory. The researchers propose and implement the concept of shop floor management, which relates to production scheduling, dispatching, move between cells, controlling and monitoring to this factory.

This research has 5 parts. First part is to improve production scheduling. In this part search for appropriate production scheduling, using the heuristics method and a computer program is also developed and used for the production scheduling. The second and the third part of research are dispatching and move between cells. After the production schedule the researcher will to improve the system of dispatching and move between cells to be a standard document, work instruction. It is found that the dispatching and move between cells are systematically. The fourth part is to improve controlling by a standard of production control, using the 4M concepts (Man, Machine, Material and Method). The researcher is to study and collect problems from shop floor of a case study factory and improve to be a standard document. It is found that shop floor can be managed with more efficient manner. And the last part is monitoring. A computer program is also developed and used for monitoring. It is found that monitoring can be cover and can be select from various constraint of production. The result of improvement is to decrease the time of this activity.

Nimsaard (2008), she proposed the development of shop floor control system and performance measurement indicators suitable for plastic injection manufacturing. This research collects primary data from visiting several factories and uses systematically designed questionnaire to interview both experts and practitioners in the field. The data from the interview has to be evaluated the validity and reliability of all factor structures by factor analysis and correlation analysis. The author also illustrated the shop floor control system represented by IDEF0 technique is then developed. Furthermore, the performance indicators (PI) of the production operations that conform to the real operations occurred in shop floor are created. The results from the research can be used as a guideline for entrepreneurs in order to produce continuously and fully utilize the production capacity. In addition, they could use the selected performance indicators to assess the efficiency of their organizations and could benchmark against other entrepreneurs in order to find the ways for productivity improvement.

Lee, Son, and Wysk (2007), this paper has illustrated how simulation-based shop floor planning and control can be extended to enterprise-level activities (top floor). More specifically, the shop floor and the top floor have been compared in terms of system components needed for the simulation-based planning and control system, including: physical entities and tasks, simulation model, resource model, coordination model based on a Finite State Automata (FSA), and (5) TCP/IP-based communication server. The research in this comparison revealed that most of the above-mentioned components for the shop floor were extensible to the top floor. However, the research also creates new challenges for top-floor planning and control.

Dai and Li (2010), this study offers a method to solve a practical shop floor system problem. It is known that in a complicated system, when observing the database of the shop-floor system directly, including the product yield rate and quantity, we can not find the problem during the period, so this study proposed solving the system problem. In addition to using a neural network technique for diagnosis, experienced judgment is also required to find the reason for the problem. Furthermore, learning sample size, learning cycle, and learning rate parameters also influence experimental results. Future studies can make comparisons with the data of different productions, change input and output items, or use regression-analysis, and can make the results diagnosed more accurate. This research focuses on the shop floor integration system (SFIS) as a real time management system using neural network technology to do the system diagnosis against system operational errors. Furthermore, the approach will discuss and improve the system efficiency by analyzing the questionable information detected. A real case is provided to demonstrate the effectiveness of the presented approach.

CHAPTER III

ANALYSIS OF THE CASE COMPANY

In this chapter, a plastic bag-packaging manufacturer was selected as a case study for this thesis. The case company basic background information and existing company structure are provided. Following, characteristic of business and sales, products, especially in production process through the shop floor are described. Including, the focus on the problem occurred will be indentified and analysed.

3.1 Background of the Case Company

The case company has been established over 20s years, by the first generation of the family. The case company at that time was producing only plastic bag and rubber band on its first manufacture, which located in Bangkok province. The case company manufactures and distributes product locally. Continuously, when the business has passed on to the second generation, the manufacture has expanded another plant to Samutsakhon province according to high customer demand and the development of product line. The new products have been paired up to the existing range of product and that is allows customer purchase more. Since then, the case company manufactures and sales throughout Thailand and expand to neighbouring country markets.

3.2 Organisation Structure

The case company is a build up form of family business so that the organisational structure is centralised and has a hierarchical characteristic in its self. There is head of the family act as a president of the company, which all the decisions such as production, stock, financial, and improvement process are only made by him. This could be the reason why the actual organisation chart does not really exist. To initiate the shop floor control system into production line, it is needed to setting up an organisation chart to expand authority level and responsibility.

From the research, the formal organisational chart is not existing, but most functions are sectioned from responsibility such as accounting section, film blowing section, sales section, and so on. Therefore, to get the picture of current organisation structure, the organisation chart could be sketched as Figure 3.2.1.

The managing director of the company has command and made all decisions direct for everyone in every function and that make the organisation structure of this case company very flat according to Figure 1. With this consequence, it is obviously that the organisation is relying on one person alone, and that is not competent for long-term development for the company. The activities in the case company are group in to section even though the formal organisation chart does not exist. There are functions that describing as following.

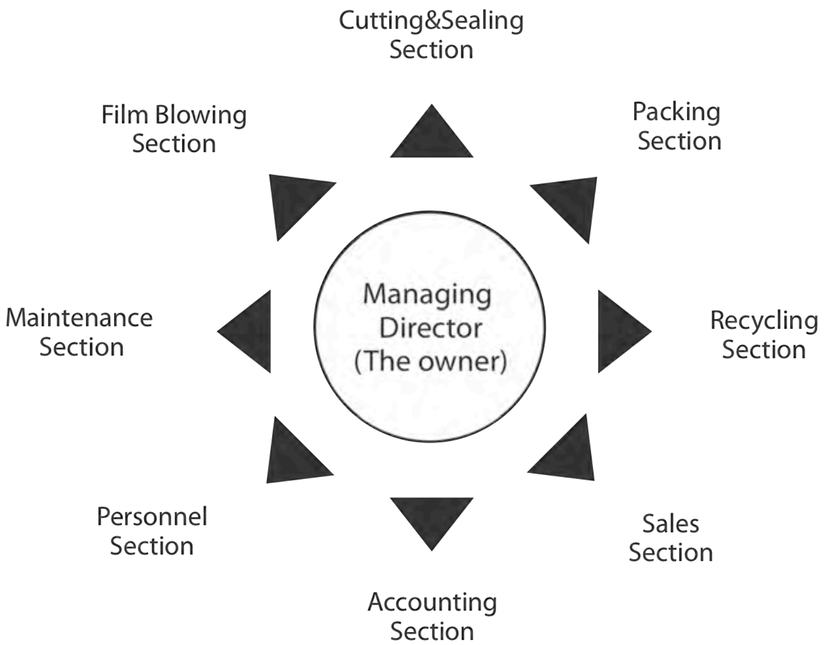


Figure 3.2.1: The current management and responsibility of MD

3.2.1 Accounting Section

In accounting section is basically consisting of two subordinate units, which are Accounts Receivable and Accounts Payable. The Accounts Payable unit is responsible for paying all invoices for raw materials and services purchased by the company. In addition, The Accounts Receivable is responsible for recording sales for which they are not immediately paid, or to record bills that they have received.

3.2.2 Sales section

Sales Section in the case company is response for every activities related to sales, marketing, customers and competitors such as product delivery commitment. Including, the customer feedback, competitor’s information, and current market information are also act on in this department. Moreover, sales section also has responsibility of delivery scheduling. They are dealing with finished goods (FG) stock checking and arranging customer order to be ready for customer pickup or transfer to freight forwarder.

3.2.3 Personnel

Personnel staffs are taking responsibility on salary calculation and payroll. Another responsibility is time attendant checking. It is to make sure that there are workforces going to be ready for everyday production. If there is absent of worker or shortage of worker in some process, the arranging of worker replacement will be managed by this section.

3.2.4 Maintenance Staff

This section takes responsibility on machines across the production and takes care of all utilities in the company. It includes adjusting the machine during production and repairing the machine when it breakdown.

3.2.5 Film Blowing

This section takes responsibility on film blowing process and also setting up the machine for each production start. The foreman of this process has a responsibility to quality checking and data collecting through the cutting and sealing production line

3.2.6 Cutting and Sealing

This section takes responsibility on cutting and sealing process. Workers are working on cutting and sealing machine and also setting up the machine for each production start. Main task for work in this station is to weight the output and skin packing.

3.2.7 Packing

This section is final station. Packing worker will collect small pack from each cutting & sealing machine to the strapping machine.

Even though the case company has less formalization, the activities in the company was grouped into section according to function performed, which mostly head of each section are run by family member. However, most decision in this organization is still slow because the decisions have to waiting for the head of the family to decide. This is become centralization in case company organization.

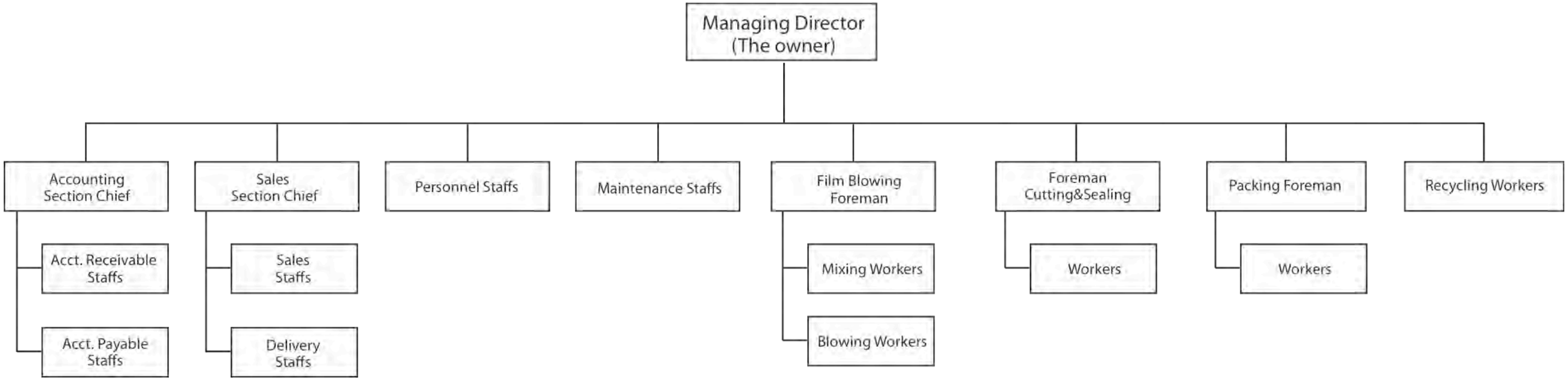


Figure 3.2.2: The current organisation chart

3.3 Operation of The Company

The case company runs 24 hours a day, 7 days a week. The reasons behind of none stop production is that cost and time for machine set up and shut down are high. Because its nature of process of film blowing that convert plastic resin to plastic film, machine needs to continuous run to reduce cost of losses during set up time and shut down. The case company has 2 working shifts, which day shift and night shift. Each shift working 8 hours with 4 hours overtime.

3.3.1 Workforces

After data collection analysis, it reveals that 52.3% are more than 10 years experienced, 34.8% are more than 5 years experienced and the rest is 12.9%, who have work experience less than 5 years in their field. The case company has around 50 workers in the production line, which can be categorized according to table following.

Table 3.3.1: Employees in the Production Line

PP Production Workforce		
Film Blowing		
Type	Twin-Screw	Single-Screw
Quantity	14	3
Cutting and Sealing		
Type	Touch Seal	Heat Seal
Quantity	20	-
Resin Mixing		
Type	1,000 KG	
Quantity	6	
Packing		
Type	Strapping	
Quantity	6	

3.3.2 Machinery

According to the production process and the product, there are 4 categories of machinery in productions, which shown in Table 3.3.2 below. The PP production has 20 units of blowing-machines as a total, which are 17 for twin-screw type and 3 units of single-screw type. In the resin mixing process, there are 2 unit of 500 kilograms machines type.

Table 3.3.2: Table of number of machinery in the case company

PP Production		
Film Blowing Machines		
Type	Twin-Screw	Single-Screw
Quantity	17	3
Cutting and Sealing Machines		
Type	Touch Seal	Heat Seal
Quantity	10	-
Resin Mixing Machines		
Type	500 KG	
Quantity	2	
Packing Machines		
Type	Strapping	
Quantity	3	

3.4 Functional activity and documentation process

The activity of the case company according to Figure 3.3.1, it starts when customer contact with the sales to order placement. If the customer order is made-to-stock product, chief of sales section will then checking with the finished goods (FG) stock. Then, the purchasing order data will be created and stored to database. Chief of sales section will retrieve data in order to scheduling the delivery and release the delivery order to delivery staff. The available product will be prepared and arranged to transfer to freight forwarder or customer pick up.

In case of the product ran out of stock, sales staffs are going to prompt to MD about the shortage. MD will manage to produce the certain product that out of stock. If the order placement is a special order or made-to-order, MD will decide to make or no make. Once the decisions are made, the customer will be informed minimum of quantity with price or order reject in case of inability to produce with reasons. Then, MD will order job to the film-blowing foreman according to size of width directly. Interestingly, the orders from MD mostly are made in verbal. There are no job orders for film blowing production.

According to Figure 3.3.1, in the high light area, it is obviously that all the production management decision relies on managing director alone. There should be function to take care the MD job and the MD can monitor only. The span of control is needed in this case company in order to better planning and control

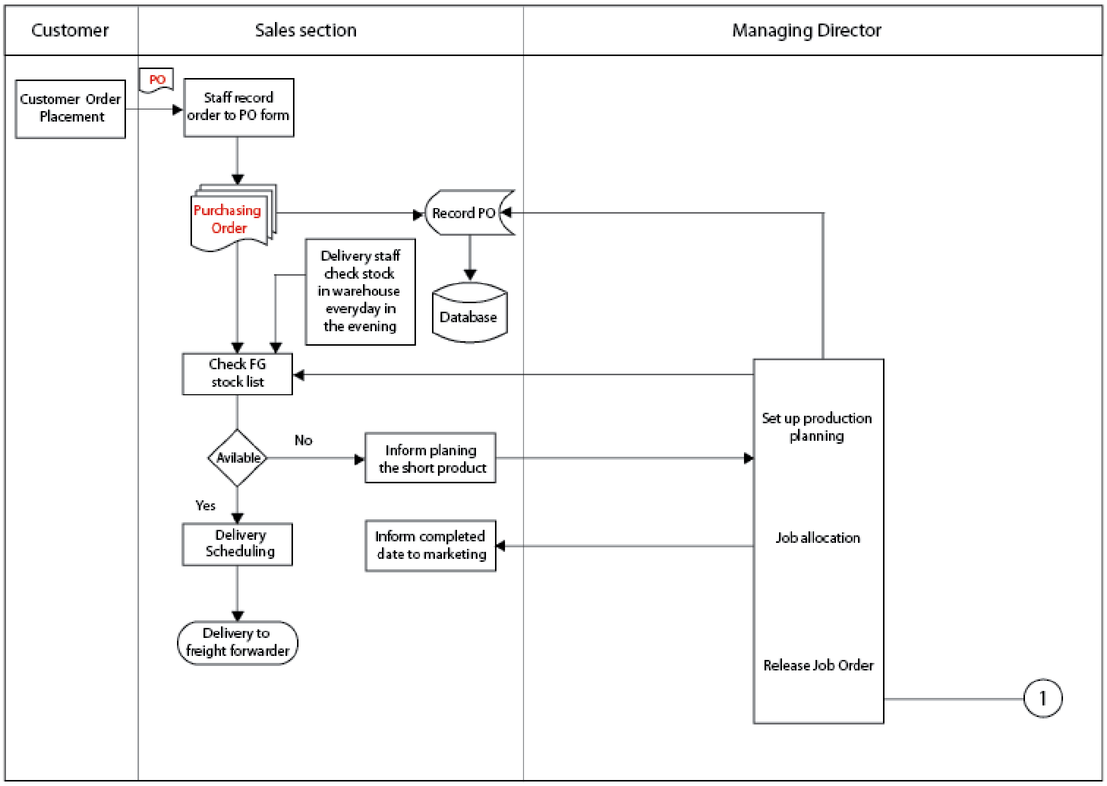


Figure 3.4.1: The current functional activity and documentation flowchart

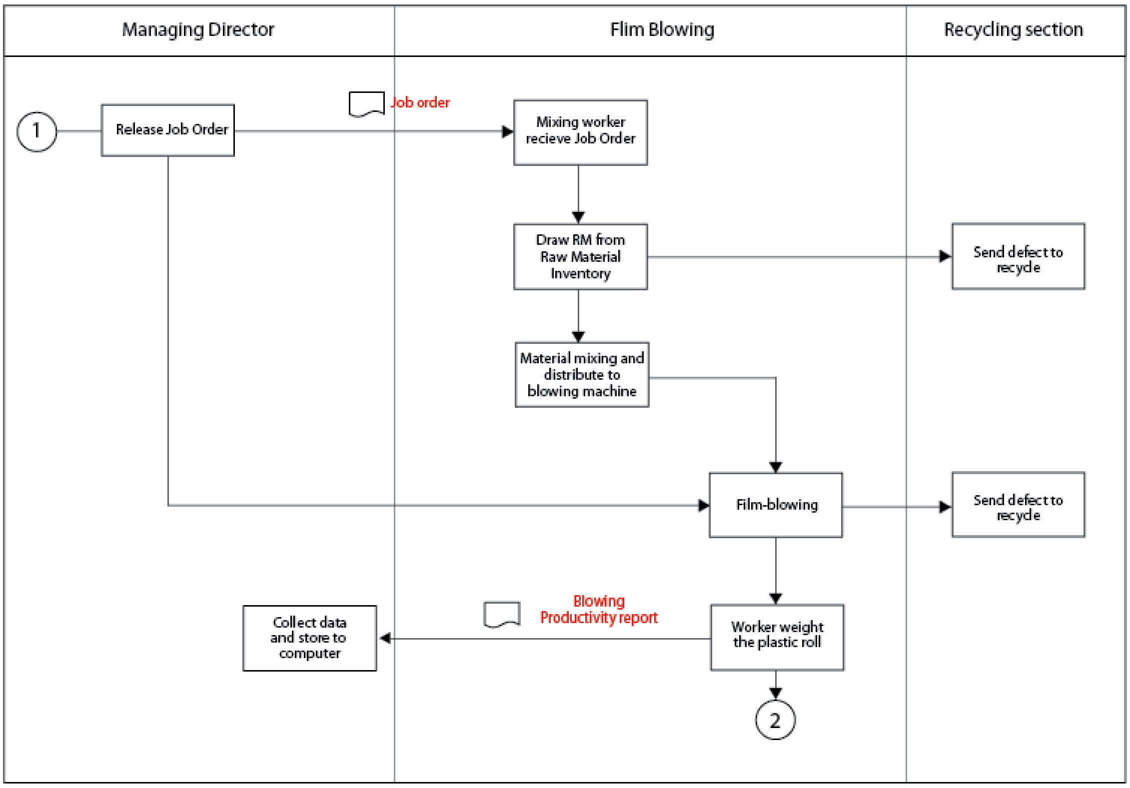


Figure 3.4.2: The current functional activity and documentation flowchart (cont.)

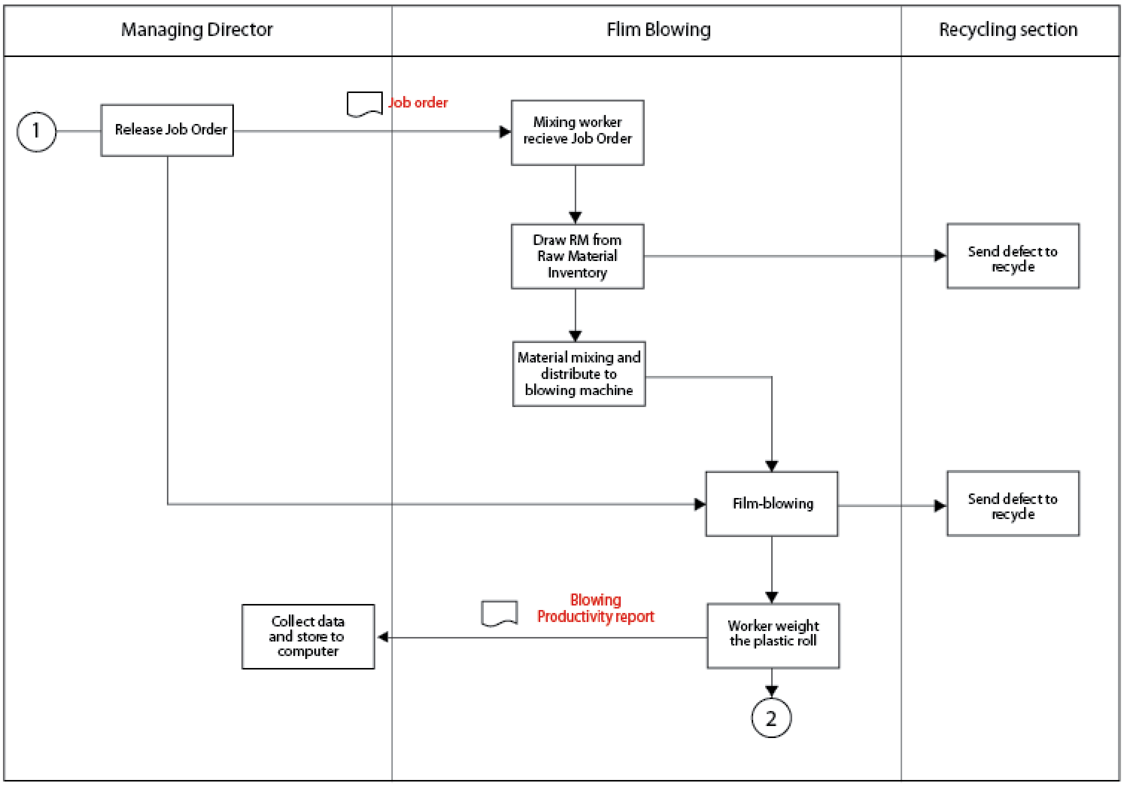


Figure 3.4.3: The current functional activity and documentation flowchart (cont.)

3.5 Production

3.5.1 Product

The case company is a plastic packaging manufacture, available in almost every size from 2 inches to 30 inches. The case company's product classified in the made-to-stock product. One unit of the finished goods has weight 30 kilograms, which contain 6 packs of 5 kilograms packing and in 5 kilograms contains 10 packs of 500 grams packing.

Table 3.5.1: Summary of PP product sizes

PP	Specification of main product			
	Total sizes	Width size	Length size	Thickness
Number of sizes	36	17	36	2

3.5.2 Processes Description

In the case study, the production processes is uncomplicated process, it is converting from plastic resin to plastic film and then pass through to cutting and sealing machine, and lastly go to the packing process. According to Figure 3.4.1 and 3.4.2, it can categorise processes in to steps as following.

Firstly, resin-mixing process is the process to blend main plastic resins with master-batch (colour resins). This process is mostly complete in one step within the machine. It starts with worker fill main plastic resin and master-batch into the mixing machine and wait until the two materials are well combined. The raw material, mostly used, is plastic resin. There are several kinds of plastic resins, which give different characteristics. Each type of plastic resin is therefore selected with the product's application. Some plastic resin is mixed with additives to increase specific qualifications such as anti-static properties or additional strength properties.

Secondly, once the raw materials are well blended, it will be sent to the blown film extrusion process (film blowing process), which is basically consists of an extruding a tube of molten thermoplastic and continuously inflating it to several times initial diameter, to form a thin tubular product that can be used directly, or slit to form a flat film. In depth, the plastic resins melt is extruded through an annular vertical slit die. This is to form a thin walled tube. Air is introduced via a hole in top of the die and a high-speed air ring blows onto the hot film to cool it. Then, the tube of film continues upwards, continually cooling until it passes through nip rolls where the tube is flattened to create ‘flat-tube’ of film. This flat-tube is then taken back down the extrusion tower via rollers. In the last step of this stage, the output is then either keeps the flat-tube as such onto reels to make bags, or the flat-tube are slit off to produce two flat film sheets and wound up onto reels for other application.

Thirdly, cutting and sealing process, the reel of flat-tube is taken from the film blowing process and put up to the cutting and sealing machine. The flat-tube is then sealed across the width of the film and cutting or perforating to mare each bag. This is done in line cutting and sealing machine and also includes making holes or the bag’s holders. The last step of this station is to skin packing as a single pack.

Finally, the finished packing, it is to gather 5 KGs packing into one 30 KGs packing. Workers in this step will manage the certain amount of bunch packing into a sack. Once a sack has been tide up with stripping machine, they will label the product information with their handwriting on the sack.

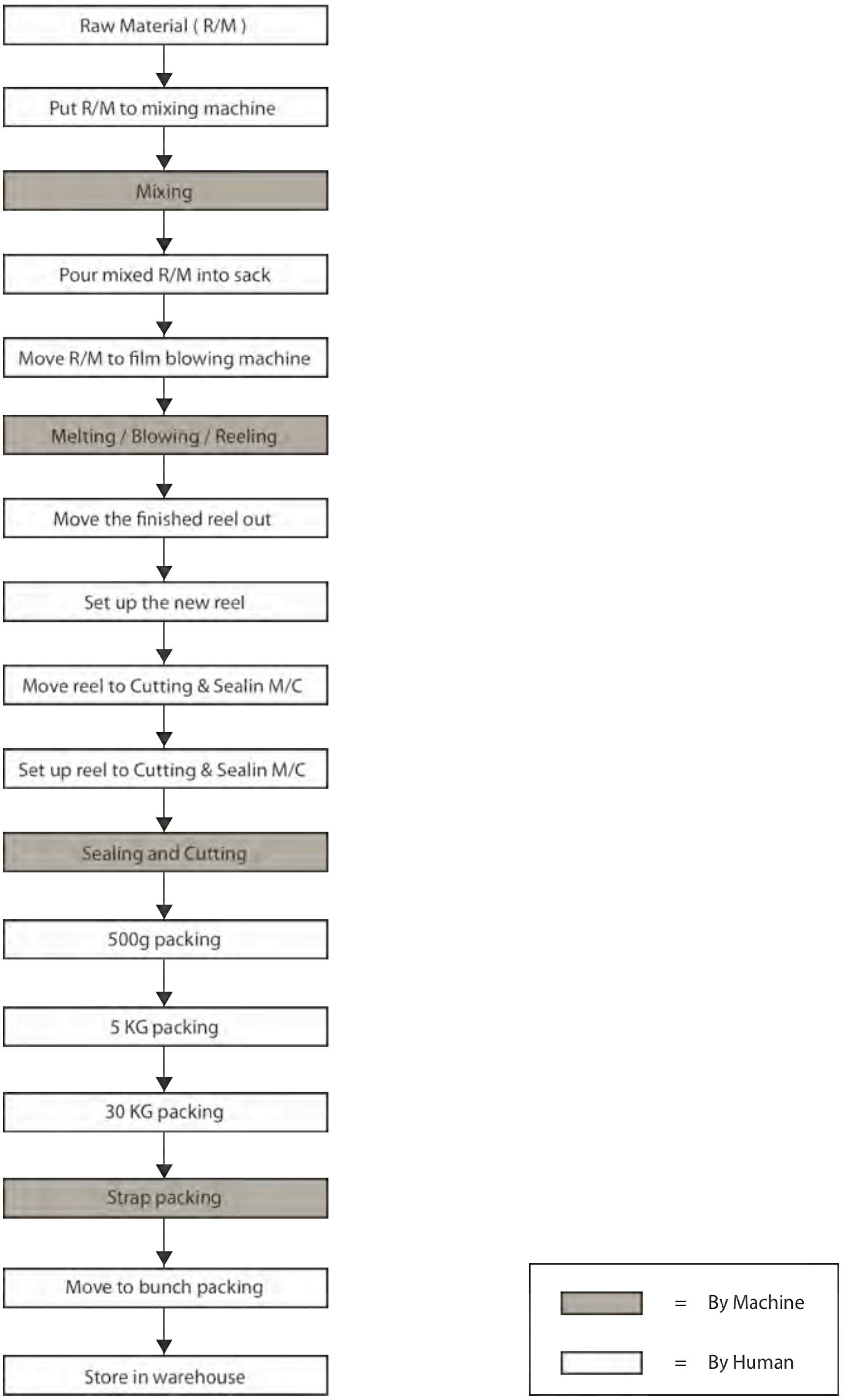


Figure 3.5.1: Production process flowchart

Figure 3.5.2: The pictorial description of production process

3.5.3 Production activity control and planning

As during conduct the survey and collecting information, it found out that basically supervisors are supervising and controlling their workers in each process closely. Workers are seemed to have a well trained, as they are quick and familiar with the machine in their station. They do not have work instruction and work assignment in order to work. They have been trained to work as fast as possible with no idea what are the achievements of the day.

For the production, the case company is run two working shifts, which are day and night shift. If categorized from the processes, film-blowing process is continuous production process, which running 24 hours a day and 7 days a week. The stability of electricity and raw material are needed in order to stay away from lost that may occur during the extrusion process and waste from the setting up machine. For the cutting and sealing, and packing processes are run 22 hours a day and 6 days a week. Every evening, once the day shift’s time is over, the night shift’s staff will stand by at the station or the day shift staffs have to wait until the night shift worker arrived before they can leave the station. This allows worker continuously do the job without the machine shutting down. So, there is only 2 hours shutting down a day for these processes.

It is also very obvious while conducting the survey that all the activity planning is depending on the management of the owner. The owner is planning from ordering raw material to scheduling the delivery of finished product. In the production process, the owner also has a vital role to deciding on which blowing machine is going to produce which product, according to the stock level sheet and purchasing order. It is almost every time that some product has ran out of stock, otherwise has a very low in stock level, which not enough for tomorrow delivery.

3.6 Problem analysis of product defect

According to Table 3.5.1, it is the data record of defect daily in three main processes. The data collected from productivity report at the end of shift, which created by foreman. The data show the total defect in each process.

Therefore, This section is going to analyse the root cause of the problem by using tools, which are workflow analysis, Pareto diagram, cause and effect diagram, and why-how analysis. The study expecting the tool will help the find root cause of problem and method to solve defect problem.

Table 3.6.1: Average number of defect in a day

Process	Average number of daily defect	Unit
Mixing		
Input	11,775.00	KG
Defect	24.57	KG
Blowing		
Output	11,631.94	KG
Defect	355.50	KG
Cutting & Sealing		
Output	11,199.87	KG
Defect	58.17	KG
Total average defect per day	396.24	KG

3.6.1 Workflow analysis

Workflow analysis or process mapping or process analysis is an applied to in this phase to identify activities and actions in the production process, which are mixing, film blowing, and cutting and sealing process. This tool helps clarify the activities that can help next identify causes and effects by fish bone diagram. This analysis is done by investigating and researching on manufacturing site of the case company. In this section, there are mixing, film blowing, and cutting & sealing will be analysed separately.

3.6.1.1 Mixing Process

In the mixing process, waste is found out from the plastic resin fall over the floor of mixing work area as Figure 3.5.2. These plastic resins will not be used in the production anymore because of the hygiene safety of the product. However, it will be used in the garbage bag production. During the day, workers are cleaning up the area and collecting all the plastic resin on the floor to the container. The quantity of this loss will be recorded each day.

Figure 3.6.1: Waste of raw material in mixing process

This research has been study-working process of mixing. According to Figure 3.3.5, the process of mixing start from worker cut to open the sack of plastic resin and located each sack in front of mixing machine. Worker will open raw material sack around 10 sacks each time due to the limitation of working area. Then, worker will put the raw material into the mixing machine with throwing method as picture 2 in Figure 3.5.4. The throwing is an inappropriate method to put the material to the machine. There is high risk that mistake and loads of plastic will fall to the floor. Another high risk is that when work throw the RM sack on top over previous sacks. The RM in the bottom of the previous sack could not let go to the machine and that bring the sack fall off the machine and again plastic fall over the floor as picture 3 in

Figure 3.5.4. Next step, worker will turn on the machine and leave the material mixing together. Once the RM and additive well mixed, worker will pour RM back into the sack once again and put on trolley. One trolley can manage up to 6 sacks of raw material. The raw material sack could be easily falling off trolley anytime because there is no protection around the trolley. This is another loss that usually occurred with new worker. After this, the RM sack will pass on to film blowing machine. Worker will manage RM sack around the blowing machine by leaning with the machine in order to avoid the sack fall down. Lastly, worker will collect raw material fall over floor for recycle and weight for data collection. The process flow also shows in Figure 3.5.2

Figure 3.6.2: Steps in mixing process


1
2
3


4
5
6
7

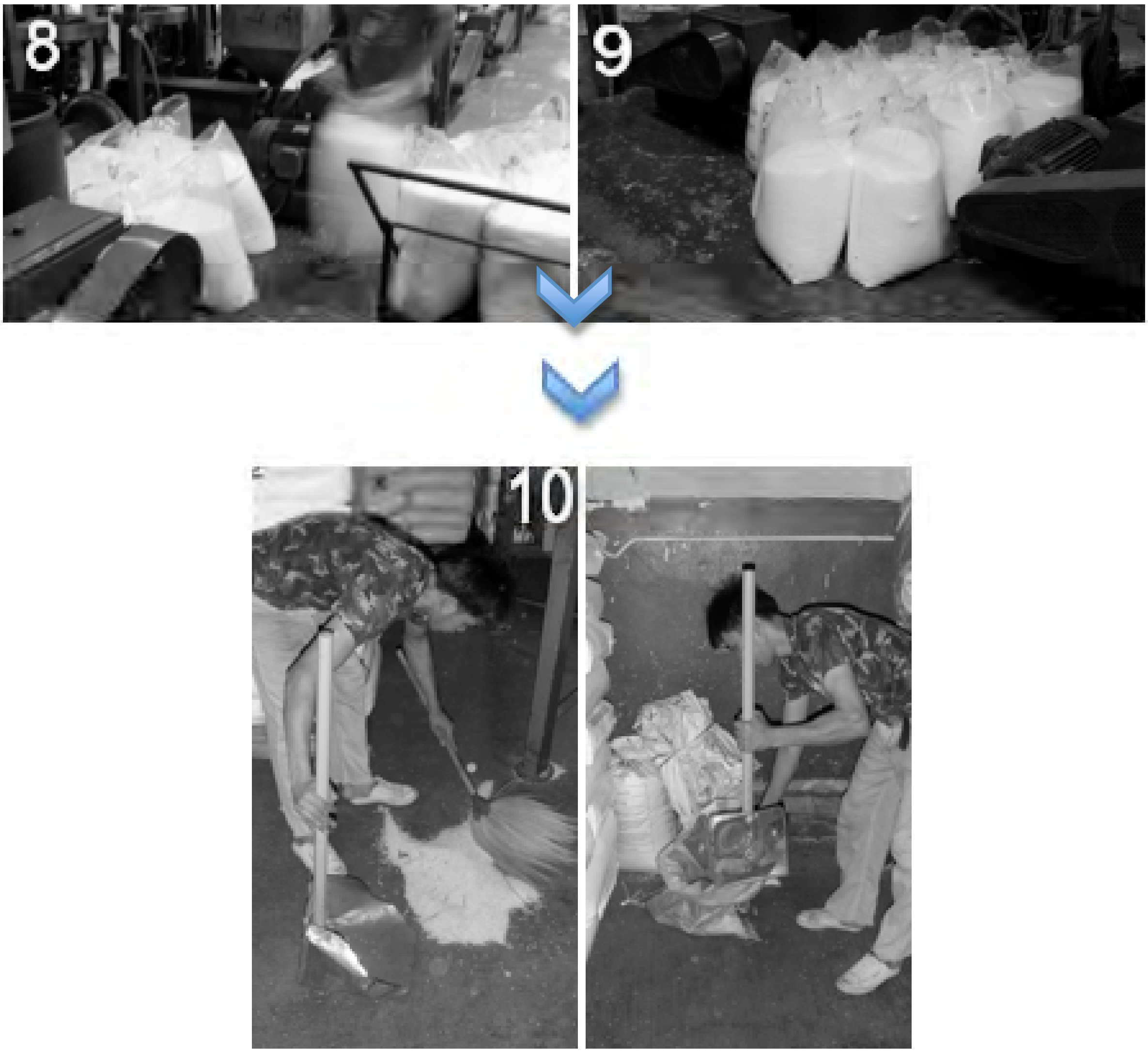


Figure 3.6.3: The pictorial description of mixing process

After analyse how worker do the job step by step, this study adopted 7 wastes for analysis the type of waste that occurring. It is found out inappropriate processing that has been shown earlier is generating waste, which comes from non-standard process and work instruction to acknowledge worker. Therefore, the methods of working in this process need to be improved. Although the average number of the loss of this process is around 12 kilograms per day, the company could save this loss up to 336 kilograms in average or 15,120 Baht in a month.

3.6.1.2 Film Blowing Process

This section is going to analyse the process and defect that generate in steps of blowing process, which separated into two parts. The first part is the process of set up the machine. According to Figure 3.5.5, it is start with open the machine and wait for the machine heat up. While wait for the machine ready, worker will set up block according to the width of product specification and replace the filter screen. One the machine is heated up put the material and the plastic film will flow out of the blower this step the worker will run the plastic film through the machine. The final step is to set the plastic film into roll.

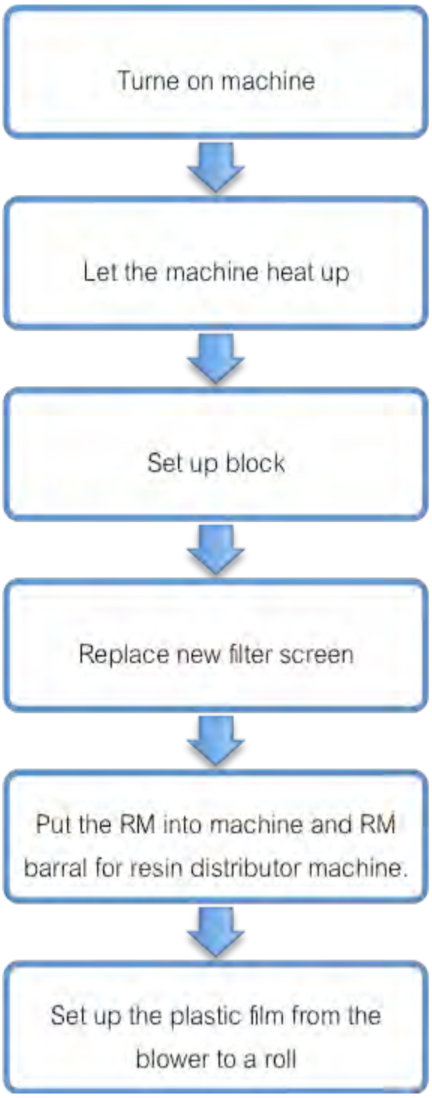


Figure 3.6.4: Process of set up the film-blowing machine

The second part is that the machine will transform the resin to plastic film continuously. This part of the process can be described as process loop in Figure 3.5.6. The loop starts when worker feeds the material from the plastic sack that mixing worker store around the blowing machine. The machine produce the plastic film, which run thru rolls and stored in roll of plastic. The new set up of roll will be operating every 2 hours. Worker will running plastic film and quickly set the film to the new roll. Then, take out the finished roll out of the machine and bring the roll to weight. Next, the weight of each plastic roll will be record in to paper and the information such as name of worker, shift, and thickness of plastic film will be written on the plastic roll to notify worker in cutting and sealing as image 13 in Figure 3.5.8. Lastly, the plastic rolls will store in the waiting area.

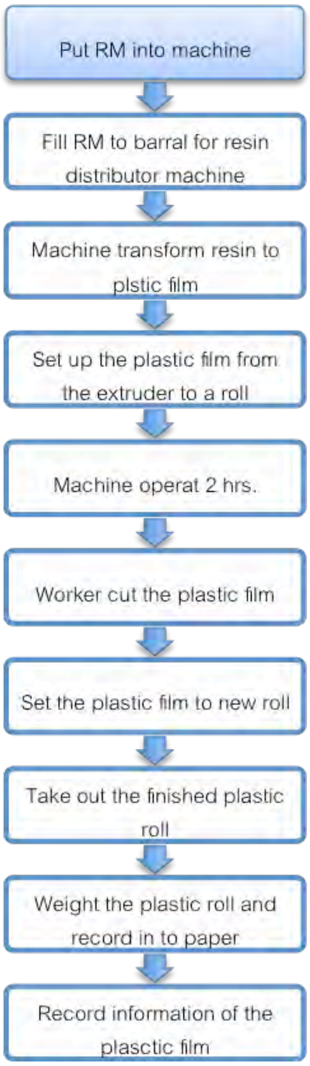


Figure 3.6.5: The process loop of film blowing

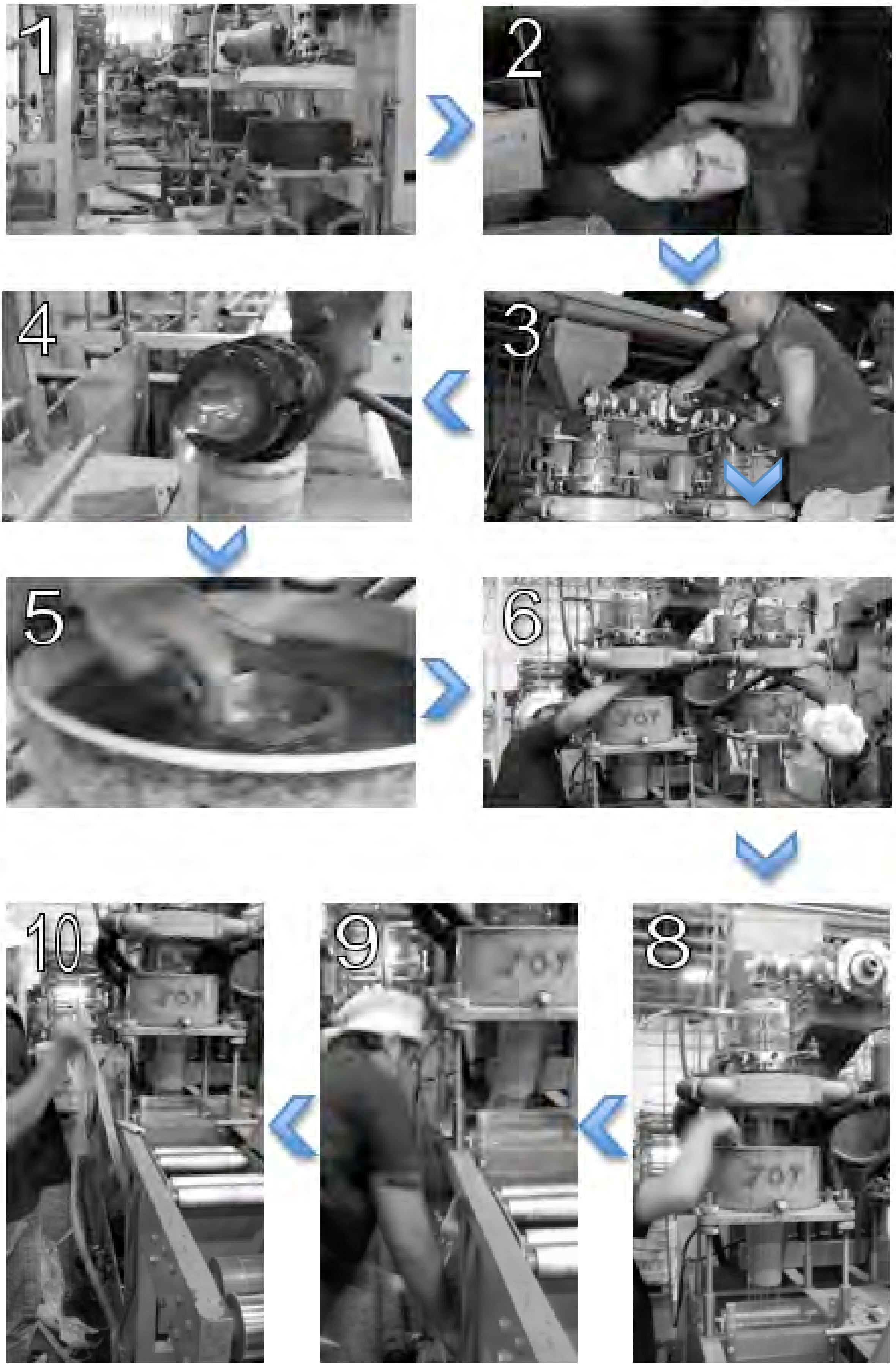

1
2
3
4
5
6
8
9
10

Figure 3.6.6: The pictorial description of film blowing process

The number of defect in this process is very high according to the machine produce the plastic film continuously. According to Figure 3.5.9, there are three defect types in this process. The defect in image 1 is found out in the beginning of set up new product size. The second image is the defect, which plastic film getting in shape but the thickness still not stable. Lastly, image 3 is the defect that generated from the filter screen is break.

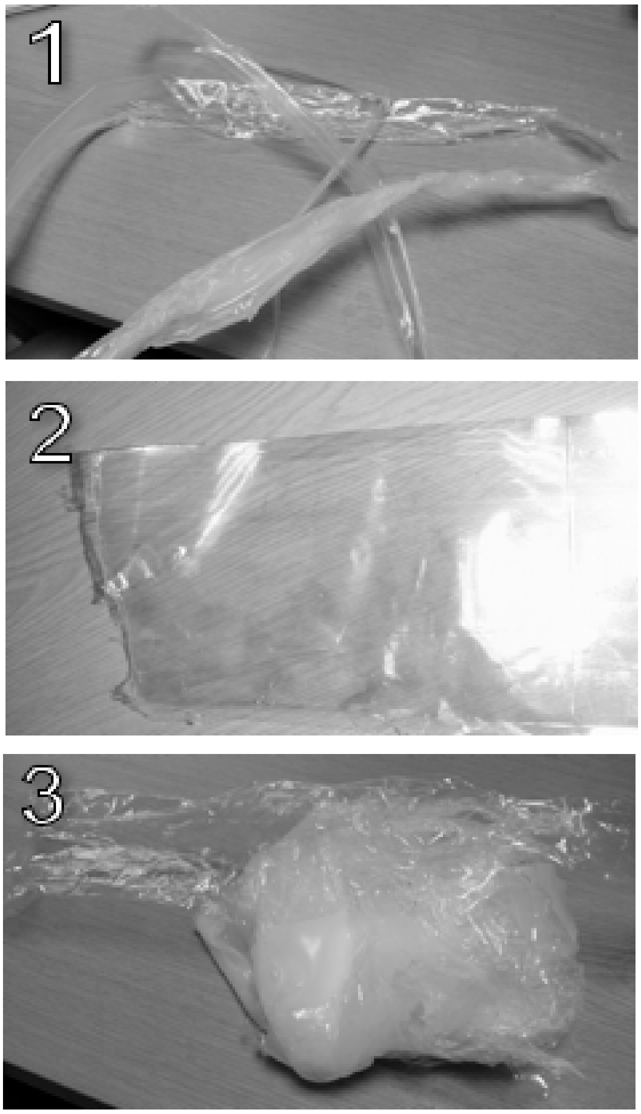


Figure 3.6.7: Three types of defect in film blowing process

According to Figure 3.5.9, the difference of these 3 defects is that the first 2 images are the defects that occur in the set up process, worker has to be quick to minimise the number of defect in the set up process. For the image 3, it is the defect that occurred because of non-preventive control the defect. The case study needs to set the standard time for filter screen changing to decrease this defect.

3.6.1.3 Cutting and Sealing Process

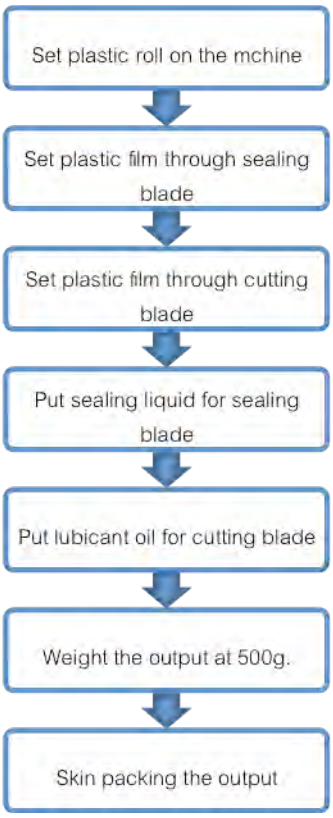


Figure 3.6.8: Process of cutting and sealing machine

The process of cutting and sealing starts from the worker setup the plastic roll to machine. Then, the plastic film from plastic roll will be setup pass through bars, sealing blade, and cutting blade. The output of this process is the plastic bag in piece. Worker will pack the output into 500 grams packing, called skin pack. Finally, worker will collect 500 grams to pack in 5 kilograms. The process also illustrate in Figure 3.6.9.

According to Figure 3.6.10, the process of apply sealing liquid, work has to stop switch off the machine to apply the sealing liquid. The white colour of liquid will drop and stick on the plastic film. The average frequency of apply this liquid is 10 time per shift depending on worker. This process, it could be saying that the more worker apply the liquid the more defect generated.

Figure 3.6.9:the pictorial illustrate the packing process in cutting and sealing

Figure 3.6.10: The processes of apply sealing liquid

3.6.2 Pareto diagram analysis for defect problem

Since the study on workflow of each process in the production, the problems have been detected and listed to check sheet. The check sheet has been scored in the period of 50 days. The number of occurrence has been sum up and using Pareto diagram for further analysis. The Pareto diagram help to prioritising problem and also determine which problem effect to the case company most.

As the result in Table 3.6.1, the highest four problem are plastic chunk, black flecks, white colour stain, fallen resin. The plastic chunk and black flecks problems are the defect that found in the film blowing process. White colour stain is occurring in cutting and sealing process. Lastly, the problem of fallen resin is generating from raw material mixing process.

With this tool, the main problem of defect has been identified. This is show that the focusing on those four problems will reduce overall problem up to 74.65%. The study still continues to analyse problems further to find the actual root cause in the next tool of fish bone diagram or cause & effect diagram.

Table 3.6.2: Defect problems check sheet

Defect Problems Check Sheet Summary				
No.	Problems	Frequency	%	Accumulated %
1	Plastic chunk	36	22.26%	22.26%
2	Black flecks contaminate in plastic film	31	19.17%	41.42%
3	White colour stain	29	17.93%	59.35%
4	Fallen resin	25	15.30%	74.65%
5	Product Unshaped	13	8.04%	82.69%
6	Lubricant oil stain	9	5.56%	88.25%
7	Water stain	9	5.56%	93.82%
8	Clarity	5	3.09%	96.91%
9	Seal leak	5	3.09%	100.00%

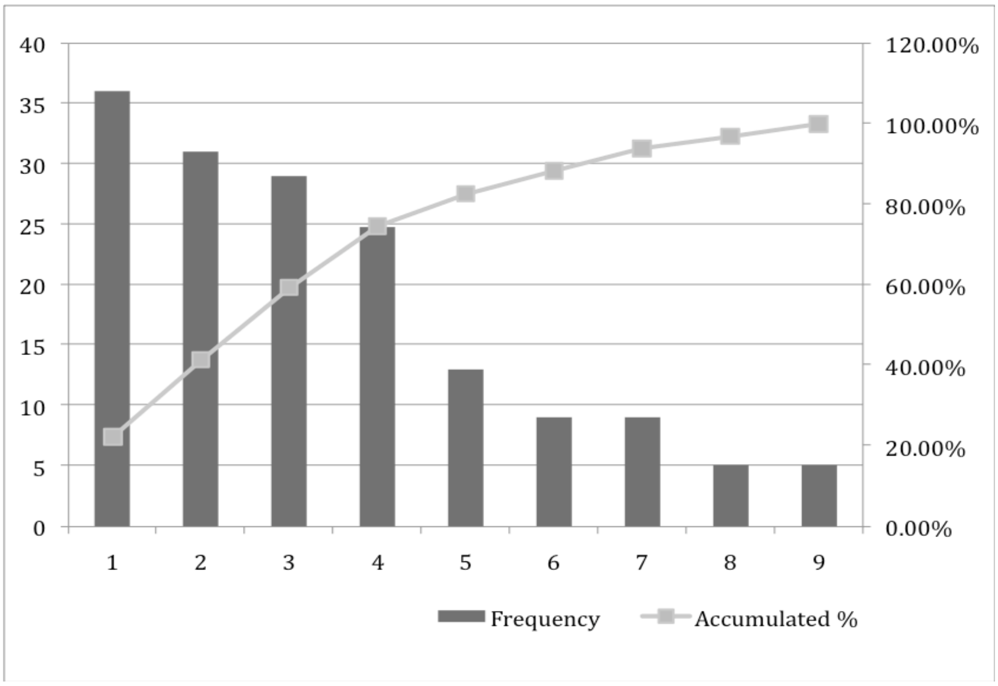


Figure 3.6.11: Pareto diagram of defect problems

3.6.3 Cause and effect diagram analysis for defect problem

Once the problem has been identified, the cause & effect diagram analysis will be using to show those problem are cause from man, machine, method, or material. The casue and effect diagram, the detail of the casuse and effect of product defect are catorised as following.

- Method
  - Plastic chunk
    - No time set for filter screen
  - Black fleck
    - No time setting for filer screen
  - White stain
    - apply sealing liquid to often
  - Fallen resin
    - Unsuitable method of work
  - Water stain
    - No time setting for filer screen

- Seal leak
  - No time set for sealing film replacement
- Machines
  - Clarity
    - Water chiller is not working properly
  - Too old
    - Generate high number of defect time
- Material
  - Low quality
- Man
  - Product unshape
    - Worker didn’t see
  - Lack of skill
    - No training
  - Lubricasnt oil stain
    - Worker didn’t see
  - Work overload

As Figure 3.6.10, most of the problems are listed in method. This is initially indicated that this company would have problem with medthod of work. This will be the focus area of problem solving.

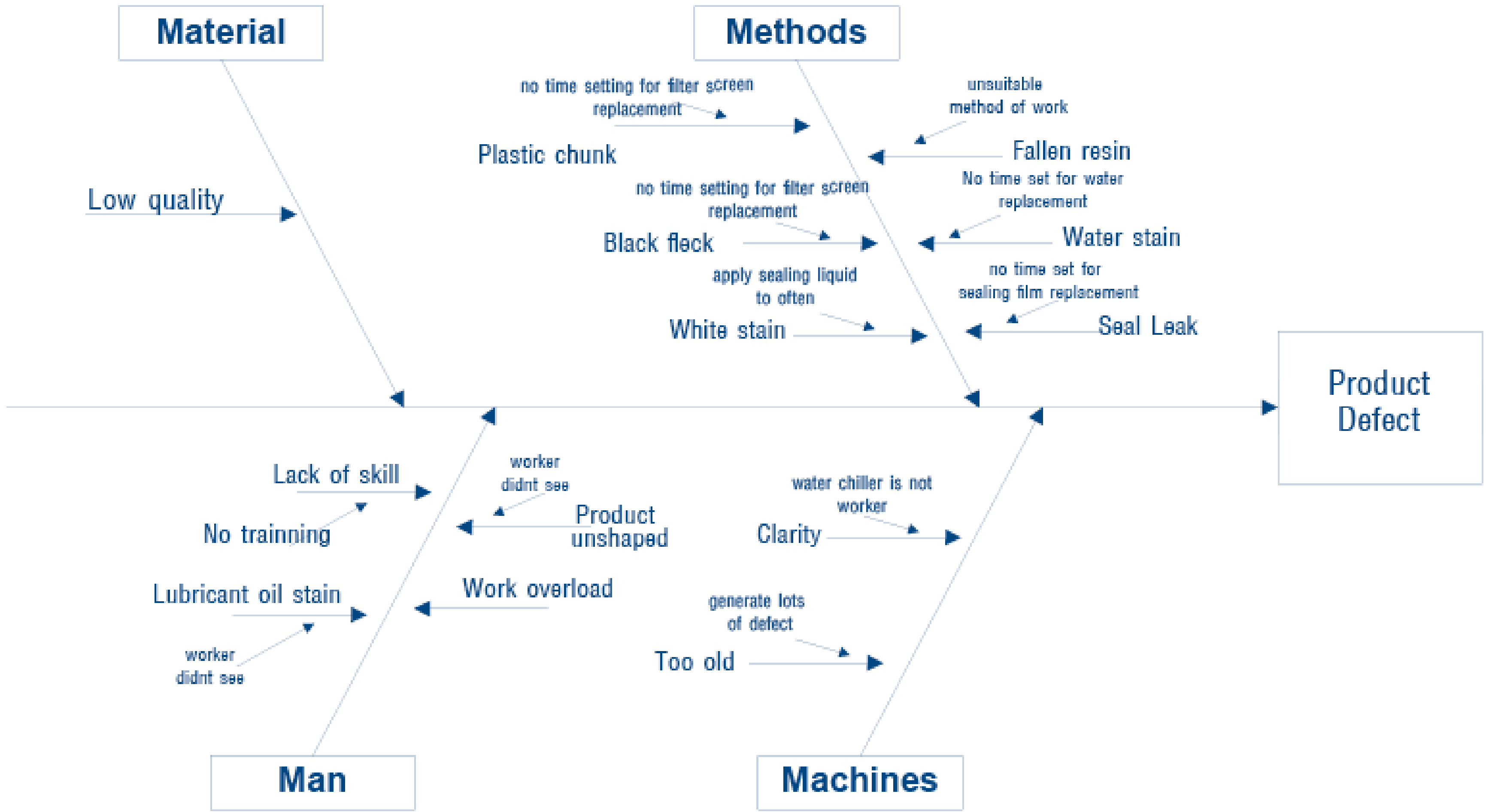


Figure 3.6.12: casue and effect digram of product defect

3.6.4 Relationship matrix

After causes of defect problem are identified by cause and effect diagram as shown in the previous section. This study has set up the session by gather related worker and foreman to score the causes. The purpose of this session is to prioritise the causes that should be emphasised. There are criteria for worker to score, which are occurrence, weight per occurrence, and possible to reduce. The score that use to evaluating in this session rates from 1 is lowest score to 5 is highest score, which can be describing as following.

- "5" refer to the highest correlation between cause and criteria
- "4" refer to the high correlation between cause and criteria
- "3" refer to the fair correlation between cause and criteria
- "2" refer to the low correlation between cause and criteria
- "1" refer to the none correlation between cause and criteria

Table 3.6.3: The relationship matrix

No.	Problems	Criteria			Total	Category	Summary
		Difficult to detect	Number of weight per occurrence	Severe			
1	Plastic chunk	2	5	5	12	Method	61
2	Black flecks	5	4	5	14	Method	
3	White stain	4	2	5	11	Method	
4	Fallen resin	1	3	3	7	Method	
5	Seal leak	5	2	3	10	Method	
6	Water stain	3	2	2	7	Method	
7	Product unshaped	3	2	3	8	Man	17
8	Lubricant oil stain	5	2	2	9	Man	
9	Clarity	2	3	5	10	Machine	10

In summary, it is obviously that the problem in method category will be focused according to the score 61. The other three causes are the less impact to the total number of defect. However, this research will cover all the nine defects that occur in the case company to protect the defect out to customer.

3.6.5 Why-How analysis

In this section, why-how analysis is the tools that will be adopted to find the root cause and then the last step of this tool will come up with the method to solve problem. The following in Figure 3.6.14 is why-how analysis for each product defect problem, which will be described in detail as below.

First, the plastic chunk problem is because of the filter screen is broken and the reason of the broken is dilapidated of filter screen in film blowing process because there is not standard time for filter replacement. Worker usually change when it break. Second, fallen plastic resin is because of the method of work is making the plastic resin all over the fall, so the solution to this problem is to redesign and process improvement of work. Third, the dirt on the product, four kinds of dirt, which are lubricant-oil stain, white colour stain from sealing liquid, black flecks contaminate into plastic film, and water stain. There dirt on the product also found out that there is not stand work and time to work.

Fourth, side leak is because of the friction of plastic roll. It is happen with the method of the storing plastic bag. Fifth, seal leak problem, this problem has consists of two causes, which are dilapidated of flam retardant tapes, sealing liquid dried. That cause also because of the standard time of replacement is not found. Sixth, unshaped product, it is because of the defect in the set up time and work has not screen it out. The solution is the set the method of work to guide the technique how the screening it out.

Lastly, clarity of the plastic film is found out that the temperature of the water in the blowing process is not cold enough. It is usually happened because of the water chillier is broken. There should be maintenance system to protect the problem.

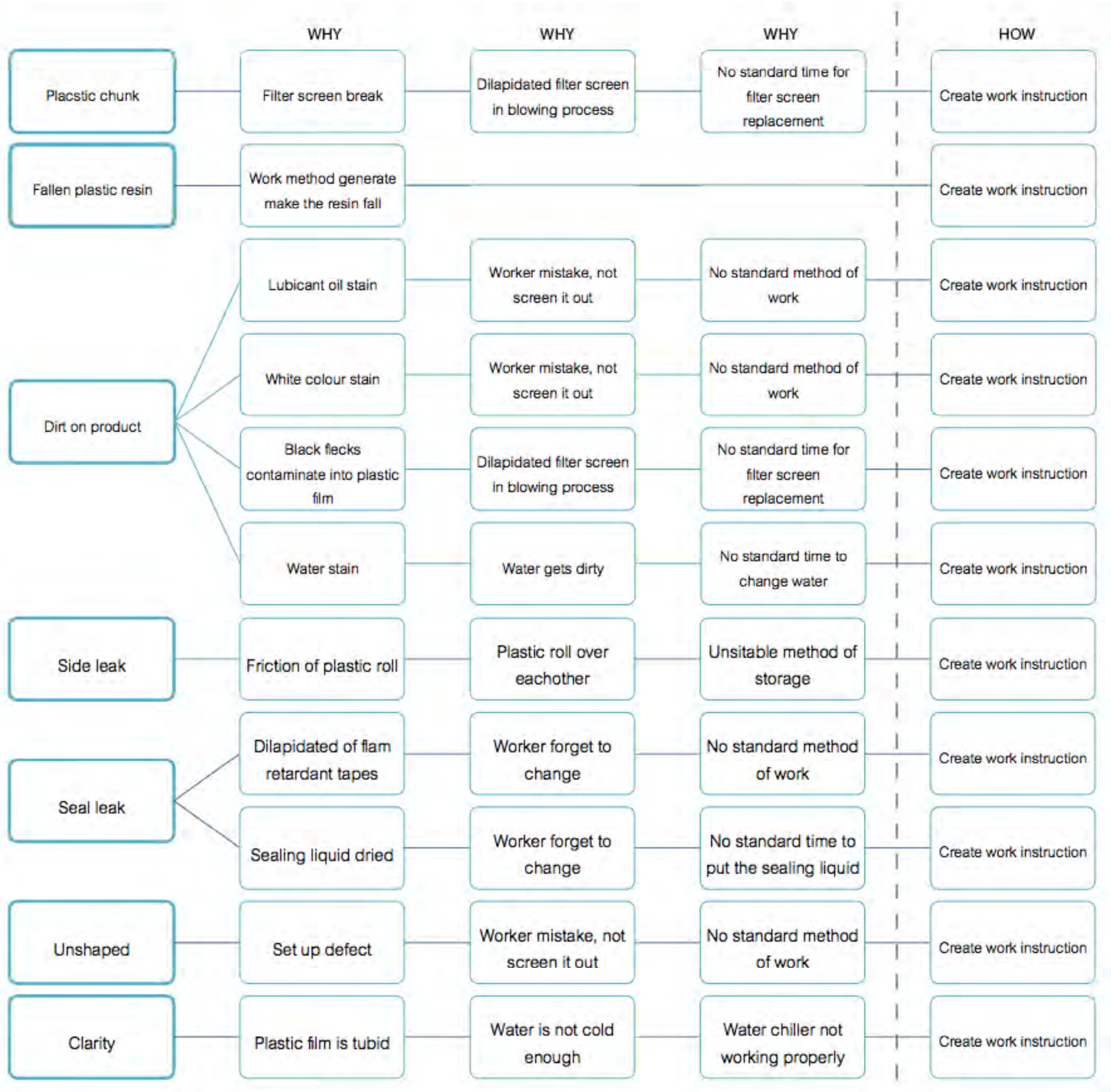


Figure 3.6.13: Why-How analysis of product defect

3.7 Problem analysis of product backlog

As number of product backlog data has been collected as Table 3.7.1, problem of product backlog of the case company is initially not about demand over supply issue. According to the number in Table 3.7.1, it shows that the quantity of actual produced in average is higher than the actual sale. This is why the case company facing the problem of product backlog. Since the number of actual produced is more than actual sales, it means that the case company hold unwanted product. Therefore, the number of unwanted product becomes the number of overproduction. It indicates that the company is facing the problem of overproduction. For further analysis, data of this section is going to indentify the root cause of overproduction. The tools that will be using to analyse are functional flowchart, cause & effect diagram and why-how analysis. The result of this section will show the root cause and how to solve problem of product backlog

Table 3.7.1: PP product backlog

Calendar	Dec '08	Jan '09	Feb '09	Mar '09
Actual Produced	335,996	294,355	381,720	392,838
Inventory	12,025	10,535	13,662	14,060
Customer Order	315,648	300,533	366,627	376,535
Actual Sales	301,823	299,541	354,418	367,762
Backlog	13,825	992	12,209	8,773
Over production	46,199	5,349	40,963	39,135

3.7.1 Workflow analysis

The current workflow will show the problem of overproduction, since the current management doesn’t have good system of job order. Currently, MD is playing the vital role in the case company including the job order. The MD is the person who in charge to direct the production. He plans and orders the production directly to foreman without written note or document that can be the reference in the future. The production will run what he order and not be change until further order.

According to Figure 3.7.1, the highlighted area is missing the job order, as mentioned earlier MD is only order job verbally. He will order the size and the thickness without mentioned the quantity and it is automatically understand between foreman and MD that the production will not be changing until his further order. In Figure 3.7.2, it is the process of finished goods checking. The delivery staff will check the stock at the end of the day. The number of FG in the warehouse will be collect in the FG stock record. Since the case company has two shift of production, the accuracy of stock checking is occurring.

Therefore, the case company needs the new functional flow chart with the document base system in job ordering and the new function to control the finished goods inventory.

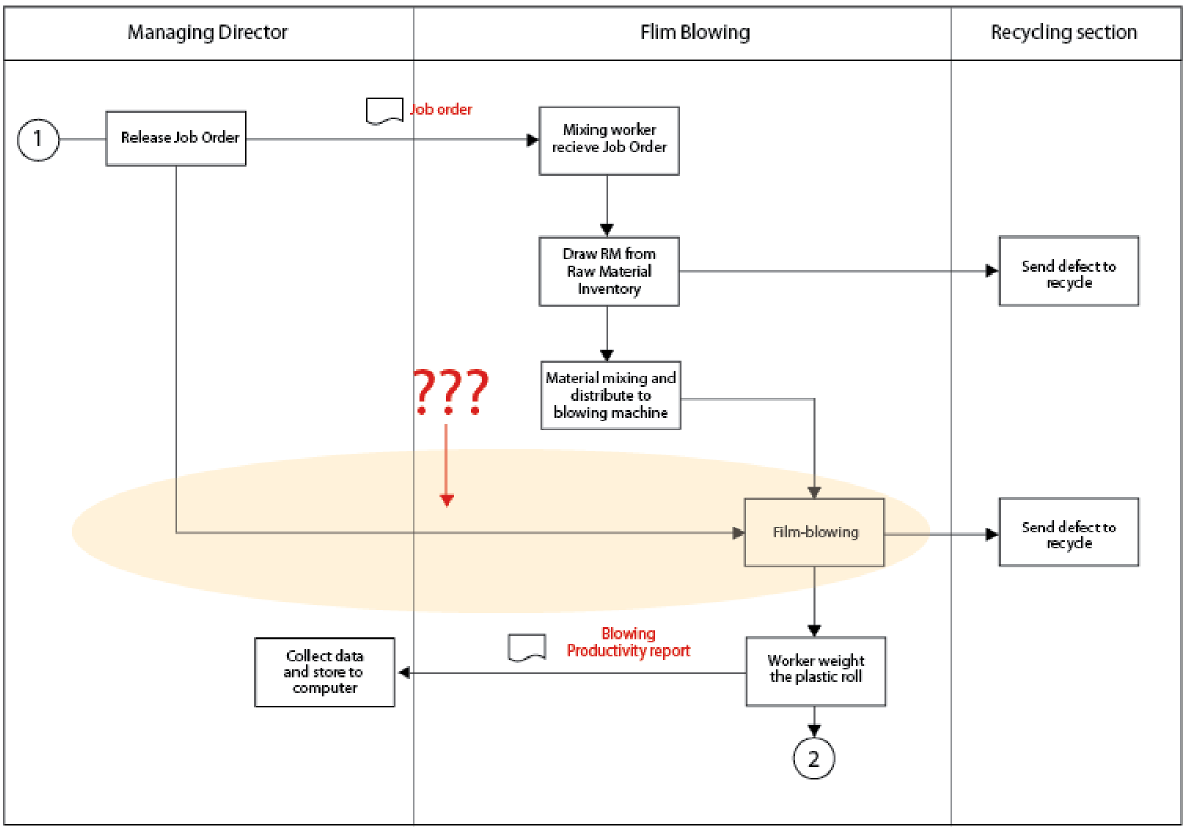


Figure 3.7.1: The process that cause the problem of product backlog

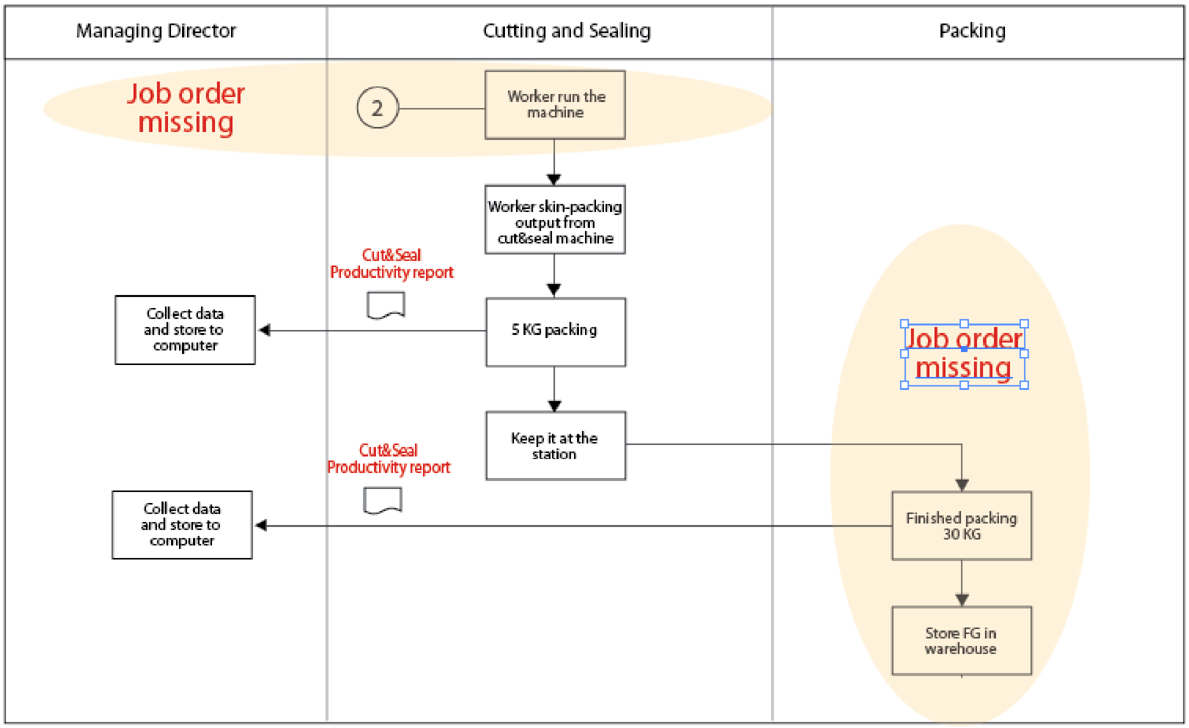


Figure 3.7.2: The process that cause the problem of product backlog (cont.)

3.7.2 Cause and effect diagram

The cause and effect will analyse the cause area of the problem. According to Figure 3.7.4, The casue and effect diagram, the detail of the casuse and effect of product defect are catorised as following.

- Matrial
  - Raw material shortage
- Method
  - No systematic process of job ordering
  - Finished goods stock checking erroe
    - No process of receiving and drawing for finished goods
  - Unorganisation
  - Production rely on one person
    - No span of control
- Man

  - o Labour shortage
  - o Lacj of skill
    - ▪ No trainning
- Machine
  - o To old
    - ▪ Less output
  - o Over capaity
    - ▪ Machine not enough

From the ploted cause and effect diagram in Figure 3.7.4, there are problem with job ordering, FG stock checking, documentation in production. The method will be focusing to further analyse to find the root casue.

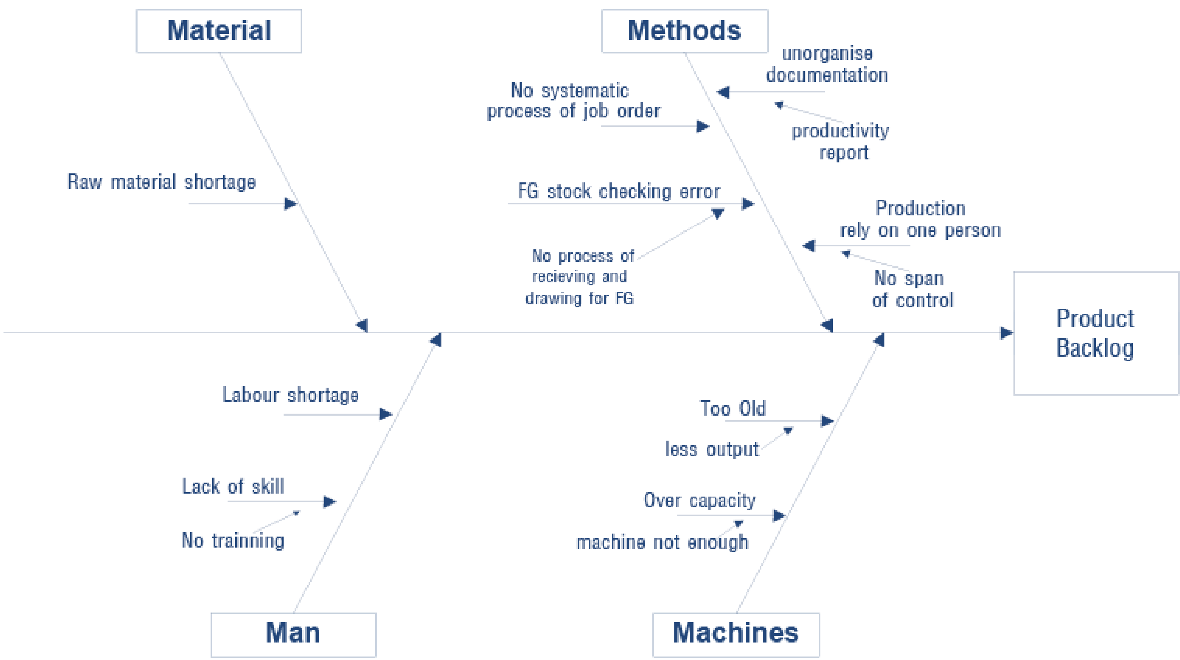


Figure 3.7.3: The cause and effect diagram of product backlog problem

3.7.3 Why-How analysis

Since the problem has been analysed with data, workflow and cause and effect, there are three main issues to be analyze with why-how analysis to find the root cause, which are demand over capacity, product stock list error, and over production.

According to Figure 3.7.5,firstly, demand over capacity is the issue that seem to be cause of the problem but according to Table 3.7.1 shows the demand of customer, which under the supply of the company, therefore this issue could be cut off. Secondly, the product stock list error, the first why is analysed that the product is not available in the FG stock list and the other why is product is actually available in the warehouse but in the stock recode shows “0”. The second “why” is indicating the reasons of the first “why”, that there is no process of receiving and drawing FG. The third why show that the reasons of no process of receiving and drawing FG, because no staff and function response for FG warehouse, and it comes to the solution that the case company should have the warehouse division and staff to control the FG warehouse.

The last one is actually because of the method of job ordering, which cause of over production. The first why is indicating the reasons of over production because of they are not notified the quantity and another reason is that MD has not change the order so worker cannot stop the production. The next why analysed that because of there is no systematic job order to control the over production and its come to the solution that implement documentation base system rather verbally, which has no reference to work.

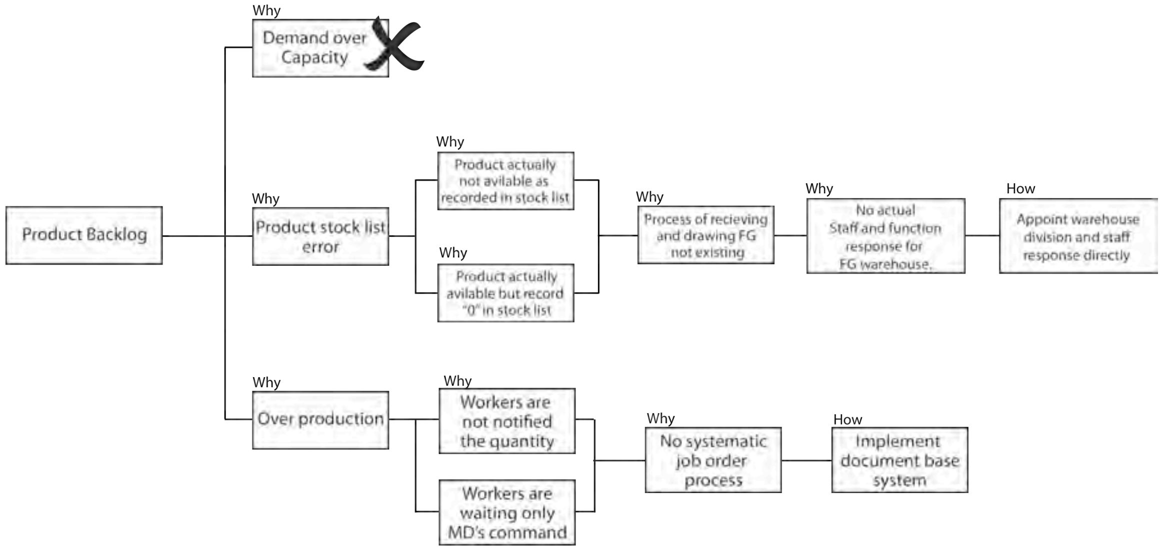


Figure 3.7.4: The cause and effect diagram analysis

3.8 Summary

Since the case company has a family business characteristic, the company is more to centralized organisation structure. It is found out that all the decision has been made by one person, which make the work overload to the MD. The company needs the structure that defines what different areas and people in the organization responsible for. Including, organization structure describe collection of various roles that have been identified, defined and staffed.

The data collection through the shop floor has been found but it is not efficiency in the way of data accuracy and usability. During the research, it found out that there are document of data collection in each process but there is no coordination between each function. For each process, there are supervisor who collecting data and they are creating format in their own way. It is resulting in many different version of data collecting format, which make a lot of confusion. With various format of data, there are errors when staff record the data to the computer. Moreover, the data stored in computer, it has never been summarized to a report or any kind of use for support information.

Work process for job activity has not been standardised. Workers are trained only main task by the previous worker. They are seems to learn and find their own way to work in their station. The company should have work instruction for them in each process. Interestingly, it found out that workers are sharing their work experiences and techniques to each other without formal training. Lack of standard instruction and training system are resulting in instability product quality and injuries across the shop floor.

The case company is facing the problem of shop floor expansion without systematic planning. Only the president of the company has managed and commanded to almost every activity in the production from ordering raw material to checking the stock level for production planning. Therefore, the implementation in next chapter will improve the shop floor control system of the case company.

CHAPTER IV

IMPLEMENTATION and RESULTS

Once the problems have been analysed in previous chapter, this chapter is discussing on implementation to reduce the number of product backlog problem. The implementation will begin with restructuring the organisation structure, appoint the shop floor functional activity and document flowchart, and changing shop floor documentation system.

4.1 Organisation and management structure improvement

The organisation structure has been the key fundamental problems of the case company. The command from top managements, responsibility assignment, communications among functions and confusion scope of job are problems that will be restructured and clarified in order to improve the management of the case company. The method of departmentalization, and work identifies will be employed to this improvement.

The restructuring of the case company organisation structure will correspond with the study of organisation management, departmentalization, and work identifies. Including, the culture of people and environment of the company is considered before any improvement.

For the tendency of organisation restructuring, the criteria that will be considered are as following.

1. New organisation structure need to be able to cope with a situation that company is continuous expand.
2. New organisation structure must clearly show the hierarchical relationship, organisation levels, Span of management authority, and responsibility of each position.
3. New organisation structure must combine similar job together and separate different job apart for better in the coordination and communication.

For overall improvement about coordination in the company, the formal organisation chart can be restructured as show in Figure 4.1.1 following.

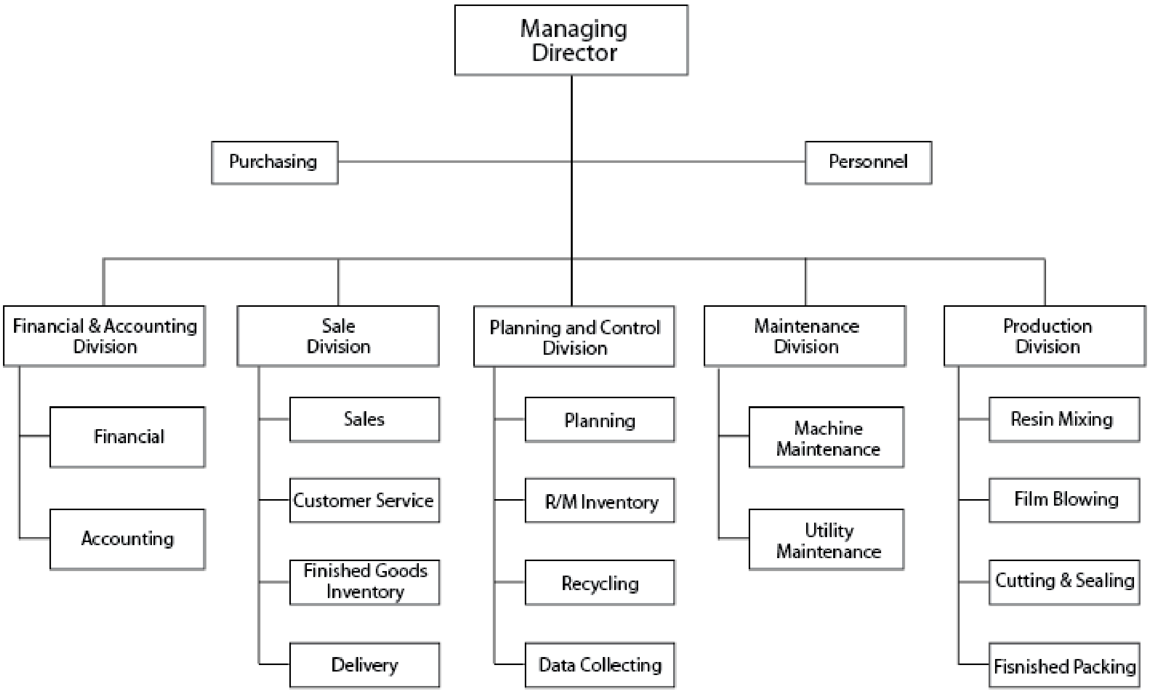


Figure 4.1.1: The case company formal organisation chart

The organisation restructuring has been departmentalized to five departments and two divisions. The responsibility of each department under control of General Manager are describing as follow.

4.1.1 Purchasing and Personnel Division

These two divisions are not grouped in any department but they are directly under the supervising to General Manager according to responsibility and authority of these two sections relates to the benefit of all employees and the company. It is difficult and complicated for workers who work in purchasing division to make a decision about purchasing things. And it is difficult and complicate for workers who work in personnel division to make a decision about the compensation and benefit for workers.

4.1.2 Accounting and financial Division

This department consists of two sections. They are account and finance. An account is response to account receivable, account payable and general ledgers. Financial is response to three activities, billing, collector and leasing.

4.1.3 Sales Division

This department consists of two divisions according to Figure. They are marketing and logistic. Marketing division consists of two sections, which are sales and customer service. Logistic division consists of two sections, which are finished goods inventory, and delivery.

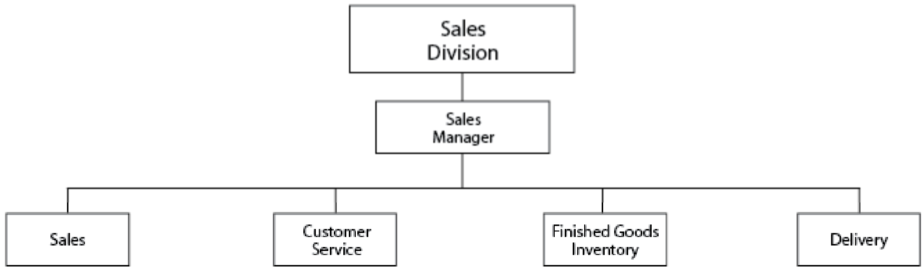


Figure 4.1.2: Sales division chart

The main responsible of this department generally start from receiving the purchase order from customer and them pass the order through production and accounting. Next step is about collaborating with production and customer for delivery date, and coordinating with delivery section to delivery goods to customer. After that if there is customer complain, this division will report and pass the information to related division. In the logistic, there is FG inventory section and delivery section. The FG inventory section has responsibility to receive goods in and draw goods out of the warehouse. Delivery section has responsibility to scheduling and preparing finished goods according to delivery note from sales manager.

4.1.4 Planning and Control Division

This division takes a responsibility of production planning and control. The jobs of this division are to plan and to control production process and work in process. This division also taking care of raw material and finished goods inventory control and delivery system through the company. The job also includes the document control for production. The new organisation structure added planning and control division. It is because this function will help work of managing director.

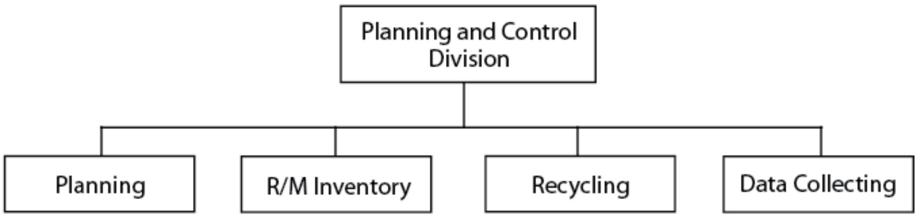


Figure 4.1.3: Planning and control division chart

4.1.5 Film Blowing Section

This division is responsible on film blowing production. The jobs of this division are to run the blowing machine and keep the motor and air pressure of the machine stable. The outputs from this division are plastic rolls, which will be brought to cutting and sealing division.

4.1.6 Cutting and Sealing Section

This division is responsible on film cutting and sealing, which a process of making a bag. The jobs of this division are screening and skin packing the product that came out from the machine.

4.1.7 Packing Section

This division is responsible on work in process of PP and PE packing. The job consists of bunch packing and finished packing, which become a finished good and will be brought to store in warehouse.

4.1.8 Maintenance Division

This division takes a responsibility of all machine maintenance and maintenance for all utility of the company.

4.2 Create of Job Description

Job description provides clearly understands for employees about their job scope, responsibility, duty and authority. The detail of job description will be classify as below:

- Job Code
- Position Name
- Department
- Division
- Section
- Report to
- Job Purpose
- Responsibilities and Duties
- Authorities
- Minimum Qualifications

To set up job code, the standard regulations is set according to well organised and to make a meaningful job code, not just a series of number.

4.2.1 Code for each job position consists of three parts.

- First part has one digit, which indicates the position of command.
- Second part consists of two digits, which indicates the level of job.
- Third part consists of five digits, which indicates the department, division, section, and sub section that employee belong.

4.2.2 Meaning of job code

- First character indicates the position in level of command. Each character has its meaning. The lists below show the meaning of each character.

1. M stands for Manager
2. E stands for Engineer
3. T stands for Technician
4. S stands for Supervisor
5. C stands for Clerk
6. F stands for Foreman
7. W stands for Worker

- Second and Third digits indicates the level of job

These two digits are set according to the job hierarchy level due to the different in experiences, job specification, job knowledge, complexity of work, corporation, training period, responsibility and physical effort are the factors that use for considering the salary level.

Job level is set up to support the expansion of the company and also the salary level, which classified to 10 level.

The level 1 is the lowest range and level 10 is the highest range. The salary level start from the minimum standard wage that setting by department of labour to the maximum salary that the company's owner satisfaction.

- Fourth to eighth digits are indicating the department, section, and sub-section that employees are positioned

<u>Fourth digit indicates department</u>

- 0 stand for Not belong to any department

- 1 stand for Accounting & Financial Department
- 2 stand for Sales Department
- 3 stand for Development Department
- 4 stand for Engineering Department
- 5 stand for Production Department

<u>Fifth and Six digits indicate division</u>

- 00 stand for Not belong to any division
- 01 stand for Production Development Division
- 02 stand for Quality Control Division
- 03 stand for Maintenance Division
- 04 stand for Production Support Division
- 05 stand for Planning & Controlling Division
- 06 stand for PP Production Division

<u>Seventh and eighth digit indicate section</u>

- 00 stand for Not belong to any section
- 01 stand for Production Planning Section
- 02 stand for Raw Material Section
- 03 stand for Recycle Section
- 04 stand for Data Collecting Section
- 05 stand for Resin Mixing Section
- 06 stand for Film Blowing
- 07 stand for Cutting & Sealing
- 08 stand for Packing

According to the focusing on shop floor control system, the job description will create only for production department.

4.2.3 The example of the meaningful job code

F01-50606 is film-blowing foreman; the following in Figure 4.2.1 is the example of the job description. For other job description, please refer to appendix A at the end of this paper.

Job Description

Position	: Film Blowing Foreman	Job Serial Code	: F01-50606
Department	: Production	Level of Command Code	: F
Division	: PP Production	Work Hours Per Week	: 54
Section	: Film Blowing		
Reports to	: PP Production Supervisor		

Job Purpose

To perform the duty in control film blowing process to achieve the objective according to the plan. Delegate subordinates, control worker for fully utilization, take care about performance assessment of subordinate and coordinate with other related people for effectiveness and efficiency of film blowing operation.

Key Responsibilities

1 To take care and control the operation of division to achieve the objectie.
2 To summarise the efficiency of section and report to PP production leader.
3 To coordinate with other related people for the information that related with division
4 To follow control and assess the performance of subordinate.
5 To affordm applaud and gloat over of work of production manager
6 To promote and develop the activity that effect to the imporove ment of division operation
7 To suggest and consult subbordinated about techinical and peocedure of operation
8 To improve working environment to be safe and effective

Authority and Major Challenge

To consider and make a decision for performance assessment and punishment of subordinate.

Subordinates's Responsibilities

Position	Number of Subordinate	Job Scope
Film Blowing Worker	40	follow output of production, quality, waste.

Working Relationship

Organisation / Business Unit	Task	Frequency
PP Production Supervisor	Daily Meeting	Daily
Planning and Control	Production Scheduling	Daily
Cutting&Sealing Section	Receive plastic roll to process	Daily

Figure 4.2.1: Job description of Film blowing foreman

4.3 Create Standard Work Instruction

Standard work instruction implementation in this research to help reduce reflect problem. There are tools and techniques that can reduce defect, work instruction is one of the basic tools that considered to the case company because of it is a fundamental of many other advance tools.

The process of creating work instruction is start from the current working process. The processes of each machine have been analyzed to see the constraint in every step. Some of the previous processes that have not generated defect will no be change.

Moreover, the safety issue is one of the criterion that consider before create each step. According Figure 2.3.1, the information in the work instruction has been classified into 6 parts, which will be described as follow.

4.3.1 Heading

This first part of work instruction will appear in every page of the work instruction. There are 7 elements in heading as follow.

1. Department – name of the department that response to the process
2. Location – place where the work instruction will be use
3. Operation – indicates the activity of the work instruction
4. Document No – number for filing start with WI- and job code
5. Job serial code – the job code as assigned in the job description
6. Page – indicate the total page of document
7. Issue no – indicates the number of revision

4.3.2 Issue history

This part allow user to trace the history of update in the past including the author of each issue.

1. Issue number – indicates the number of revision
2. Description of change – detail of which information has been update or remove
3. Author – name of person who edit
4. Effective date – the start using

4.3.3 Approval signature

The work instruction has to be approved with signature

1. Signature of Creator – the creator or author sign for the correction
2. Signature of Approver – the approver usually manager of related function
3. Signature of Authoriser – the managing director authorise to release the document

4.3.4 Information

1. Operator – job title of who follow the work instruction
2. Machine – name of related machine
3. Caution – the important remark

4.3.5 Process flowchart

This part is the area for attach process flowchart of the process.

4.3.6 Process steps

1. No – number of process
2. Images - related image
3. Description – the explanation of each step
4. Remark – important caution in the step

The following Figure 4.3.1 is working instruction template

Work Instruction

Department:		Document No.:		Page:	of
Location:		Job Serial Code:		Issue No:	
Operation:					

Issue History

Issue Number	Description of Change	Author	Effective Date

( )	( )	( )
Created By:	Approved By:	Authorised By:
Date:	Date:	Date:

Information

Operator:

Machine:

Caution:

Process Flowchart

Process Steps

No.	Images	Description	Remarks
1			

Figure 4.3.1: The template of work instruction

4.4 Redesign functional shop floor activity and documentation flowchart

From the analysis about the activity and the document flows system in the case company's shop floor. The case study does not have the actual activity flow and document flow, which causes that workers do not have the reference for workflow, the workers process same work with different process and the workers confuse about necessary documents that required. There is some activity that does not have the document to control, and some same activity has different document format. Formal standard activity and document flow in shop floor can b describe as following

According to Figure 4.4.1, it is illustrate the activity and documentation flow of two functions, which are sales section and planning and controlling division. The process start from the purchasing order (PO) from customer will be copied. Some of PO will pass it to delivery section and some recorded to computer database. The deliver section will check the FG in the stock record. If the FG is available, the PO will be schedule to deliver. In contrast, if the order is ran out of stock, staff will inform the planning section about the shortage. In the same time, planning and controlling section staff will generated the PO daily report from computer database. The report shows the total number of product in every size that has been ordered in the day. Staff will use this daily demand will be use for production planning. Staff will then a create job assignment and issue job order to each machine in the production.

According to Figure 4.4.2, once the job order has been issue, it will release to work in each process. According to Figure 4.4.2, the job order starts to release the order to mixing staff. Mixing staff will fill the draw material from, to record the total quantity of RM used in each shift and give it to RM inventory clerk. The mixing staff will be notified quantity of raw material and additive that will be used, also the machine number where to deliver after mixed. In the mean, while film blowing staff will be given the job order as well. Blowing staff will be informed to prepare the machine to run in size, thickness and quantity according to job order. When the plastic roll has produce, the specification will be fill in the product tag card and stick on the plastic roll and also weight of the plastic roll will be record in the productivity record. This report is collecting at the end of the shift by foreman and submits to planning and control division. At the end of the shift, the defect will be sent to recycling section as well as the number of defect record in the productivity report.

According to Figure 4.4.3, since the film blowing process produce the plastic film in a roll, cutting and sealing worker will keep the tag card that stick to the roll for reference during run the plastic roll. This is because if there is any defects occur with plastic film, cutting and sealing worker can refer to the certain blowing worker and machine that produce the certain plastic roll. The defect in this process will be separated into to bag one is for defect that produce from blowing process and the other is from cutting and sealing process itself. The output from this process will record to productivity form and then submit data collection section. The packing is the last step of production. They will pack product to 30 kilograms packing and then record number of finished packing or finished goods. The productivity also submits to data colleting section at the end of the shift. Packing worker now has to fill the FG transfer form before can store FG in the warehouse. This step added up to reduce problem of inaccurate stock recording. Once the FG inventory section receives finished goods, they need to update to the inventory stock record every end of the day as the delivery also draw the FG out during the day.

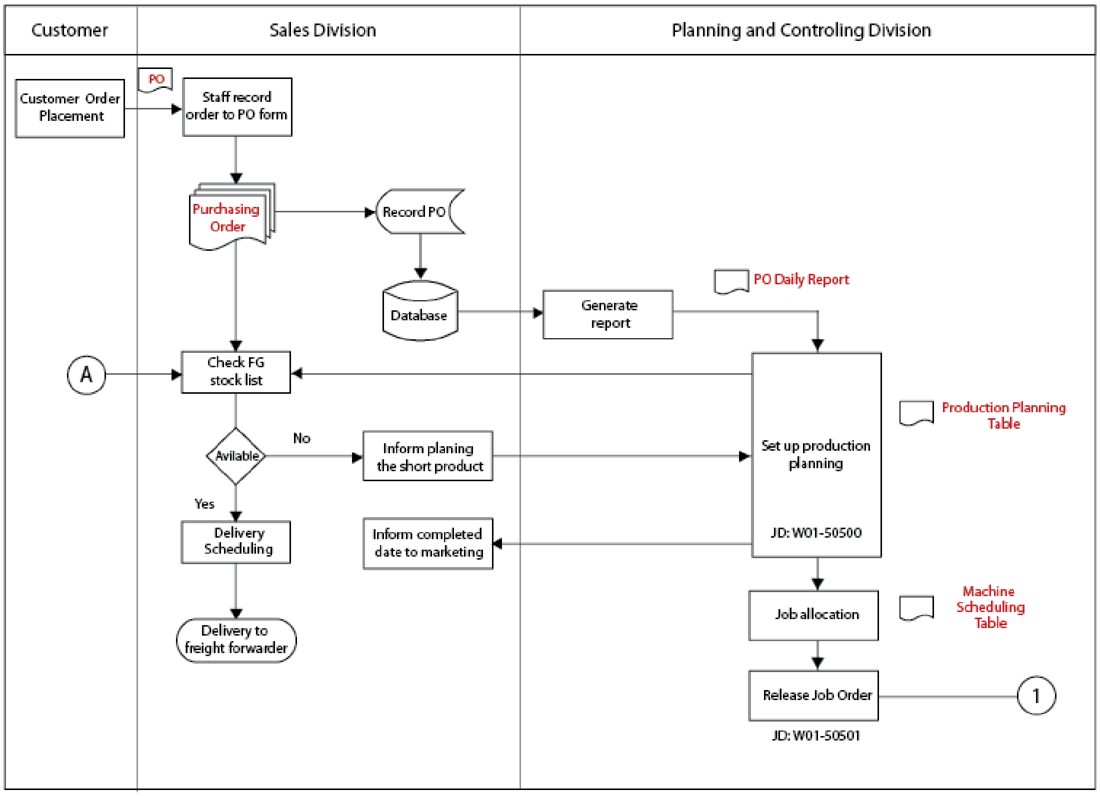


Figure 4.4.1: The formal functional activity and documentation flowchart

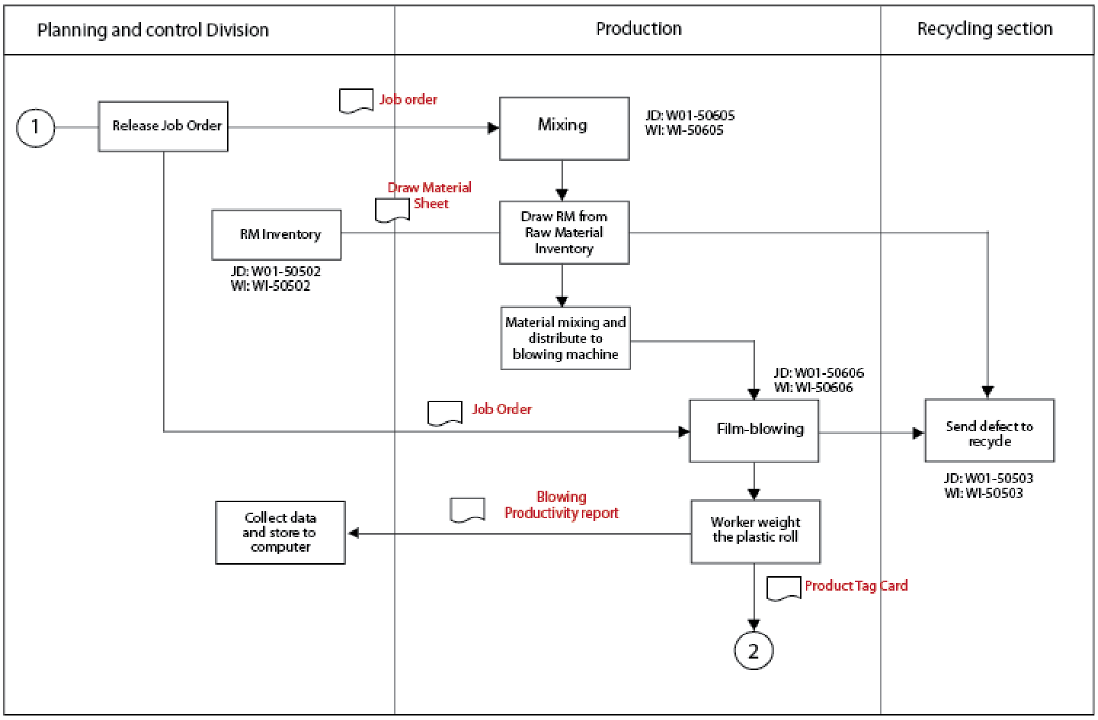


Figure 4.4.2: The formal functional activity and documentation flowchart (cont.)

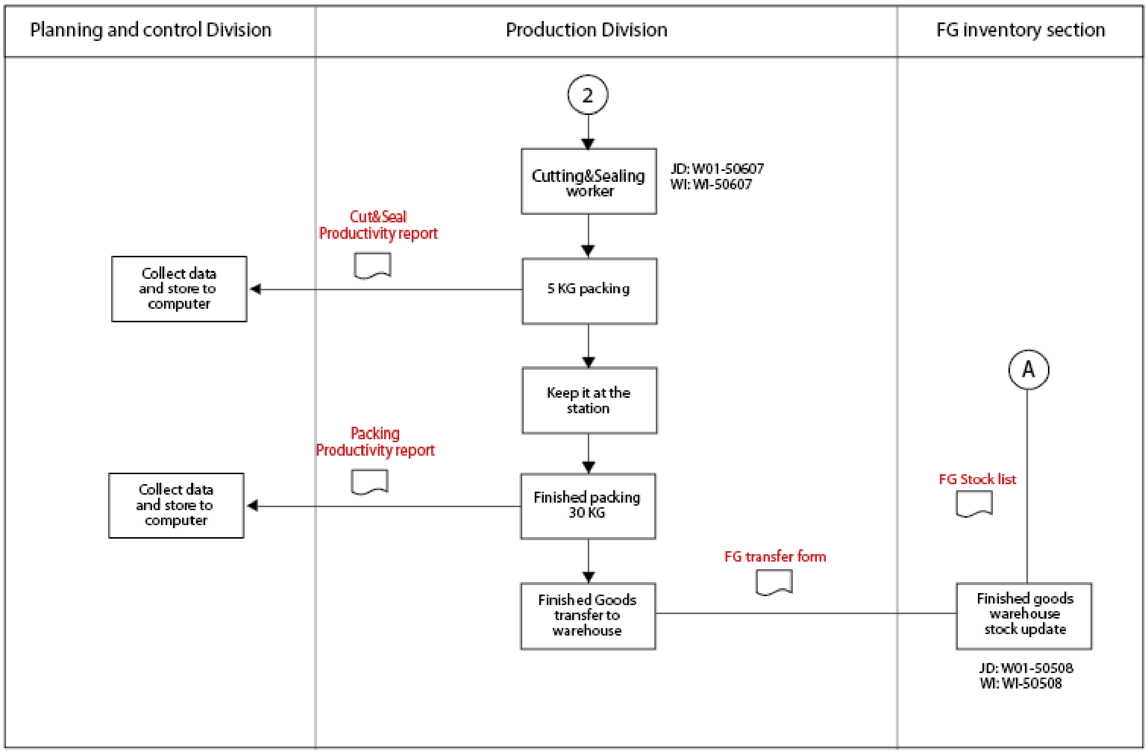


Figure 4.4.3: The formal functional activity and documentation flowchart (cont.)

4.5 Changing shop floor documentation

Since the functional shoo floor activity and document, there are some documents that existing and some need to add some information. This is also improving the collaboration between functions. Changing the document system in production proceed by add up necessary document, cut off poor information, and change the format of document. The following are the document in the shop floor of the company.

4.5.1 Purchasing order daily report

According to Table 4.5.1, it is used to collect the data about product order. The table will show the list of detail on each component of product. It uses to remind related people about the component that waiting for production. This table shows the product specification with the quantity that customer ordered. It used for planning and control foreman about total job orders. It can prevent the forgotten order that cause the delivery delay.

Table 4.5.1: Purchasing order daily report

รายงานสินค้าค้างส่งแสดงยอดยกมา

ไทยนำ

จากวันที่ 03 มีนาคม 2553 ถึงวันที่ 03 มีนาคม 2553

จำนวนรายการ : 21 — ยอดเงินในใบสั่งขาย 707,325.00
เงื่อนไข : แสดงยอดยกมา, เฉพาะสินค้าที่ยังไม่ส่งของ, จัดกลุ่มตามรหัสสินค้า — ยอดเงินที่ส่งของแล้ว 0.00
เงื่อนไข : ระบุตำแหน่งกลุ่มรหัสสินค้า [PGUP] — ยอดเงินคงค้าง 707,325.00

No	รหัสสินค้า	ชื่อสินค้า	หน่วยนับ	ปริมาณยกมา	ปริมาณสั่งซื้อ	ปริมาณส่งของแล้ว	ปริมาณคงค้าง	ยอดเงินคงค้าง	ยอดเงินสั่งซื้อ	ยอดเงินส่งของแล้ว	ยอดเงินคงค้าง
1	P1015	ถุงเรียบ 10"X15" (ห่อละ 30 กก)	ห่อ	12	2		2	23,540.00	3,600.00		3,600.00
2	P1218	ถุงเรียบ 12"X18" (ห่อละ 30 กก)	ห่อ	69	13		13	123,810.00	23,430.00		23,430.00
3	P1422	ถุงเรียบ 14"X22" (ห่อละ 30 กก)	ห่อ	25	27		27	45,330.00	48,525.00		48,525.00
4	P1626	ถุงเรียบ 16"X26" (ห่อละ 30 กก)	ห่อ	7	7		7	12,630.00	12,525.00		12,525.00
5	P2030	ถุงเรียบ 20"X30" (ห่อละ 30 กก)	ห่อ	69	12		12	123,540.00	21,600.00		21,600.00
6	P2436	ถุงเรียบ 24"X36" (ห่อละ 30 กก)	ห่อ	36	10		10	65,055.00	18,150.00		18,150.00
7	P2443	ถุงเรียบ 24"X43" (ห่อละ 30 กก)	ห่อ	11	1		1	19,530.00	1,830.00		1,830.00
8	P255	ถุงเรียบ 2.5"X5" (ห่อละ 30 กก)	ห่อ	37	5		5	72,210.00	9,750.00		9,750.00
9	P35	ถุงเรียบ 3"X5" (ห่อละ 30 กก)	ห่อ	62	30		30	111,465.00	53,895.00		53,895.00
10	P356	ถุงเรียบ 3.5"X6" (ห่อละ 30 กก)	ห่อ	33	10		10	59,490.00	17,925.00		17,925.00
11	P457	ถุงเรียบ 4.5"X7" (ห่อละ 30 กก)	ห่อ	94	21		21	169,500.00	38,100.00		38,100.00
12	P457พับ	ถุงพับข้าง4.5"X7" (ห่อละ 30 กก)	ห่อ	21	2		2	38,490.00	3,900.00		3,900.00
13	P46	ถุงเรียบ 4"X6" (ห่อละ 30 กก)	ห่อ	30	24		24	53,940.00	43,080.00		43,080.00
14	P58	ถุงเรียบ 5"X8"(ห่อละ 30 ก.ก.)	ห่อ	985	63		63	1,767,780.00	113,490.00		113,490.00
15	P58พับ	ถุงพับข้าง 5"X 8" (ห่อละ 30 กก)	ห่อ	23	2		2	44,700.00	3,900.00		3,900.00
16	P610	ถุงเรียบ6"X10"(ห่อละ 30 กก)	ห่อ	57	1		1	101,490.00	1,830.00		1,830.00
17	P611	ถุงเรียบ 6"X11" (ห่อละ 30 กก)	ห่อ	59	11		11	105,195.00	19,680.00		19,680.00
18	P69	ถุงเรียบ 6"X9"(ห่อละ 30 กก)	ห่อ	940	67		67	1,685,850.00	121,050.00		121,050.00
19	P711	ถุงเรียบ 7"X11" (ห่อละ 30 กก)	ห่อ	643	50		50	1,146,945.00	90,000.00		90,000.00
20	P812	ถุงเรียบ 8" X 12" (ห่อละ 30 กก.)	ห่อ	36	16		16	64,530.00	28,740.00		28,740.00
21	P914	ถุงเรียบ9" X14"(ห่อละ 30 กก)	ห่อ	57	18		18	102,435.00	32,325.00		32,325.00

4.5.2 Production planning table

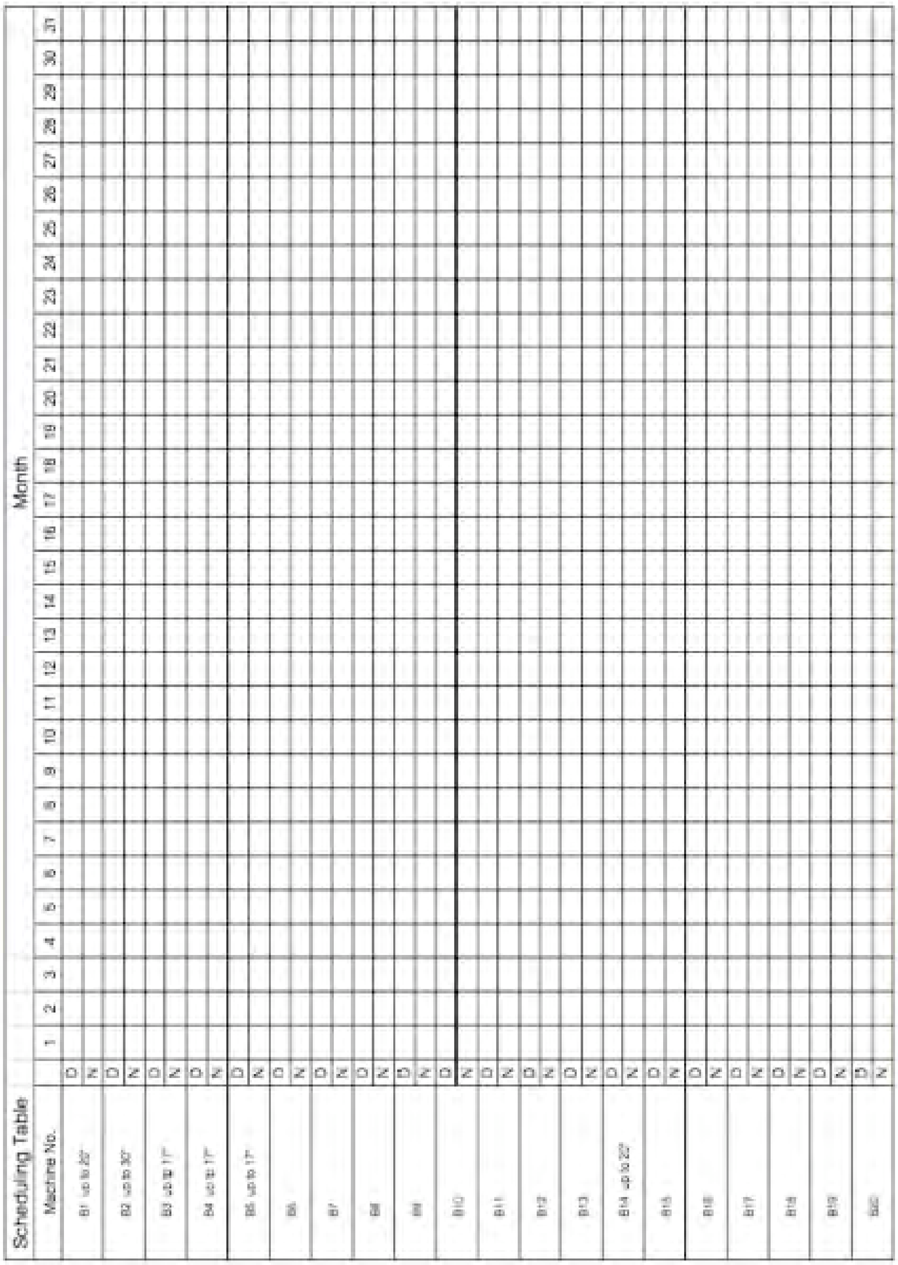
According to Table 4.5.1, the production-planning table is use for planning on which production will be produce in what day of the month. The table is monthly planning that includes the quantity of the product that plans to produce. In the first column is indicates the product sizes. The data of production plan can be gathered from the purchasing order daily report, which generated from computer database.

PlanningTable			Month																													
Product	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total
2" X 5"																																
3" X 5"																																
3.5" X 6"																																
4" X 6"																																
4.5" X 7"																																
5" X 7"																																
5" X 8"																																
6" X 8"																																
7" X 11"																																
8" X 12"																																
9" X 14"																																
10" X 15"																																
12" X 18"																																
14" X 22"																																
16" X 24"																																
18" X 26"																																
24" X 36"																																

Figure 4.5.1: Template of production planning table

4.5.3 Machine scheduling Table

Once the production-planning table is created. The table of machine scheduling is used to allocate the product that will be produce in which machine and day. This form as Figure 4.5.2 is to schedule according to the production plan. The scheduling table allow planning staff scheduling the product size with the certain machine because there is constrain of machine capability.



Scheduling Table

Machine No.		Month 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
B1 up to 22"	D																															
	N																															
B2 up to 30"	D																															
	N																															
B3 up to 17"	D																															
	N																															
B4 up to 17"	D																															
	N																															
B5 up to 17"	D																															
	N																															
B6	D																															
	N																															
B7	D																															
	N																															
B8	D																															
	N																															
B9	D																															
	N																															
B10	D																															
	N																															
B11	D																															
	N																															
B12	D																															
	N																															
B13	D																															
	N																															
B14 up to 22"	D																															
	N																															
B15	D																															
	N																															
B16	D																															
	N																															
B17	D																															
	N																															
B18	D																															
	N																															
B19	D																															
	N																															
B20	D																															
	N																															

Figure 4.5.2: Template of machine scheduling table

4.5.4 Mixing Job order form

According to Figure 4.5.3, mixing job order from is indicate mixing worker the raw material and additive that will be used include the quantity and the destination of the mixed resin that will use. The form has to be signed with planning staff. This job order form also use as drawing form of raw material. Mixing worker will give this form to RM inventory to draw material. The RM inventory will sign off in the paper to confirm that this job order has already been paid off.

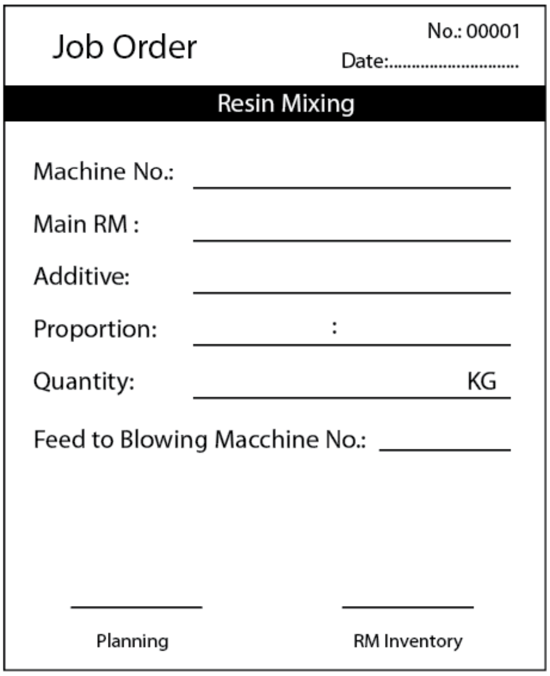
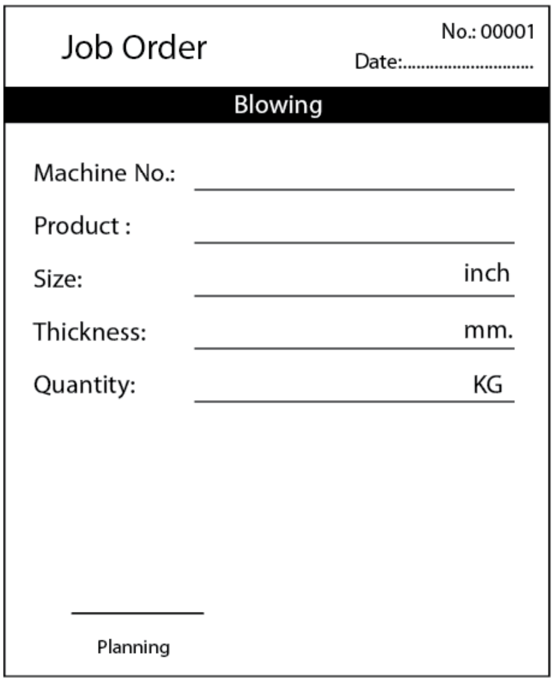

Job Order
No.: 00001
Date:............................
Resin Mixing
Machine No.: ____________
Main RM : ____________
Additive: ____________
Proportion: ______ : ______
Quantity: ____________ KG
Feed to Blowing Macchine No.: ______
Planning
RM Inventory

Figure 4.5.3: Template of job order form for mixing process

4.5.5 Film blowing job order form

According to 4.5.4, film blowing job order is basically indicates the product type, size, thickness, and quantity to produce. This form will be released form planning and control division with signature of planning staff. The form will give to film blowing foreman and then foreman will distribute to worker in each machine again.



Job Order
No.: 00001
Date:............................
Blowing
Machine No.: ______
Product : ______
Size: ______ inch
Thickness: ______ mm.
Quantity: ______ KG
______
Planning

Figure 4.5.4: Template of job order form for blowing process

4.5.6 Plastic roll tag card

According to Figure 4.5.5, this tag card will be use to stick on the plastic roll to indicated the specification of the roll. It will use as a reference in cutting and sealing process. When the plastic roll is set up in the cutting and sealing machine, workers have to collect this tag card in order to trace the problem occurs with the plastic film.

Figure 4.5.5: Template of tag card for plastic roll

4.5.7 Material drawing sheet

As Figure 4.5.6, this sheet is located at RM inventory. The staff in RM inventory will fill the detail of mixing job order to the material drawing sheet, and also ask the mixing worker sign off when they got the raw material as required. This is to make sure that the material in certain job order already has taken.

Material Drawing Sheet								No.: 00001
No.	Date	Job order No.:	Machine No.:	Resin	Qty.	Additives	Qty.	Received by
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

Figure 4.5.6: Template of material drawing sheet

4.5.8 Finished goods stock record

According to Table 4.5.3, this is the table that FG warehouse staff will be update from the data in the finished good receive sheet and finished good draw sheet every end of shift.

Table 4.5.2: Finished goods stock record

Date:

Polypropylene (PP) Finished goods stock record			
Size	Quantity	Size	Quantity
2" X 5"		7" X 11"	
2.5" X 5"		7" X 12"	
3" X 4"		8" X 12"	
3" X 5"		8" X 16"	
3" X 6"		9" X 14"	
3.5" X 5"		10" X 15"	
3.5" X 5.5"		12" X 18"	
3.5" X 6"		14" X 22"	
4" X 6"		16" X 24"	
4" X 7"		16" X 26"	
4.5" X 6"		18" X 26"	
4.5" X 7"		18" X 28"	
5" X 7"		24" X 36"	
5" X 8"		24" X 40"	
5" X 9"		24" X 43"	
6" X 9"		24" X 44"	
6" X 10"		30" X 40"	
6" X 11"			
6" X 12"			

Operated by

4.5.9 Finished goods receive sheet

According to Figure 4.5.7, the finished goods receive sheet, it is located at FG warehouse. It uses to record the finished goods that transfer from production. Normally, packing worker is the person who sends the finished goods to FG warehouse. FG warehouse staff has to get the sender signoff to confirm the finished goods is already stocked.

Finished goods receive sheet

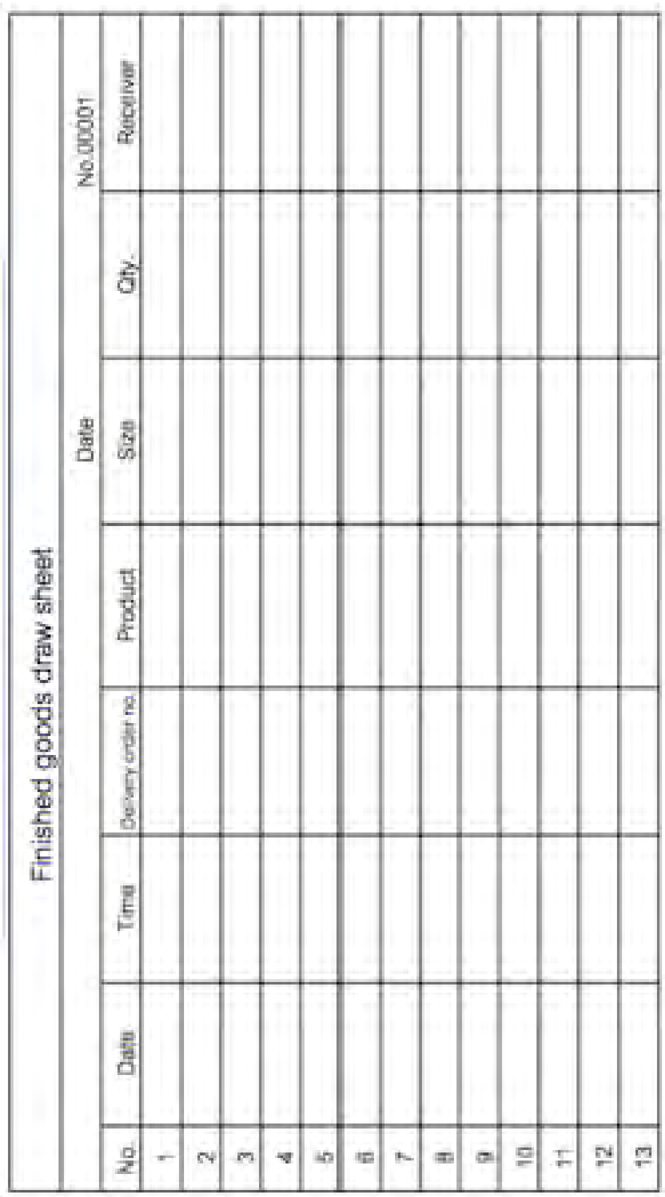
Date No.00001

No.	Date	Time	Product	Size	Qty.	Sender
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						

Figure 4.5.7:Template of finished goods receive sheet

4.5.10 Finished goods draw sheet

According to Figure 4.5.8, this document is located at finished goods warehouse. It is use for delivery staff comes to draw finished goods in order to prepare product for customer or freight forwarder. FG warehouse staff has to get receiver signoff in the receiver field to reference that they have already took the finished goods with correct quantity.



Finished goods draw sheet

Date No.00001

No.	Date	Time	Delivery order no.	Product	Size	Qty.	Receiver
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							

Figure 4.5.8: Template of finished goods draw sheet

4.5.11 Film blowing productivity form

According to Figure 4.5.9, this form is located at the film-blowing machine. It is used as the productivity report. The film-blowing worker has to fill the starting time of each new plastic roll and finished time every time the plastic roll is taken out. RM used is the field that worker need to fill the number of barrel that contain the mixed plastic resin. The important part of the form is the set up waste and defect field. Worker needs to separate the setup waste and defect every time it occurs.

Blowing Productivity Report

No: 000001

Date: ....

Machine no.		Job order no.		Operator		Shift	
Product:		Sizes		Thickness			Remark
No	Time start	Time finished	Qty.	Setup waste	Defect	RM used	
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
Total							KG

Figure 4.5.9: Template of film blowing productivity form

4.5.12 Cutting and Sealing productivity form

This document is located at cutting and sealing machine according to Figure 4.5.10. It is used as the productivity record. In the quantity field, worker draws a line to represent one unit of 5 KG packing and worker will then sum up the total of the line and multiply by five and that is the quantity in kilograms. This form includes the plastic roll that has been used during the shift. The reason that worker need to fill this field is because the planning can find the quantity of plastic roll, which waiting for the cutting process. The important part of this form is the defect number. Worker has to separate the defect into three kinds, which are defect from blowing process, set up defect, and defect that occur in cutting and sealing itself.

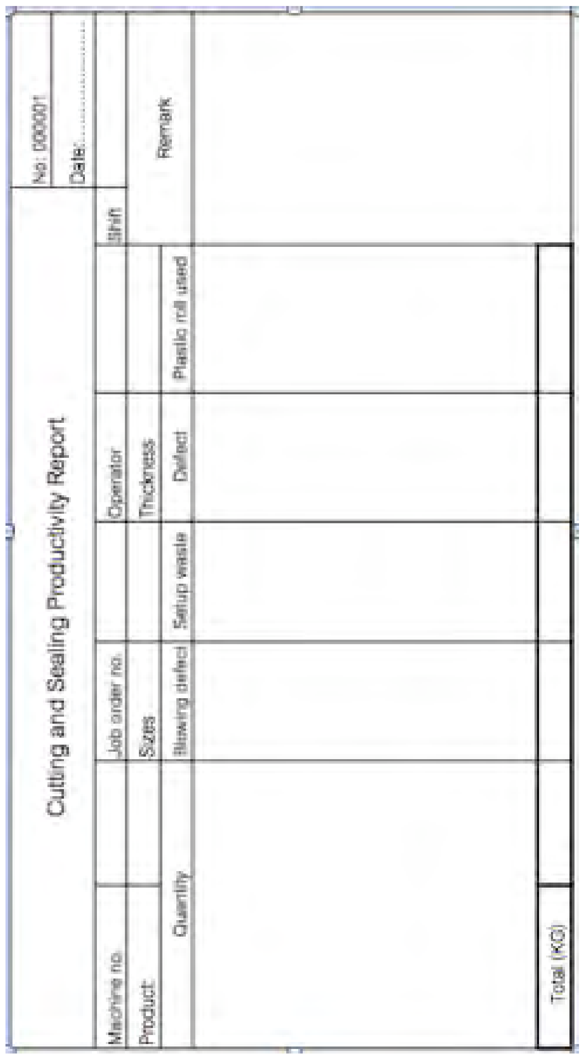

Cutting and Sealing Productivity Report
No: 000001
Date:........................
Machine no. | Job order no. | Operator | Shift
Product: | Sizes | Thickness | Remark
Quantity | Blowing defect | Setup waste | Defect | Plastic roll used
Total (KG)

Figure 4.5.10: Template of cutting and sealing productivity from

4.5.13 Packing productivity form

This document is located at finished packing station according to 4.5.11. Worker uses this from as the output report. In the field of quantity, worker will draw a line to represent one unit of 30 KG finished goods and they will sum up the total and put the number in the total field. This form is also use as finished goods transfer form for packing worker. They need to put time, quantity of finished good that will be transfer to warehouse. In addition, worker should not forget to ask FG warehouse signoff in the "FG warehouse staff" field. It will be used as references that warehouse have received finished goods with the correct quantity.

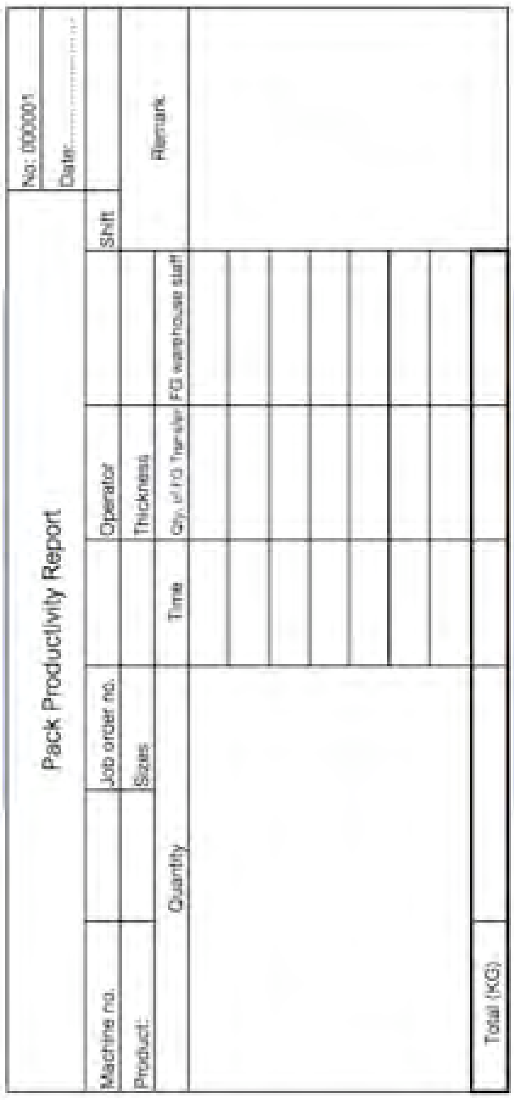


Figure 4.5.11: Template of packing productivity form

4.6 Production process improvement

There are main improvements in production process, which are mixing, film blowing, and cutting & sealing. Firstly, in the mixing process, there is the equipments add up to this process to help reduce the number of plastic resin fall over the floor in the mixing process. It is not only reduce the plastic resin fall in the mixing process, but it helped reduce the fallen plastic resin across the factory especially that fall along the mixing station to film blowing station as well.

The process improvement for mixing process is focusing on reducing the number of plastic resin fall on the shop floor. As the analysis from earlier chapter, the root cause of this problem is because of the method of worker that generates this loss. The implementation of this process is find equipment to solve the problem. There are barrel and trolley as Figure 4.6. The barrel will be using instead of the plastic sac and the trolley is the equipment to take barrel to film blowing machine.

Figure 4.6.1: The trolley and barrel

For safety issue, however, the new method of pouring RM into the machine has been detecting the two concern points. There is a chance that the knife would be dropped in to the machine. The problem solved by tide the knife with the machine. Another concern, it is safety of worker because of the new process worker has to work very close to the machine. However, the safety would not be an issue as long as the machine turns off while worker feeding RM to the machine. This has been added to the work instruction criteria of mixing process already.

Since these tools have been implement, it makes changes in the process of mixing. According to Figure 4.6.2, the new process starts form worker cut the RM sack and pour into the machine straight away. Once finish mixing, worker move barrel to put the RM in it and distribute to film blowing right away. Moreover, this new method of working is eliminated the method of work that generates defect. The new method of working is making worker do the work easier.

Figure 4.6.2: The new process improve for mixing process

Figure 4.6.3: Pictorial shows the new method of work in mixing process

Secondly, since the new work instruction (refer to appendix B) has been implemented, the improvement in the film blowing process, it is setting time for filter screen replacement. This is reduced the number of defect that came out form the broken filter screen. As well as, the setting time for sealing flam retardant tapes, it is usually replaced when worker feeling want to replace and that cause the number of seal leak defect problem. Also the setting time for apply sealing liquid, workers are apply sealing liquid to often and that cause high number of white stain on the product.

Furthermore, there are improvement that not related to the topic of this research but it has been implemented is that the visual control in the pace of film blowing process. According to Figure 4.6.4, the red stickers have been attached on the ruler that uses to measure the width length of the film. The red sticker allows workers observe the width of the film easier than ruler alone.

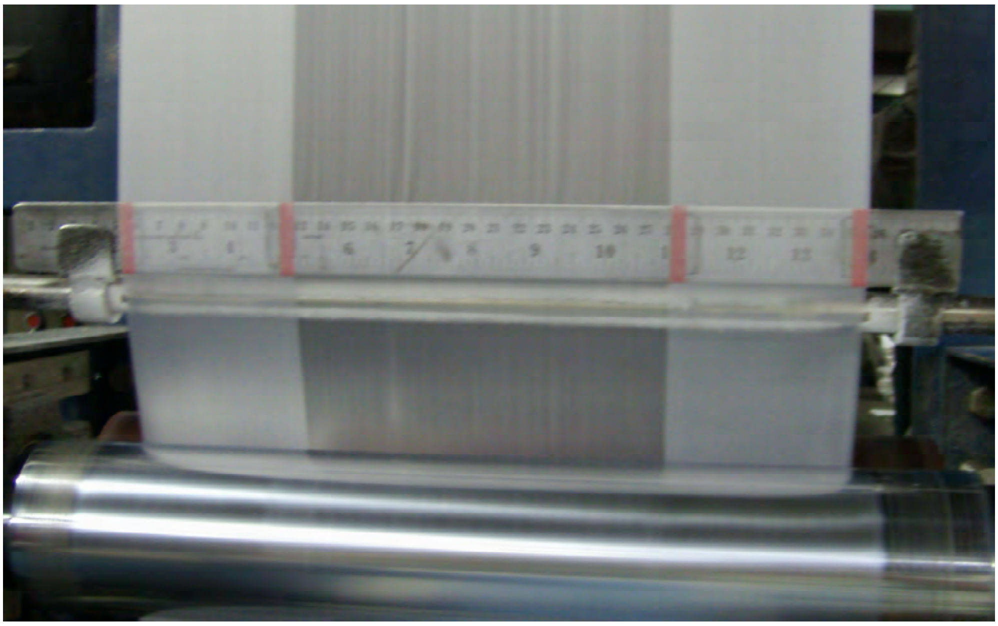


Figure 4.6.4: The visual control in film blowing process

Work instruction is playing the vital role in this process improvement. Workers are now working as standard method after they had passed the training with the new working method. Furthermore, this study also implements the new way of storage the plastic roll in to the process of film blowing, since the research found out that the way of storing plastic roll could cause the problem of side leak. The FIFO method of storing also has been applies to enhance the way using plastic roll in order. The first plastic roll that has been finished from film blowing machine will be used first. This is resulting in the zero defect of unused plastic roll.

In additional, since the new organisation structure has been departmentalised, workers tend to know where they belong in the company. The new functions and new responsibilities are added up. Therefore, the document of job description has been created and assigned. It helps workers and staffs to know their scope of job and responsibilities. Moreover, the function of planning and control is also the new division that created to help work of MD in planning the production.

Since the planning and control division has been working, the production plan and finished goods delivery seem to synchronize very well. The finished goods inventory has less stock level of over production and capacity of the production has been utilised to produce on what customer ordered. Moreover, Managing director has more time to manage overall management of the case company.

4.7 Implementation of FIFO in storage

Beside implement the standard work instruction, the First-In-First-Out theory has been adopting to this process. The focus of this improvement is at the process of storing plastic roll. The main idea of improvement start from worker arrange plastic roll on the pallet and use it pallet by pallet. However, there is no identification of which pallet should be used first or later.

Figure 4.7.1: The method of plastic roll storage

According to Figure 4.7.1, the method of identification has created by using three colour sheets. The colour sheets are includes blue, yellow, and red. Red indicates the plastic roll in this pallet has been starting using and should be used for first priority. Yellow is indicating the plastic roll in this pallet has not bee n starting using. Worker will change yellow sheet to red sheet, if the pallet starts using. Blue is meaning there is plastic roll in red or yellow pallet that has to be used before this pallet.

4.8 The Model of Shop Floor Control System

After all improvement in various aspects such as reorganization, production process and data collection process improvement. Since then the five functions in production activity control (PAC), which are scheduler, dispatcher, monitor, mover, and producer have work in the scope synchronously. There are job order and information that flow in the system that shown in the following Figure 4.8.1.

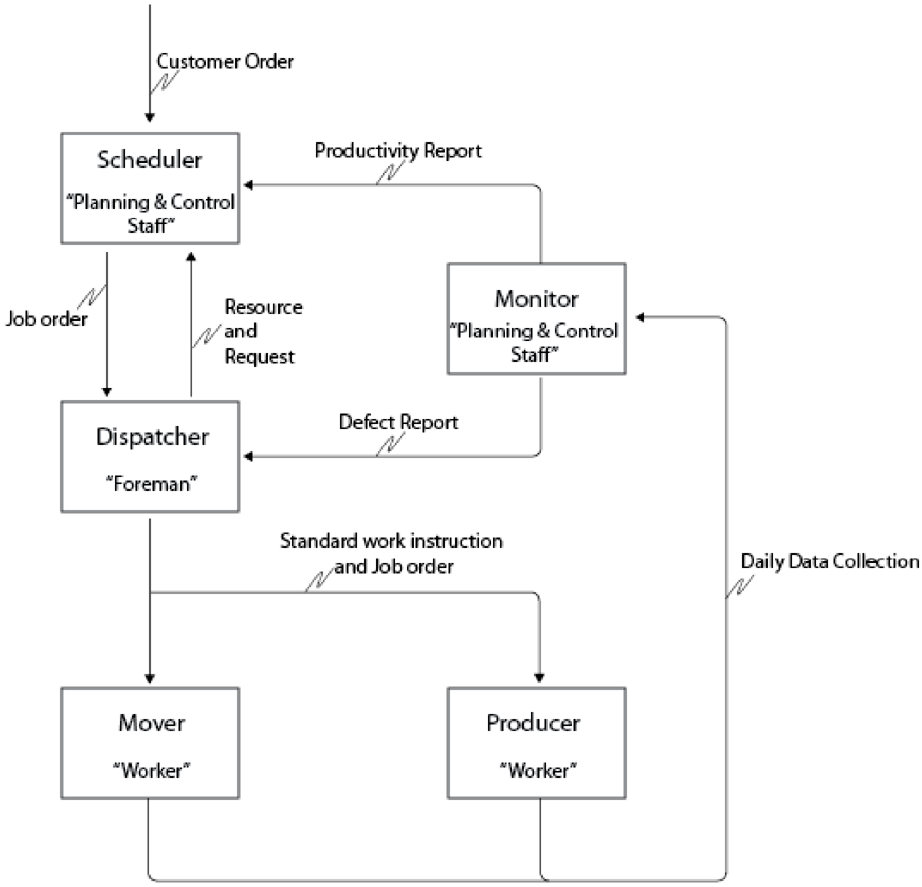


Figure 4.8.1: Production activity control model in shop floor control system (Bauer, 1991)

According to Figure 4.8.1, scheduler is represented as staff of the planning and control division. They are creating production plan according to the customer order from the purchasing order report and also checking on the finished goods stock level. Dispatcher are foreman in each process, they will receive job order from scheduler and distribute to their division such as mixing, film blowing, and cutting & sealing process. Mover and producer function are worker or subordinate of foreman, who work according to job order, standard work instruction and the scope of job description. Dispatcher and monitor are function that response by planning and control staff and foreman. They are response for manager and foreman to observe and monitoring over operation layer. The data and information from monitoring will send to scheduler to give the current status of the production, resources, and performance, which scheduler can make the decision to release production plan, job assignment for mover and producer function in the future. Additional, scheduler will report the consumption of raw material to MD in order to purchasing process.

4.8.1 The SFC function model

According to N. Nimsaard (2008), she proposed the shop floor control system model for plastic injection manufacturing. This section is going to employ her model to apply in the new model of shop floor control system that implemented in the case company. The technique of integrating definition for function modelling (IDEF0) will be employed to explain the new model.

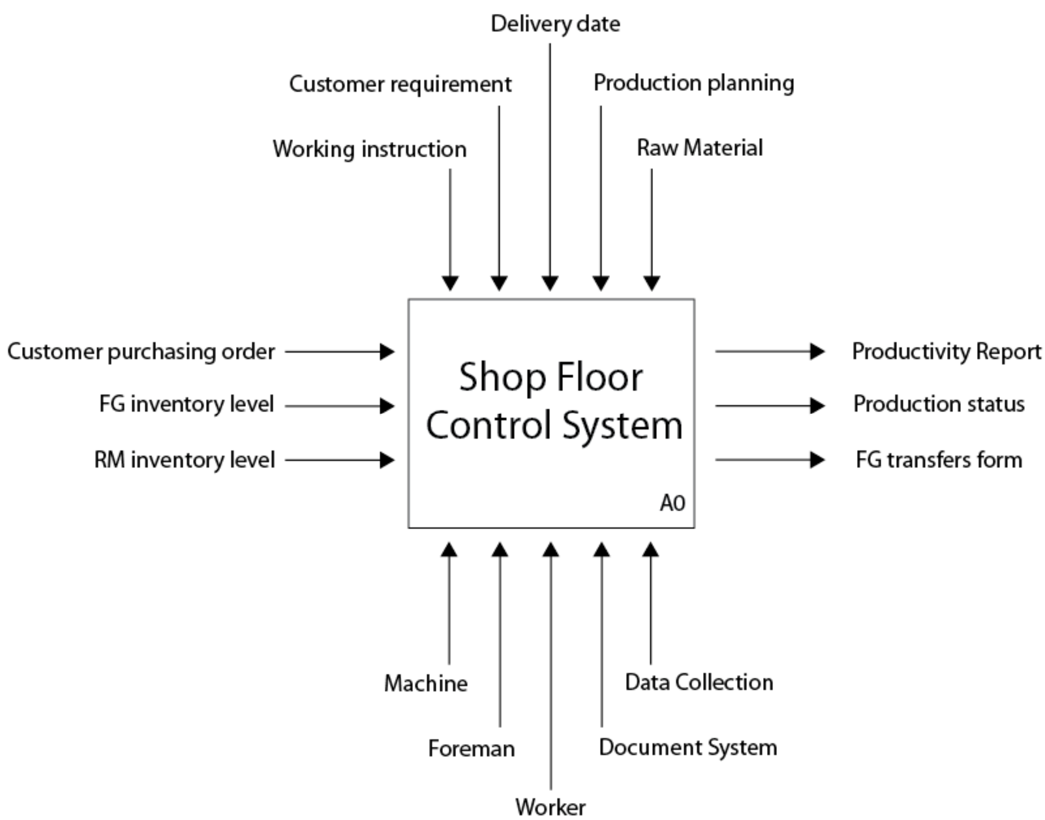


Figure 4.8.2: The SFC function modelling of the case company

According to Figure 4.8.2, the model is describing activities that related to the shop floor control system. The activities are input, output, control, and mechanism. Input are those activities that initiated the consequence activities or production, which can be customer purchasing order, finished goods inventory level, and raw material inventory level. The output is the resulted of the certain activities that brought in, which in this case can be describe as productivity report, production status, and finished goods transfer form. The elements of machine, foreman, worker, document system, and data collection are the mechanism that necessary to have to accomplish the result of activities. The last element of the model is the control. The control is the activities that control all the activities in the production, which are work instruction, customer requirement, delivery date, production planning, and raw material.

Shop floor control is the activities management that allow the production flow smoothly by cover up from planning, production scheduling, job assignment, production, controlling, and monitoring the production until finished goods transfers to warehouse. Beside, it includes the data collection in the production, which report to the management.

4.8.2 The SFC activity relationship model

With analysis of activities in the shop floor control by using technique of $IDEF_0$, it will not describe the relationship between activities in the SFC; likewise, it describes and shows the flow of document, material and man in the SFC as well. The main activities in SFC consist of five main activities. According to Figure 4.8.3, they are scheduling, dispatching, production, monitoring and closing production order is added up for the final activity according to the case company.

Develop Schedule is the allocation of production resource such as labour force, machine, and facilities. This is allowing the production run as the placement of customer purchasing order. The scheduling is involving with job order for each process in the production.

Dispatch Production is the receiving information of production scheduling to start activities in the production. This is also related with preparing the production resources such as raw material, machinery, and worker to be ready for the production.

Production is the process that converts the raw material to the finished goods by using the resource that has been prepare and according to customer requirements. For the effectiveness of the production, the production has to be concerned with the factor of quantity, quality, and time constraint.

Monitor and Control is the process of process of controlling the production after the releasing the job order. This is monitoring the progress of production that has been on the track of the production scheduling, which can be change immediately in order to any emergency occurred during the production.

Closing production is the process in the final step of the production. It starts when the worker finished packing the product as finished good, which will be transferred to finished goods warehouse. The closing production is also involving with the process of raw material return, and machine vacancy status report.

4.8.2.1 Develop schedule

According to Figure 4.8.4, develop schedule consists of 4 breakdown activities, which are check raw material and finished goods status, check machine status, schedule preparing, and schedule releasing. The activities of the develop schedule will be described as following.

Check RM and FG status is the process that gathers the information in the job order to check the status of the finished goods and raw material stock level. This is to make sure that there is an adequate amount of FG and RM for production. The information will be support for further production scheduling. This is performing by planning staff.

Machine status is the process that verifies the status of the machine to be ready for the production according to the production plan. If the machine is available, this information will be use for further production scheduling. This pace is performing by foreman of film blowing and cutting& sealing process.

Schedule preparing is the step of scheduling the production. The information that used to scheduling are the information of available raw material, labour force, and machine. This activity is response by planning staff.

Schedule releasing is the step that the production and machine scheduling, and job allocation are release to the related staff to be the guideline for the production. This duty is performing by planning staff.

4.8.2.2 Dispatch production

According to Figure 4.8.5, dispatching production consists of 6 breakdown activities, which are receive information, alternative analysis, material release, resource release, worker job assignment, and production release. The activities of the dispatch production will be described as following.

Receive information is the procedure that the information of production planning table, working day, machine constraint, PO report, RM and FG inventory level are received and going to use for analysis in order to plan the further production. This activity is response by planning staff.

Alternative analysis is the process of verifies the production planning that propose can be operate or it needs to make any change due to the unavailable of machine. This is to allow the production can be run without any having difficulties. This activity is response by planning staff.

Material release is the pace that mixing workers are drawing the raw material and additive, which indicated in the job order, with raw material warehouse section. This activity is response by RM warehouse staff.

Resource release is in the procedure that film blowing and cutting & sealing workers are prepare the machine for the certain production size according to the machine allocation. This pace is performing by foreman of film blowing and cutting & sealing process.

Worker job assignment is the procedure that a certain job has assign to certain worker according to their skills but in the case company job assignment is always with the job order, which indicated the machine no. Planning staff will be response for this activity.

Production release is the pace that congregate the information of the analysed production planning from the alternative analysis, which most suitable for the current situation, including the available raw material and machinery. Foreman in each process will release this information further as job order to the production line.

4.8.2.3 Production

According to Figure 4.8.6, production pace consist of 6 breakdown activities, which are mixing, block set up, set condition, film blowing, cutting and sealing, and packing. The activities of the production will be described as following.

Mixing is the process to blend main plastic resins with master-batch (colour resins). This process is mostly complete in one step within the machine. It starts with mixing worker fill main plastic resin and master-batch into the mixing machine and wait until the two materials are well combined. The raw material, mostly used, is plastic resin. There are several kinds of plastic resins, which give different characteristics. Each type of plastic resin is therefore selected with the product's application. Some plastic resin is mixed with additives to increase specific qualifications such as anti-static properties or additional strength properties.

Block setup is the paces that film blowing worker are preparing the block size of the film-blowing machine. The block will control width size of the plastic roll.

Set condition is the process that film-blowing worker will set up the motor speed of the film blowing machine. This is to control the thickness of the plastic film.

Film blowing is the process, which is performing by film blowing worker that the process is basically consists of an extruding a tube of molten thermoplastic and continuously inflating it to several times initial diameter, to form a thin tubular product that can be used directly, or slit to form a flat film. In depth, the plastic resins melt is extruded through an annular vertical slit die. This is to form a thin walled tube. Air is introduced via a hole in top of the die and a high-speed air ring blows onto the hot film to cool it. Then, the tube of film continues upwards, continually cooling until it passes through nip rolls where the tube is flattened to create ‘flat-tube’ of film. This flat-tube is then taken back down the extrusion tower via rollers. In the last step of this stage, the output is then either keeps the flat-tube as such onto reels to make bags, or the flat-tube are slit off to produce two flat film sheets and wound up onto reels for other application.

Cutting and Sealing is the pace that the reel of flat-tube is taken from the film blowing process and put up to the cutting and sealing machine. The flat-tube is then sealed across the width of the film and cutting or perforating to mare each bag. This is done in line cutting and sealing machine and also includes making holes or the bag’s holders. The last step of this station is to skin packing as a single pack. The cutting & sealing workers are performing this activity.

Packing is the finished packing, packing worker will collecting 5 KGs packing into one 30 KGs packing. Workers in this step will manage the certain amount of bunch packing into a sack. Once a sack has been tide up with stripping machine, they will label the product information with their handwriting on the sack.

4.8.2.4 Monitor and control

According to Figure 4.8.7, monitor and control consist of 3 breakdown activities, which are collect production data, analyse data, and create report. The activities of the monitor and control will be described as following.

Collect production data is the procedure of data recording and collecting in each process. This is to gather all data for further analysis due the continuous improvement by data collection staff.

Analyse Data is the pace that gathered data being analysed, which will evaluate the production progress with the production planning by monitoring staff.

Create report is the process that create the document or report that necessary for the further improvement such as daily productivity report and defect report by planning and monitoring staff.

4.8.2.5 Close production order

According to Figure 4.8.8, close production order consist of 3 breakdown activities, which are material return, tool and equipment return, and finished goods storage. The activities of the close production order will be described as following.

Material return is procedure that mixing worker return raw material left from the mixing process to raw material warehouse.

Tool and equipment return is the pace that film-blowing workers are inform the foreman in the film blowing section according to the available machine or the machine that just finish for each job order. This allow foreman to report to the planning and control staff for further job order and machine scheduling.

Finished goods storage is the procedure that packing workers are transferring the finished goods to warehouse. This process is done by worker need to fill the finished goods transfer form and also finished goods warehouse staffs need to fill the detail of the certain finished good to the finished goods receive table with signature.

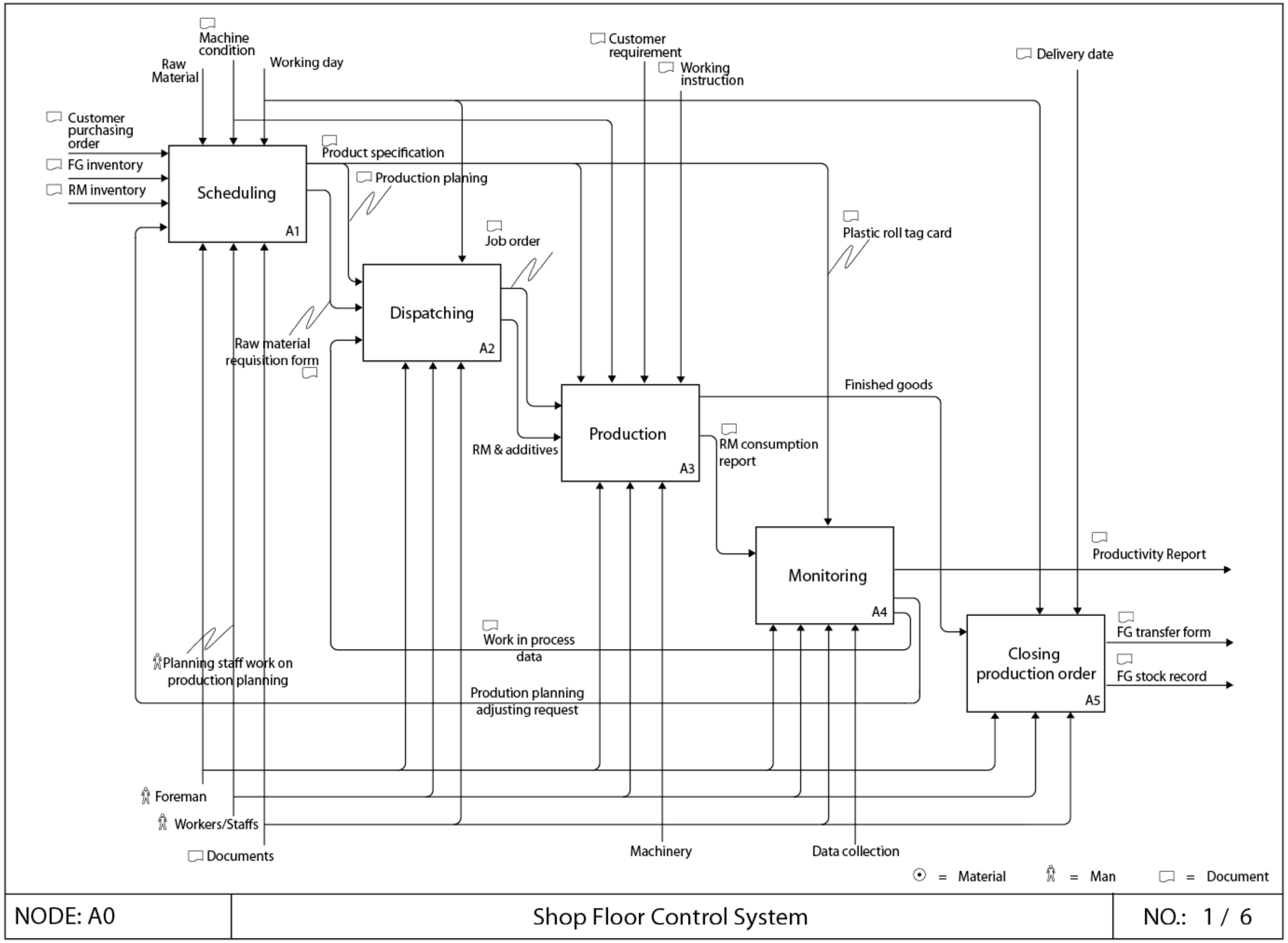


Figure 4.8.3: The model of shop floor control system

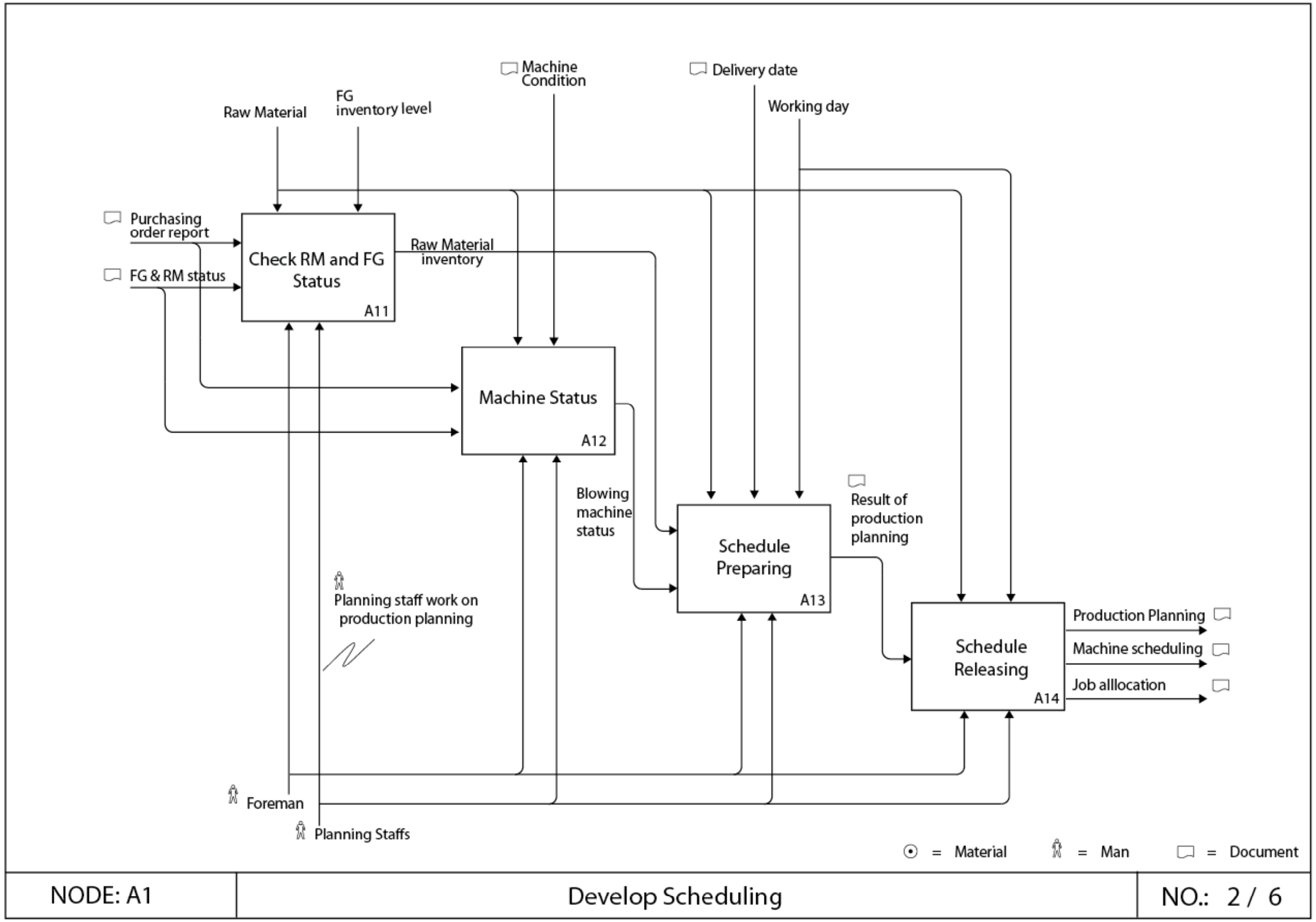


Figure 4.8.4: The model of develop scheduling activity

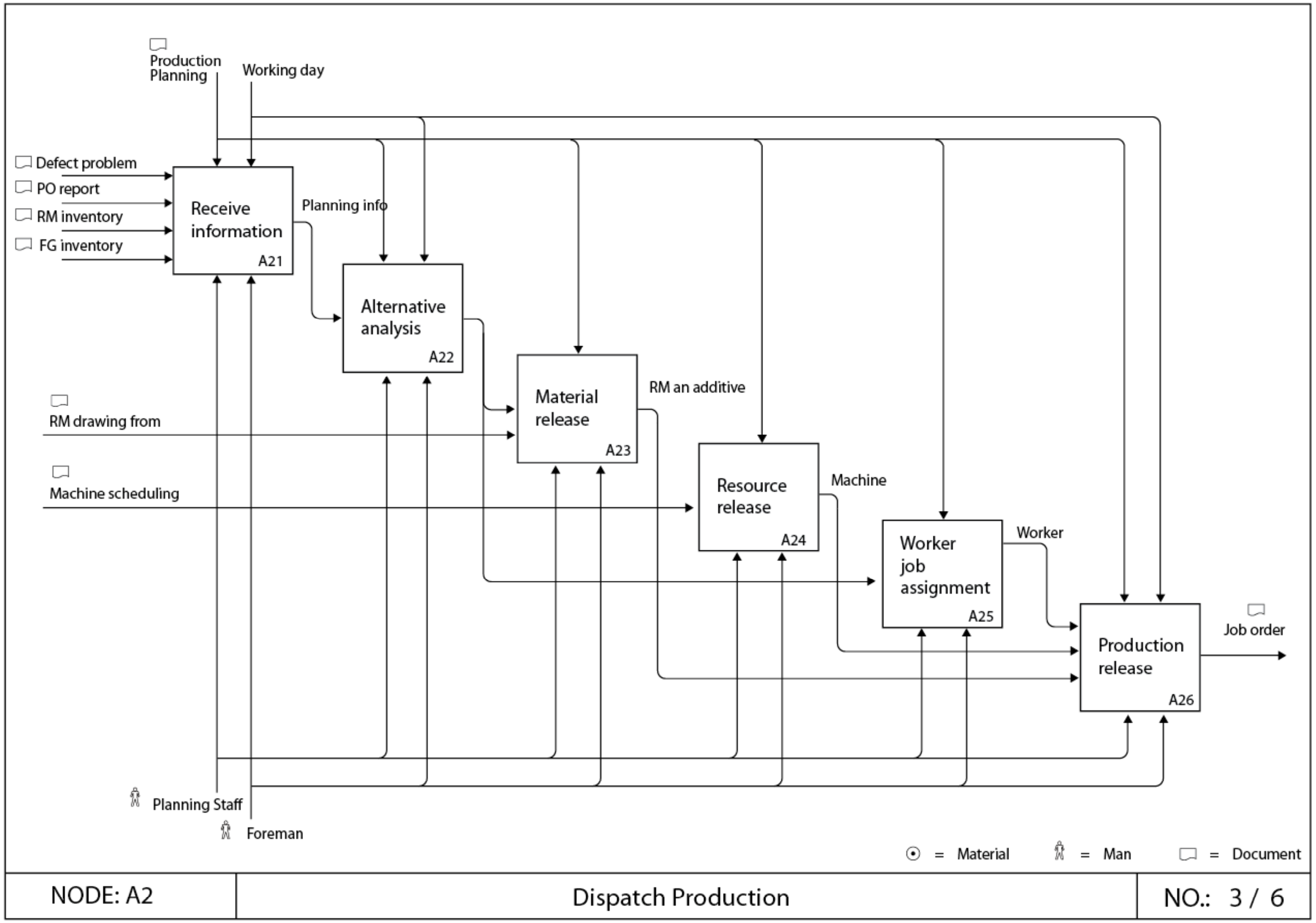


Figure 4.8.5: The model of dispatch production activity

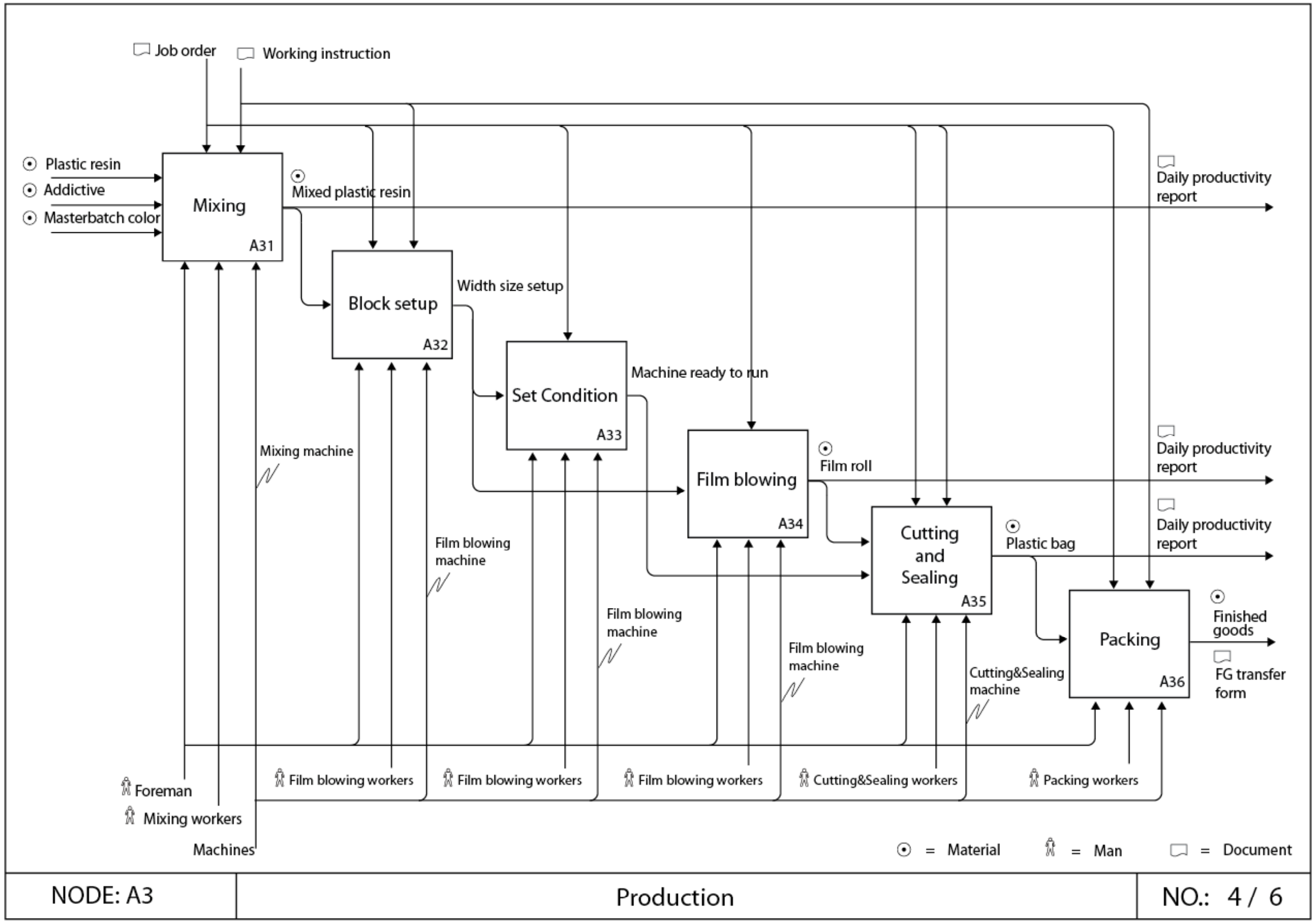


Figure 4.8.6: The model of production activity

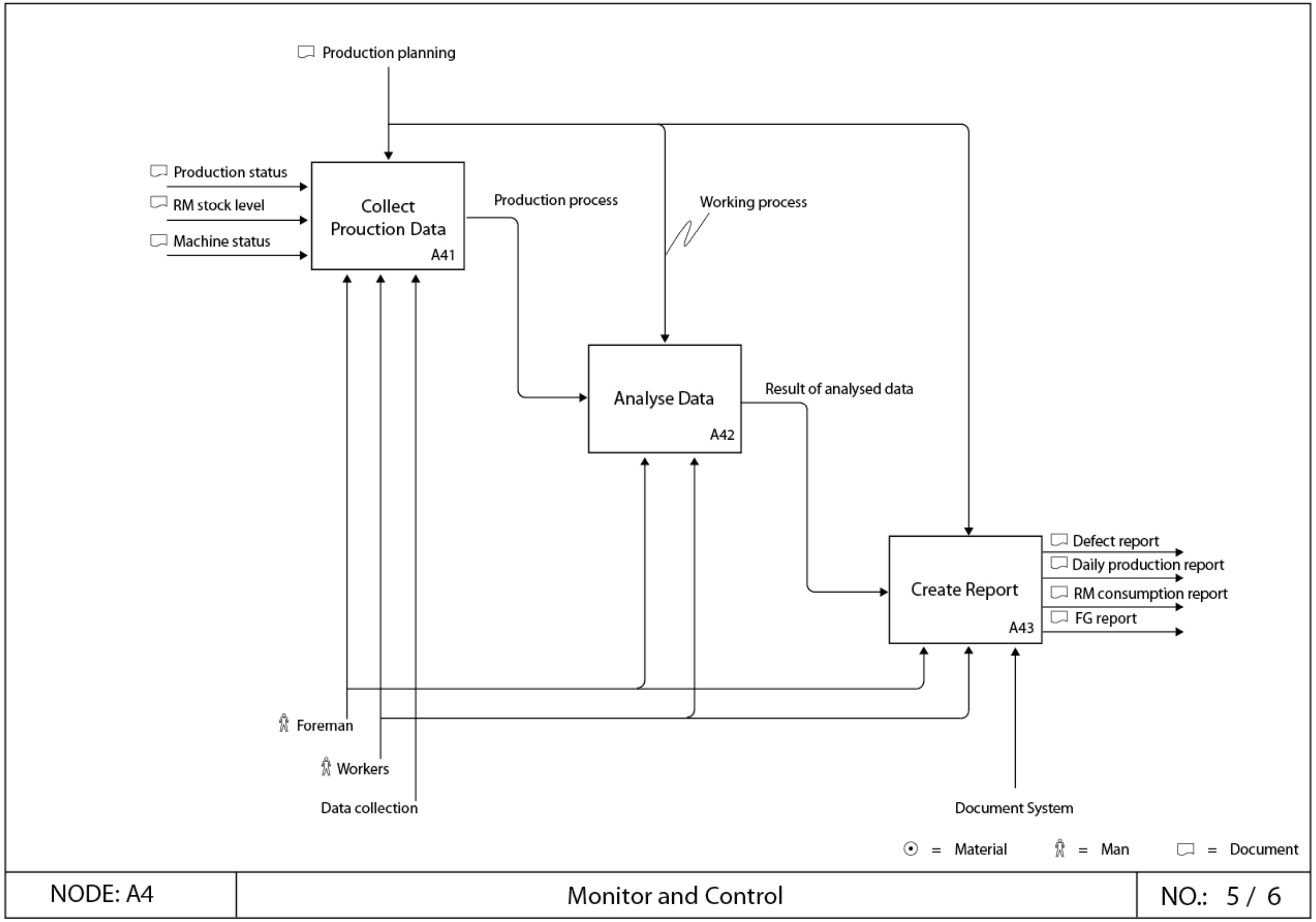


Figure 4.8.7: The model of monitor and control activity

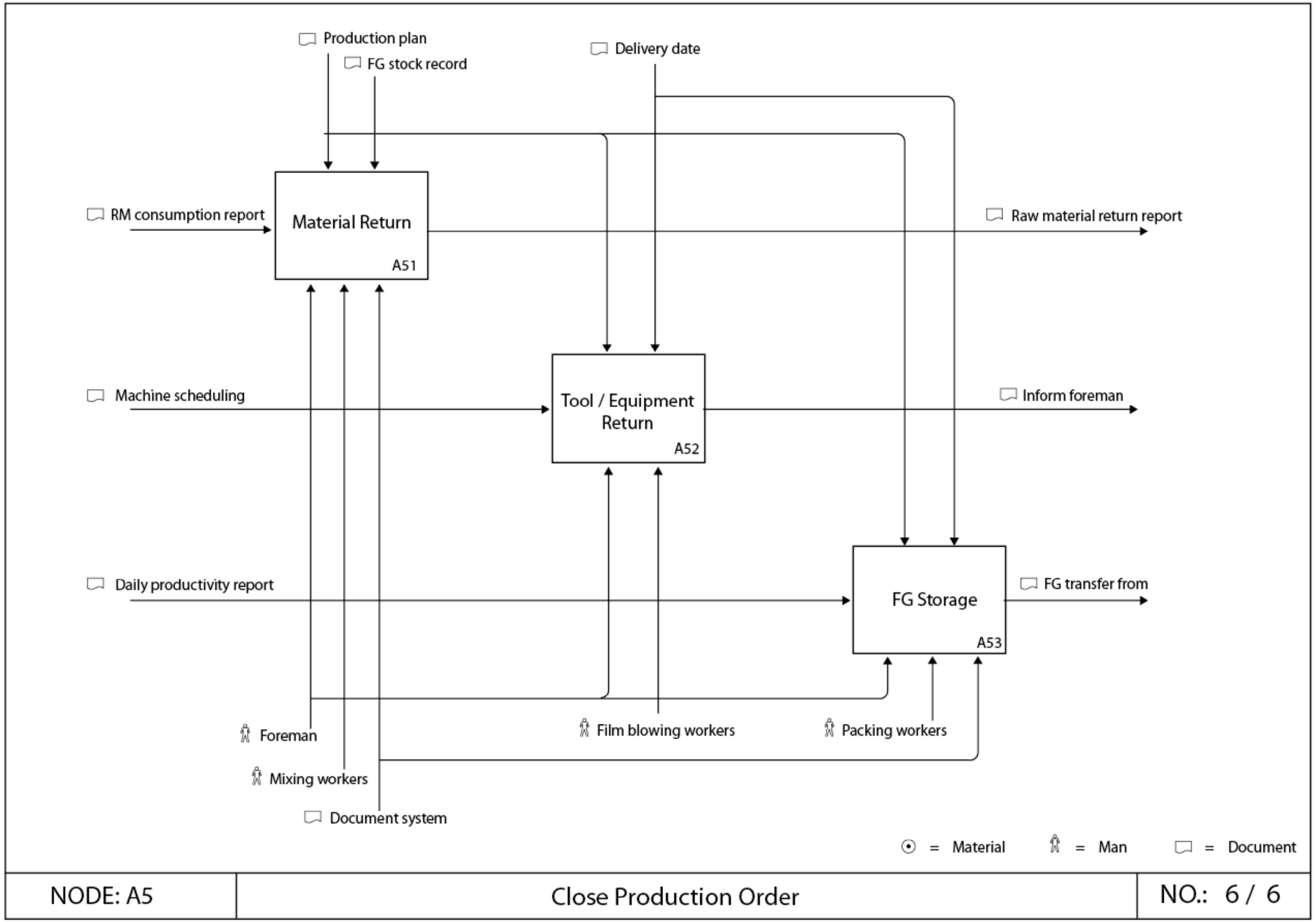


Figure 4.8.8: The model of close production order activities

4.8.3 Job assignment in the SFC

According to Figure 4.8.3, since there are five main activities in the shop floor control system model, the job assignment in this section will be respectively described according to scheduling, dispatching, production, monitoring, and closing production order.

In develop scheduling pace, there are 4 breakdown activities, which are check raw material and finished goods status, check machine status, schedule preparing, and schedule releasing. There are two main positions, who response in this pace. The first is planning staff in planning and control division, who are response for receive raw material and finished goods status, schedule preparing, and scheduling releasing. The other position is foreman of film blowing and cutting processes, which response for verify machine status.

Dispatching, there are Planning staff, foreman in film-blowing process and cutting & sealing process, and RM warehouse staff response in dispatching pace. Planning staff is responsible for receive information, alternative analysis, worker job assignment. For the foreman of film blowing and cutting & sealing process are responsible of resource release activity and production release. The last activity in dispatching is material release, which performing by raw material staff.

Production, there are foremen and workers of each process perform the 6 breakdown activities in the production. Firstly, mixing workers will receive job order that indicated the information of RM that will be used. They will then draw the certain material, additive, and master batch colour with RM warehouse that will be used in mixing process. Secondly, film-blowing workers are performing the block setup, set condition, and film blowing activity according to job order and follow the work instruction. The cutting & sealing activity is performing by cutting and sealing workers. Finally, the packing activity will perform by packing workers. Workers in each process will work follow the work instruction according to appendix B.

Monitor and control, there are three main tasks in this pace. The collect production data activity is responsible for foreman in each process to collect from workers and then data collection staff will collect it again from foreman in order to record to the computer database. The recorded data in the computer will be analyse in the pace of analyse data by planning and control staffs. Then, they will create the report of defect, daily production, RM consumption, and FG inventory level.

Close production order, there are three positions, which response foe this pace. Firstly, material return activity is responsible by mixing worker, since the raw material is left from each job order or production. Next, tool and equipment return is the process that film-blowing worker inform to their foreman for the available machine or the machine that just finish for each job order. This allow foreman to report to the planning and control staff for further job order and machine scheduling. The last activity in this closing production order is FG storage, which perform by packing workers.

4.8.4 Work Instruction in The SFC

The work instruction has been created for processes in the production, which is mixing, film blowing and cutting and sealing. Work instruction is the guideline and the process that workers have to follow in order to maintain the efficiency of the production and also for the safety of the worker as well.

Mixing is the process to blend main plastic resins with additive and master batch. Work instruction in this process is mainly control the working method of the worker. It is because the step of working method makes high number of waste in this process. Work instruction will lead work to work in the method that not create waste.

Film blowing, work instruction in this process is primarily related to the time setting to replace the filter screen of the extruder, which cause of high number of defect in the process itself and consequences defect that found in cutting & sealing process.

Cutting and Sealing, work instruction in this section also involving with time setting for flam redundant adhesive tape and sealing liquid replacement. Work instruction set time for worker to replace the tape and sealing liquid according to reduce defect that occurs during replacement. This is because workers are replace the tape and sealing liquid to often. Therefore, the work instruction in the SFC is a controller and primarily cover in the production pace in the SFC functional model. For further detail of work instruction, please refer to appendix B.

4.8.5 Document flow in the SFC

According to Figure 4.8.3, the documents that used in the scheduling activity are customer-purchasing order, FG inventory, and RM inventory, which will be used as the resource to generate the production planning, machine scheduling, and job allocation. Then, the dispatching will be using those documents and also PO report, RM inventory, and FG inventory in order to release job order to production.

The job order starts to release the order to mixing staff. Mixing staff will fill the draw material from, to record the total quantity of RM used in each shift and give it to RM inventory clerk. The mixing staff will be notified quantity of raw material and additive that will be used, also the machine number where to deliver after mixed. In the mean, while film blowing staff will be given the job order as well. Blowing staff will be informed to prepare the machine to run in size, thickness and quantity according to job order. When the plastic roll has produce, the specification will be fill in the product tag card and stick on the plastic roll and also weight of the plastic roll will be record in the productivity record. This report is collecting at the end of the shift by foreman and submits to planning and control division. At the end of the shift, the defect will be sent to recycling section as well as the number of defect record in the productivity report.

Since the plastic film roll transfer to cutting & sealing process, cutting and sealing worker will keep the tag card that stick to the roll for reference during run the plastic roll. This is because if there is any defects occur with plastic film, cutting and sealing worker can refer to the certain blowing worker and machine that produce the certain plastic roll. The defect in this process will be separated into to bag one is for defect that produce from blowing process and the other is from cutting and sealing process itself. The output from this process will record to productivity form and then submit data collection section. The packing is the last step of production. They will pack product to 30 kilograms packing and then record number of finished packing or finished goods. The productivity also submits to data colleting section at the end of the shift. Packing worker now has to fill the FG transfer form before can store FG in the warehouse. This step added up to reduce problem of inaccurate stock recording. Once the FG inventory section receives finished goods, they need to update to the inventory stock record every end of the day as the delivery also draw the FG out during the day.

4.8.6 Material flow in the SFC

According to Figure 4.8.9, after material has draw from RM warehouse. It will put to the mixing machine and then the mixed plastic resin will be distributed to film blowing machine, which are single-screw and twin-screw types. Once the blowing machine convert the plastic resin to film roll, the roll will move to cutting and sealing machine waiting for cutting and sealing into a plastic bag. At the cutting and sealing station, the plastic bag will be packed and will be stored in the FG warehouse.

4.8.7 Man flow in the SFC

According to Figure 4.8.10, the man flow is start from raw material requisition form that performed by mixing staff. The mixing staff will move raw material to mixing machine and distributed mixed resin to film blowing machine. Once the film-blowing machine produce a thin film to a plastic roll, film–blowing staff is going to move plastic roll to cutting and sealing machine. The worker form cutting and sealing machine will set up the plastic roll to the cutting and sealing machine and they will pack the plastic bag from the machine into 500 grams. Then, packing workers will collect 500g packing to pack into 30 KG as a finished pack. The finished packing will be stored in finished goods warehouse, waiting for delivery to customers.

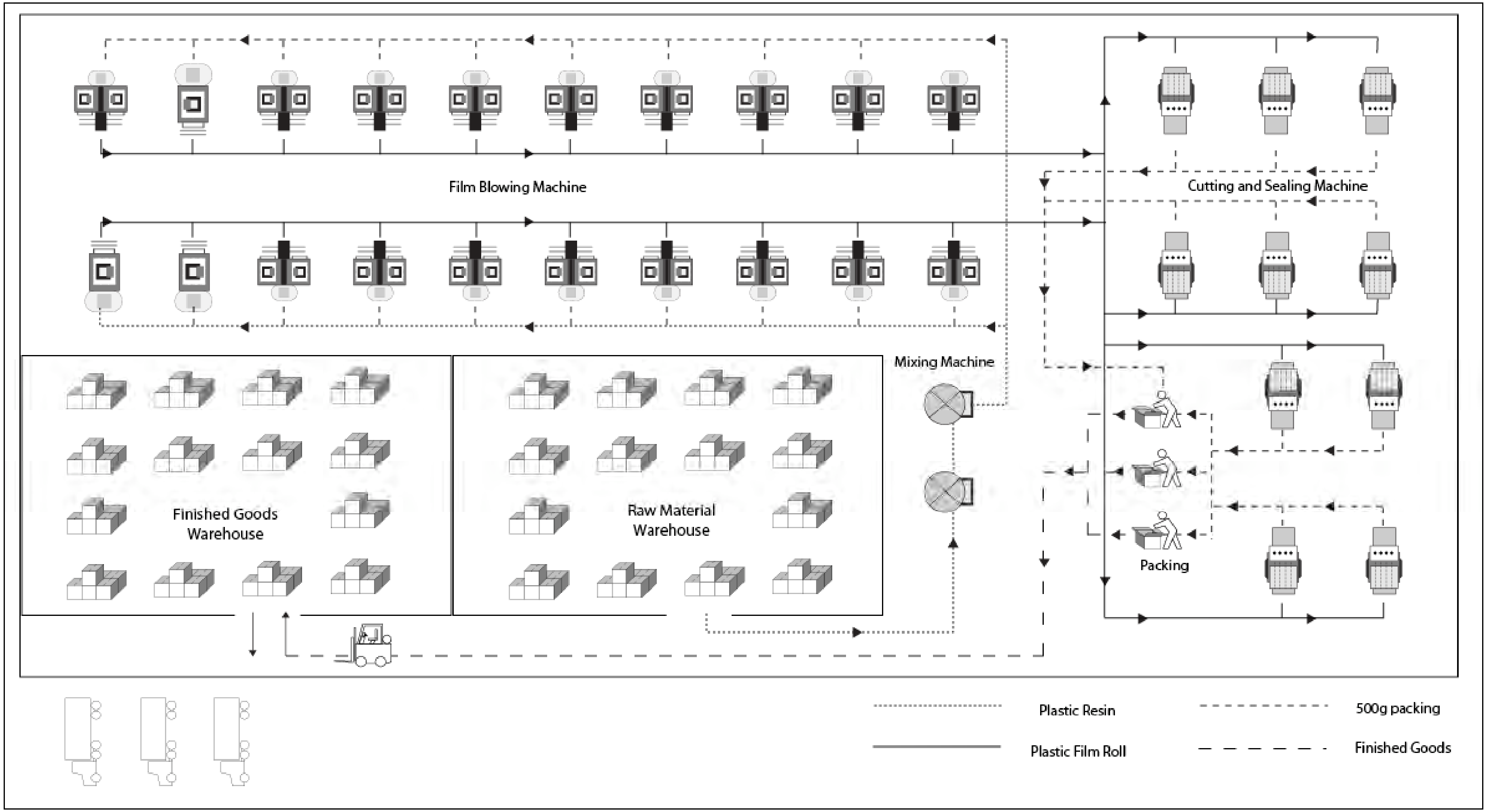


Figure 4.8.9:Material flow

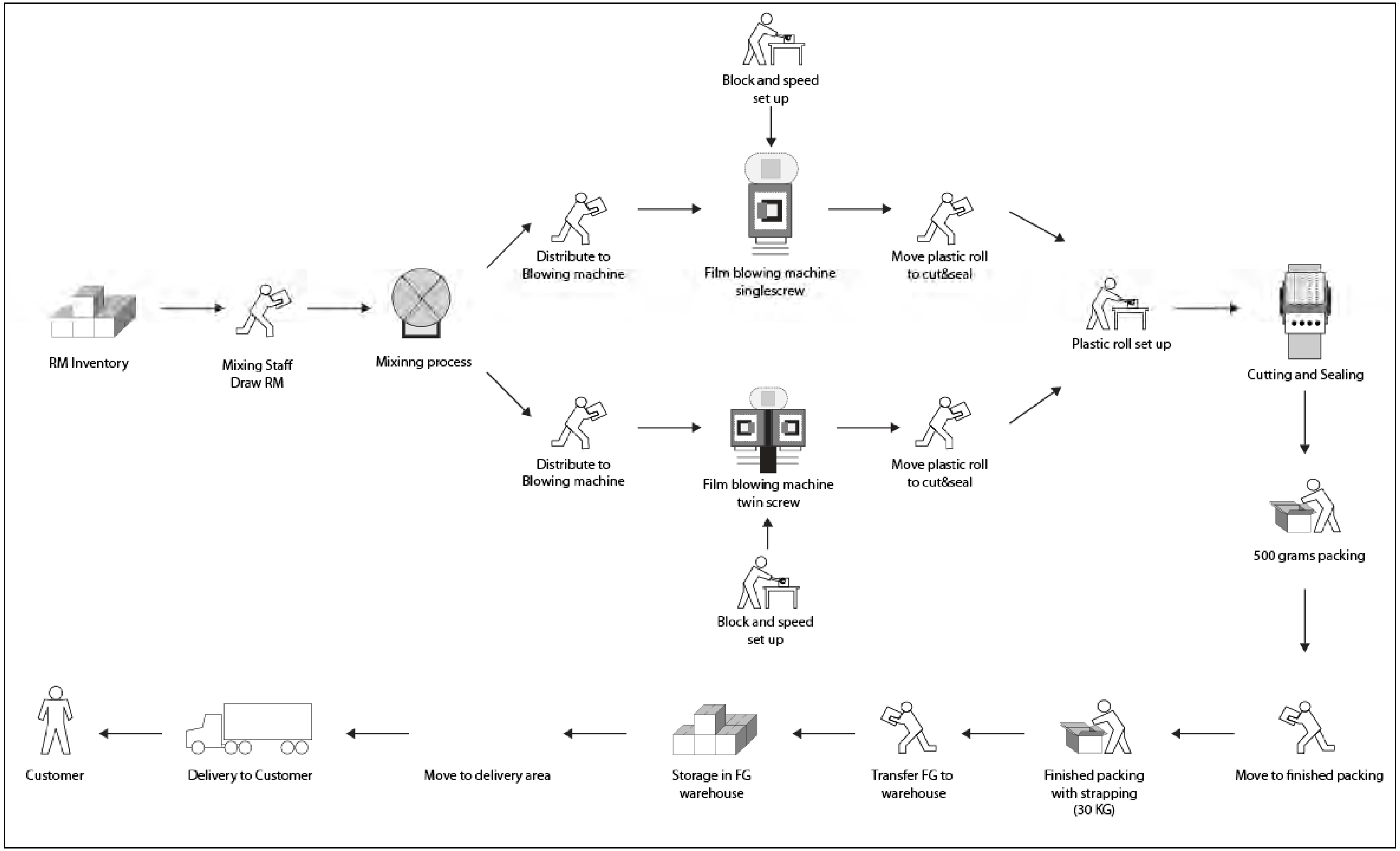


Figure 4.8.10: Man flow in the SFC model

4.8.8 Summary

By using tool technique of $IDEF_0$, it allows this study to show the SFC model systematically. The model illustrated the relationship from main activities to breakdown activities clearly. It explains the input, control, mechanism an output of each activity in the shop floor control system. Moreover, the model also shows the flow of product, man, machine and document clearly. This SFC model is developed especially for plastic bag packaging (film blowing process), which is currently using in the case company. It is the fundamental step and guideline for the further development in the future.

4.9 Results comparison

This section is going to illustrate result differentiation in each period of time. The results from improvement will be categorised into two topic, which are product defect and product backlog. The results are comparing and demonstrate in table and chart, which comparing with three phases of before implementation, during implement, and improved. Recommendation

4.9.1 Product defect results comparison

According to Table 4.9.1, the results during 4 month after implementation have show that the total number of product defect is reduced to 15,679 kilograms comparing to before implement the number of product defect is at 42,218 kilograms. In percentage, the number of product defect reduced to 2.03% from 3.07%.

Since the process improvement has been adopted the equipment for the new process of distribute plastic resin. The number of defect in mixing process has been reduced by 0.02% from 0.11% to 0.09%. In film blowing process, the number of defect is reduced to 1.81% from 2.78%. The result of the last process that has improvement is cutting and sealing process has the number of defect reduced to 1.81% from 2.78% in the period before implementation

Therefore, the company could generate more profit according to this product defect reduction around 45,932 baht per day. The most important thing is not only the impressive number of product defect has decreased, but the way that this research get workers and managements involve and share idea together that is more important result, because once all the functions are synchronised, no matter of what problem they are facing, this case company will get thru it.

Table 4.9.1: The result comparison before and after implementation

Process	Phase 1	Phase 3	Differentiation
Mixing	Unit : KG		
Input	1,326,125.00	1,135,650.00	190,475.00
Defect	1,471.60	1,039.80	431.80
%	0.111	0.092	0.02
Blowing			
Output	1,376,911.20	1,328,062.70	48,848.50
Defect	38,283.18	24,093.00	14,190.18
%	2.78	1.81	0.97
Cutting & Sealing			
Output	1,314,908.50	1,093,904.80	221,003.70
Defect	2,463.55	1,406.42	1,057.13
%	0.187	0.129	0.06
Total	3.07%	2.03%	1.04%

4.9.2 Product backlog result comparison

Table 4.9.2: The result comparison before and after implementation

Unit: KG	Before	After	Differentiation
Backlog	8,950	3,900	5,049
Backlog (%)	2.63	1.11	1.52
Over production	32,912	23,986	8,926
Over production (%)	9.37	6.69	2.68

After implementation of the planning and control function and the process of finished goods warehouse, it make the company has more span of control and working with document based system. The implement bring the flow of collaborate work smoother and the problem in the shop floor can be traced. According to Table 4.9.2, the number of product backlog decreased from 8,950 kilograms to 3,900 kilograms. The number shows that the case company produced more on what customer ordered. In consequence, this implementation make the over production decreased to 3.69 % from 9.37% as well.

4.9.3 Summary

Since the work instruction has been implemented, which standardised the production processes, the number of defect in process of mixing, film blowing and cutting & sealing are literally reduced. The new work instruction together with the new document system allow foreman to track problem and the progress of the production in each customer order.

Moreover, the new division of planning and control plays vital role in the production, which leads the production to produce the right product in the right time for customers. This is resulting in the number of overproduction decreased and allowing finished goods in flow faster or less finished goods being kept in the warehouse.

CHAPTER V

CONCLUSION and RECOMMENDATION

Since the problems of the case company have been pointed out, through the problem solving, there are tools and techniques that have been employed in this study. This chapter is going to summarise the SFC improvement, which has been developed for plastic packaging factory.

5.1 Conclusion

This thesis focuses on developing the shop floor control system for plastic packaging factory. The overall operation of the case company is initiated form the family business and still going on with the management of the leader of the family. The problem of the case company firstly is the management that rely on one person. Since the case company has been expanding, the activity and information through the factory is getting complicated day by day. The owner of the company alone could not be able to handle and monitored all operation in the factory. In consequence, there are problems that occurs everyday and it has been solved but not at the root cause.

To find the root cause of problems, this research employed tools that indicated the root cause of problem, which are check sheet, Pareto diagram, cause and effect diagram analysis, relationship matrix, why-why, and how- how analysis to find the solution to solve the problem. This study firstly started from investigating and observing at the case study factory. Since the case company has variety of the product, this study focused on the main production, which is polypropylene (PP) production line. This production produce the U-shaped plastic bag for food, which mainly using PP plastic resin as main raw material. The problems that arise in the PP production during observing have been listed. It is found out that there are eight problems that collected from the plant visiting and customer complain during observe. Those eight problem listed could be classified in to two main problems, which are defect and order backlog problems.

Secondly, the problems were investigated more on the frequency of occurrences by using check sheet. The investigation took 30 days to collection the data. The data is then prioritised with the Pareto method to analyse on which problem has the most effected to the case company. The result has been shown in the Pareto diagram to illustrate the most impact problem. After that, the cause and effect diagram has used to find whether problems cause from man, machine, method, or material. The result of using cause and effect diagram was indicated that the case company would have problem with method of work. Therefore, the method of work was the focused area of problem solving for both problem of defect and order backlog.

Thirdly, the relationship matrix adopted in this study. This study has set up the session by gather related worker and foreman to score the causes from the previous tool. The purpose of this session is to prioritise the cause that should be emphasised. The result of this session was the same as the result from the cause and effect tool. It was the method area that should be focused. Lastly, why-why analysis was employed to find the root cause in the method area. The last step of this tool revealed the solution to certain problem.

Therefore, there are solutions to solve problem of defect and order backlog. For the defect problem, work instruction and job description are created and implemented. This is to indentify responsibility and to standardise the work method, which reduce the process that generated waste or product defect. The work instruction plays a vital role to reduce the product defect and waste. Mixing and film flowing are the processes that work instruction help to improve the number of defects For the order backlog problem, reorganisation structure by adding the planning and control function to help work of MD. It reduces the number of over production, which causes the order backlog problem. In addition, there is FG warehouse function also added up to solve the problem of stock checking mistake. Including the document though the shop floor also reformatting and added some necessary data into the new form according to the usability and traceability of the document.

5.2 Problems and Limitations

With the previous situation of the case company, the shop floor control was manages and problems solved by the foreman. This is because of foreman has most experienced in the production cell. However, the problem with the case company pointed out the inefficiency of the shop floor control, which make the high number of the defect for both in the production line and came out the customer. This is because of foreman have no knowledge about the techniques and tools in the shop floor control. Another cause of the problem is that the management of the case company has not realised and understand the important of applying the theories, tools, and techniques to the shop floor control. Moreover, another reason that tools and techniques of shop floor control have not been applied in the case company is because of the complicating process in the factory and time constraint.

In the beginning, there are basically loads of question have been going on with worker. Most of the time, it is found out that workers are seemed to be annoyed and evasive to answer. They felt like being faultfinding and they were not answer what actually happened in the factory. When time goes by, the information that workers gave out return to them as a new solution for them to work easier and faster. In the implementation part of the study, workers were more supportive and very helping hand in order to ask to do something for photo shooting.

Another problem in this research is the problem of data collecting, works were acting like they have more job to do and denied to do it because it takes a period of time for worker to understand and get used to the new format of the document in both data collection and productivity report. So that, there is extra incentive set up for them. In the very last step, workers are seemed to understand and get the picture of the research. They tend to be active to report situation and the result that have been changes. Therefore, the study is found out that it is not only the problem in the production that difficult to manage, people are complicated and more difficult to manage.

5.3 Recommendation

With current situation, there is high business competitive in all business in Thailand. Every company wants to survive in this field of competition. The case company is one of the survivors. They are growing up and expanding, which make activities in the business are increased and more complicated. The owner of the business has no ability to handle with close monitoring all operation in the production. Therefore, this research is a good start because shop floor control system is the fundamental to help monitor and manage activities in the production.

The further emphasis should be highlight more on safety stock, would be more useful for the case company. The problem of over production is one of the point that this case company should focusing because in the owner opinion the over production product will be sell for sure but it would be better to use that capacity to produce what customer currently order, which not make the company holding the stock. This lead to the profit making that company would lose in the uncertainty of plastic resin price. Moreover, the data collection could be extending in the future study such as real time shop floor data collection, which possible for current technology advancement. With the web technology, the data collection can real time and allows the top management access and check the progress of the production through the computer anywhere and anytime.

However, the management of shop floor is necessary for plastic packaging manufacture. It can help identify the problem in early stage. The SFC is the fundamental management for step ahead to advance tools, which can facilitate the manufacturer to compete in the business field. Especially, plastic packaging manufacturers in Thailand that currently not only have to compete with domestic competitors, but the Asian nation such as China, Indonesia, and Vietnam, since the taxation of plastic product become zero for FTA agreement.

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APPENDICES

Appendix A

Appendix B

Appendix C

BIOGRAPHY

Wattana Krisnavarin was born on 23rd of March 1984 in Chiang Mai, northern province of Thailand. He initially graduated his first degree in Diploma of Computing at MIBT (Melbourne Institute of Business and Technology), Melbourne, Australia and then continues his study in Bachelor Degree of Multimedia at Swinburne University of Technology, Melbourne, Australia. He is working for plastic packaging manufacturing for 3 years. He is therefore continues his further educational in Master Degree of Engineering Management at Regional Centre for Manufacturing System Engineering (RCMSE), Chulalongkorn University, Thailand and University of Warwick, United Kingdom.