

SUPPLY CHAIN MANGEMENT FOR MANUFACTURING INDUSTRY

MOHD UBAIDALLAH BIN ABD RASHID

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ABSTRACT

This thesis discusses one of the topics in engineering management which is Supply Chain Management. Engineering Management is a term that is used to describe a specialized form of management that is required to successfully lead engineering personnel and projects. The term can be used to describe either functional management or project management- leading technical professionals who are working in the fields of product development, manufacturing, construction, design engineering, industrial engineering, technology, production, or any other field that employs personnel who perform an engineering function.

Supply Chain Management is the management of a network of interconnected businesses involved in the ultimate provision of product and service packages required by end customers. Supply Chain Management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption.

Practicing supply chain management in industry giving benefits to company in term of utilizing man, machine, method and materials. The outcomes of this thesis show the practical of the theory. Analysis using Time Study method that founds by Federick W Taylor show the importance of applying engineering management in industry.

Result that obtain in this thesis show that increasing supply from 12 cars to 14 cars can done.

ABSTRAK

Tesis ini membincangkan satu topik dalam bidang kejuruteraan pengurusan iaitu Pengurusan Rantaian Perbekalan. Kejuruteraan pengurusan adalah istilah yang diguna untuk mendefinisikan pengurusan yang pakar yang diperlukan untuk menjayakan individu dan projek dalam kejuruteraan. Istilah ini juga boleh digunakan untuk mendefinisikan kefungsiian pengurusan atau pengurusan projek- menjadi rujukan pakar teknikal yang bekerja di dalam bidang pembangunan produk, pembuatan, pembinaan, kejuruteraan rekaan, kejuruteraan industri, teknologi, pengeluaran atau bidang bidang lain yang mengupah pekerja untuk menjalankan fungsi kejuruteraan.

Pengurusan Rantaian Perbekalan adalah pengurusan hubungan yang berkait dalam perniagaan yang diceburi yang melibatkan ketetapan produk dan perkhidmatan paling terbaik yang dikehendaki oleh pengguna akhir. Pengurusan Rantaian Perbekalan merekod semua pergerakan and penyimpanan bahan mentah, proses kerja, inventori dan produk akhir daripada titik permulaan hingga titik akhir sesuatu produk.

Penggunaan Pengurusan Rantaian Perbekalan dalam industri memberi kebaikan kepada syarikat dalam aspek pemanfaatan pekerja, mesin, metode dan bahan. Hasil tesis ini telah menunjukkan pengaplikasian teori secara praktikal di industri. Analisis tesis ini yang menggunakan cara Pengkajian Masa yang dihasilkan oleh Federick W Taylor menunjukkan kepentingan mempraktikkan kejuruteraan pengurusan dalam industri.

Keputusan yang didapati dalam tesis ini menunjukkan penghantaran boleh ditingkatkan dari 12 buah kereta ke 14 buah kereta.

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LIST OF ABRREVIATIONS

SCM	Supply Chain Management
MBM	Mercedes Benz Malaysia
AMM	Automotive Manufacturer Malaysia
MBPS	Mercedes Benz Production System
JIT	Just in Time
EDI	Electronic Data Interchange
VMI	Vendor Management Inventory
ECR	Efficient Consumer Response
TPS	Toyota Production System
SMED	Single Minute Exchange Die
TPM	Total Productive Maintenance
SWOT	Strength, weakness, opportunities and threats
LB	Logistic Building
BS	Body Shop
PS	Paint Shop

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CHAPTER 1

INTRODUCTION

1.1 General Overview

Supply Chain Management (SCM) is a system that used by an organization to organize the process of planning, implementing and controlling the operations of supply chain as efficiently as possible. Supply chain management spans all movements and storage raw materials, work-in-process inventory and finished goods from point-of-origin to point-of-consumption (Jay Heizer and Barry Render,1996).

Nowadays, SCM applied in various industries such as automotive, manufacturing and services. SCM give various benefits to an organization that apply the system especially in term of optimizing time and space. More than that, SCM will keep the flow of process run smoothly. In order to reduce the number of defective parts, cut labor costs and improve efficiency, SCM is the tool that will be used.

Normally, SCM will achieve one of the goals which are adding value chain. Value chain means the function within a company that add value to the products or service that the organization sells to customer and for which it receives payment (Henri Pierreval, Roman Bruniaux and Cristopher Caux, 2006).

1.2 Project Background

Supply Chain Management is an important system that needs to apply in industry. In order to practice the knowledge practically, case study need to be done to let theory can be applied. Nowadays, many companies collaborated through a network of production units, so as to provide customer with the desired products. SCM, which are more precisely addressed in this thesis generally refer to a set of networked organizations working together to source, produce and distribute products and service to the customer.

Automotive Manufacturing Industry is an industry that really applies SCM to perform a good automotive. Several manufacturers integrate successfully their internal process to external suppliers and customers in a single supply chain (Frolich and Westbrook, 2001).

Technology and management need to work together to achieve good result. Mercedes Benz is an establish company that produce an automotives. In order to assemble Mercedes Benz automotive in Malaysia, Mercedes Benz Malaysia (MBM), was collaborate with Automotive Manufacturer Malaysia (AMM).

This collaboration applied SCM for the purpose of producing automotive to the maximum efficiency. There are several departments in a plant. Each department does their own job to achieve one objective which is produce good automotives. Each department need to contact efficiently and will use SCM as the contact medium. Good contact between departments in a good manner will let the plant work smoothly.

Logistic Department in AMM is an organization that responsible to manage receiving raw material, storage and do delivery in the manner that ask by two departments which is Body Shop and Production Line.

Body Shop is the department that responsible to assemble each part of car body part to become a complete car framework. Production Line is the organization that does the job to produce complete car. Their responsible is to receive car framework from

Body Shop and trim part from Logistic Department. After Production Line finish their job, then, a complete car ready to send to market to sell.

The flow of process and person In charge of Logistic Department that responsible of unpacking trim section and body section of Mercedes Benz Automotive parts is as in Table 1.1 and Table 1.2:

Table 1.1: Process Flow and Person in Charge of Unpacking Trim

Department	Section	Type of Document
Logistic	Unpacking Trim	Process Flow

Person in Charge

Operator and Forklift Driver

Forklift Driver

Operator

Operator

Operator

Outline

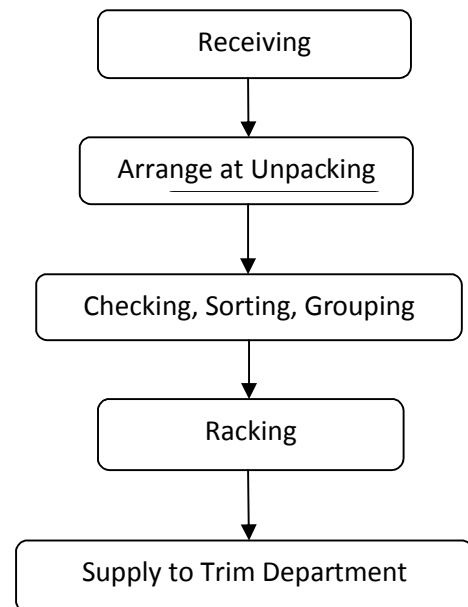


Table 1.2: Process Flow and Person in Charge of Body Parts

Department	Section	Type of Document
Logistic	Body	Process Flow

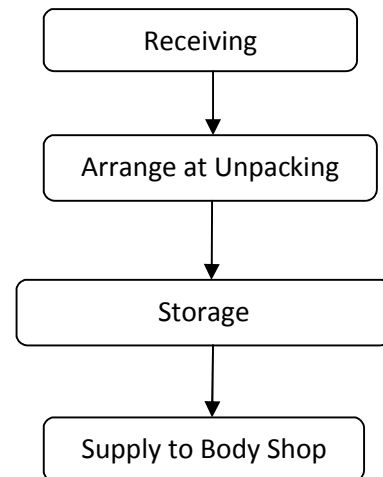
Person in Charge

Operator and Forklift Driver

Forklift Driver

Operator

Forklift Driver

Outline**1.3 Objective**

The main objective of this thesis is to study the system that used by the plant, analysis and find capacity of the system and propose suggestion of supply chain between Logistic Department and Production Line of trim part of C-Class Mercedes Benz Car

1.4 Scopes of the Project

This plant have connection problem between Logistic Department and Production Line on rack part that consist trim part, this study will work on scope to solve the problem. This scope consists of:

- i. Record the time to move Complete Knocked Down (CKD) from storage area to working area.

- ii. Record Time to unpack the CKD, move and arrange it on rack.
- iii. Record time to move all the parts from Logistic to Production Line.
- iv. Find the capacity of sending trim part of C Class Mercedes Benz Car from Logistic to Production Line and propose suggestion to improve the supply chain.

1.5 Problem Statement

In order to fulfill the demand that asks by Production Line, analysis the strength of Logistic need to be done. However, this data do not available yet. Because of that, the problem occurs:

- i. Logistic Department can't guarantee to supply the demand that ask by Production Line if the demand is increasing suddenly in any number.
- ii. Logistic Department does not has its capability data on supply trim part to Production Line.
- iii. Logistic Department have problem to identify the correct number of man and machine need by that department so that the method applied are not known the efficiency.

1.6 Outline

Chapter 1 is the introduction of the project. This chapter also explains the objectives and scopes of the project.

Chapter 2 is discussion about the literature review. This literature review will elaborate on SCM and the process that operate in plan. This chapter based on study from AMM Plant, text books, journal and sources from internet.

Chapter 3 explains the project methodology for Supply Chain Management of trim part of C-Class Mercedes Benz car. This chapter also shows how to find and analysis the parameter that will be investigated to answer the objectives of this project.

1.7 Gantt Chart

The Gantt chart of this project is done to make sure that the process of completing this project will follow the schedule that be planning earlier. Based on schedule, the process of this project will doing in smooth condition. Besides that, this schedule can guide and show what a progress is going on by the time. The Gantt chart of this project is referring in the Appendix A1 and A2.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The purpose of chapter 2 is to explain about principles and function of SCM. Since AMM is an automotive manufacturer vendor for Mercedes Benz Malaysia, this plant implements a system that called Mercedes Benz Production System (MBPS).

MBPS is a system that implements Just in Time (JIT). JIT is a concept that really focused on utilizing SCM. This chapter will explain about JIT and how this concept gives big benefits to SCM.

To let we understand better on this plan activities that use MBPS, that it good for us to review on JIT and it's contain.

2.2 Supply Chain Management

SCM is a network management that includes vendors of raw materials, plants that transform those materials into useful products, and distribution centers to get those products to customers (Lawrence D. Fredendall Ed Hill,. 2000).

Automotive industrial groups are introducing structural changes in their manufacturing systems in order to guarantee optimal trade-off between customer satisfaction and production costs (Haag and Vroom, 1996; Proff, 2000)

Without any specific effort to coordinate the overall supply chain system, each organization in the network has its own agenda and operates independently from the others. However, unmanaged network results inefficiencies. For example, a plant may have the goal of maximizing throughput in order to lower unit costs. If the end demand seen by the distribution system does not consume this throughput, there will be an accumulation of inventory. Clearly, there is much to be gained by managing the supply chain network to improve its performance and efficiency.

2.1.1 Decision Variables in SCM

In managing the supply chain, the following are decision variables:

- Location- of facilities and sourcing points.
- Production- what to produce in which facilities.
- Inventory- how much to order, when to order, safety stock.
- Transportation- mode of transport, shipment size, routing and scheduling

2.1.2 Just in Time

The development of JIT in Japan was influenced by a crowded country with few natural resources. Japanese became very sensitive to waste and inefficiency. They regard scrap and rework as waste and excess inventory as an evil because it takes up space and ties up resources. A president of Toyota (Eiji Toyoda) gave a mandate to his people to eliminate waste. JIT approach was developed at the Toyota Motor Company of Japan by

Taiichi Ohno (which became Toyota vice president). JIT is a term to describe Toyota Production System (TPS), widely recognized as one of the most efficient manufacturing operations in the world. JIT requires only necessary units be provided in necessary quantities at necessary times. Items are supplied only when needed or “just-in-time”. It can be an effective method for reducing inventory and stock-outs (Henri Pierreval, Roman Bruniaux and Cristopher Caux, available online 6 December 2006).

Some firms have successfully improved their supply chain performance by implementing an approach known as Just in Time (JIT). As known, the main goal of JIT consists in establishing optimal combination of competition and cooperation considered as a basic feature of inter-firm networks (Pfohl and Buse, 2000).

With JIT, the vendor specifies delivery quantities sent to customers through the distribution channel using data obtained from Electronic Data Interchange (EDI). JIT, Vendor Management Inventory (VMI) and Efficient Consumer Response (ECR) all refer to similar concepts, but applied to different industries. For example, the grocery and apparel industries tend to use ECR, whereas the automobile industry tends to use VMI and JIT.

2.1.3 Just In Time and Lean Manufacturing

JIT emphasizes continuous improvement to eliminate waste. Toyota Production System (TPS) emphasizes employee learning and empowerment in an assembly line environment. Lean Production is a term used to describe JIT and Toyota Production System (TPS). AMM used Mercedes Benz Production System (MPS) in order to apply JIT in the plant. MPS and TPS is a tools that quite similar in order to apply JIT in plant.

JIT is a philosophy of continuous and forced problem solving that supports lean production. Lean production supplies the customer with their exact wants when the customer wants it without waste through continuous improvement.

2.1.4 Seven waste of JIT system

When applying JIT, there is waste that plant need to focus. In the JIT philosophy, wastes include anything that does not add value to the product. The wastes are:

- Overproduction.
- Queues.
- Transportation.
- Inventory.
- Motion.
- Over-processing.
- Defective product

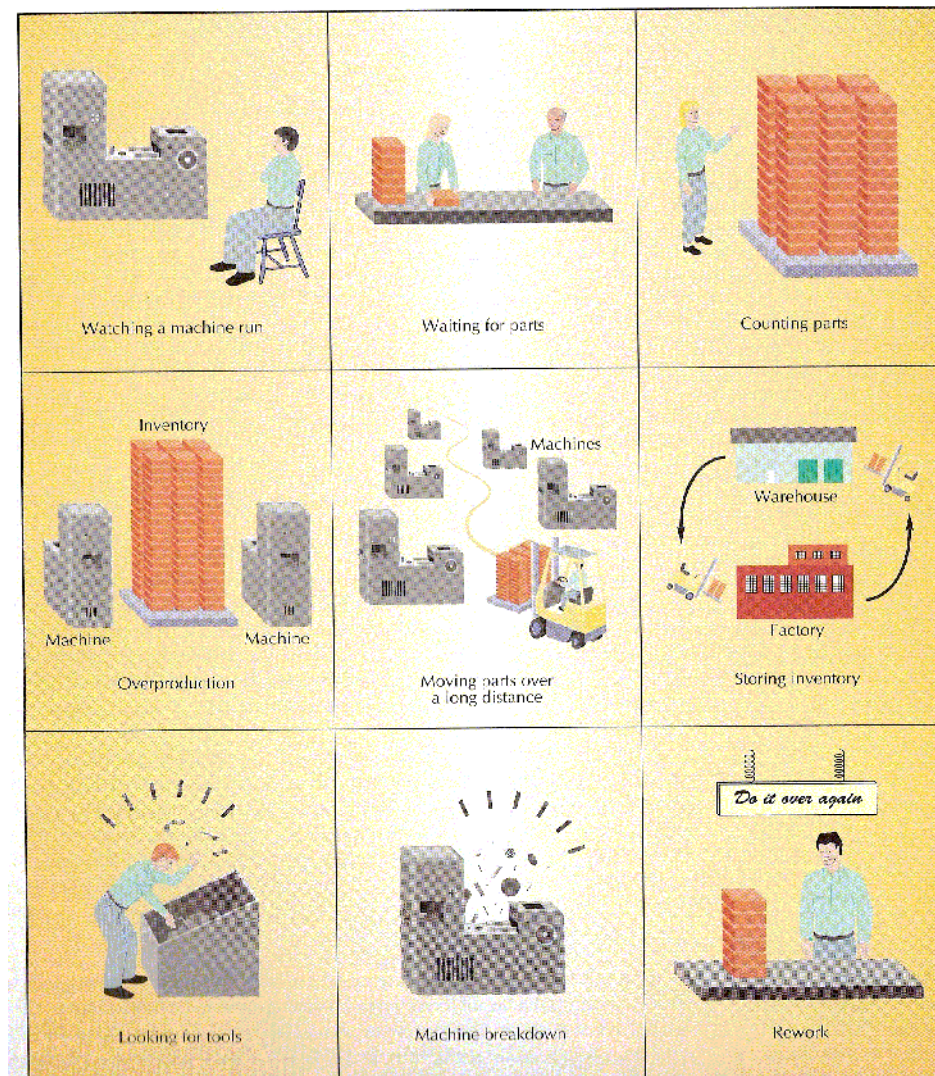


Figure 2.1: JIT avoided activities

2.1.5 Elements of JIT

- Supplier networks.
 - Supplier and purchaser work together to remove waste and drive down costs
 - Few suppliers

- Nearby suppliers
- Repeat business with same suppliers
- Support suppliers so they become or remain price competitive
- Share forecasts of demand
- Frequent deliveries of small-lot quantities
- Long-term contract
- Minimal paperwork to release order
- Pull production system.
 - A pull system uses signals to request production and delivery from upstream stations
 - Upstream stations only produce when signaled
 - By pulling material in small lots, inventory cushions are removed, exposing problems and emphasizing continual improvement
 - Push systems dump orders on the downstream stations regardless of the need
- Cellular layout.
 - Cell produce similar items, setup time requirements are low and lot sizes can be reduced
 - Build work cells for families of products
 - Include a large number operations in a small area
 - Minimize distance
 - Design little space for inventory

- Improve employee communication
- Use poka-yoke devices
- Build flexible or movable equipment
- Cross train workers to add flexibility
- Small lot production (reduce inventory).
 - Small lot production requires less space and capital investment, transportation between station can be simplified and quality problems are easier to detect.
 - The inventory level is like the level of water. It hides problems but allows for smooth sailing. When the inventory level is reduced, the problems (rocks) are exposed.
- Quick setup.
 - Shigeo Shingo – study die set up systematically to reduce changeover times.
 - Reduced set up time on a 1000 ton press from 6 hours to 3 minutes using a system called SMED (single minute exchange of dies)
- Kanban production control system.
 - Kanban – Japanese word for card
 - The card is the authorization for the next container of material to be produced
 - Contains basic information such as part number, brief description, type of container, quantity per container, preceding station and subsequent station

- Kanban corresponds to a standard quantity of production or size of container
- The number of Kanban card or container, in a JIT sets the amount of authorized inventory.
- To determine the number of containers moving back and forth between the using and producing area, need to set the size of each container.
- Need to know the lead time needed to produce a container of parts
- Need to know the amount of safety stock needed
- Total productive maintenance (TPM)
 - Machine cannot operate continuously without some attention
 - Maintenance activities can be performed when the machine breakdown to restore the machine to its original operating condition.
 - Breakdown maintenance involves the repairs needed to make a failed machine operational
 - Preventive maintenance is a system of periodic inspection and maintenance designed to keep a machine in operation
 - With accurate records on the time between breakdowns, the frequency of breakdowns, and the cost of breakdown, we can mathematically determine the best preventive maintenance schedule.
 - Breakdowns can still occur, even with this degree of precision.
 - JIT requires more than preventive maintenance. JIT requires Total Productive Maintenance

- TPM combines the practice of preventive maintenance with the concepts of total quality – employee involvement, decision based on data, zero defects, and a strategic focus.
- The goal of TPM is zero breakdown.
- The basic foundation of TPM is 5S activities which is *seiri, seiton, seiso, seiketsu and shitsuke* (sort/segregate, simplify/arrange, shine/sweep, standardize, sustain). This to emphasize on cleanliness of work environment.
- A major cause of machine failures and poor product quality is the build up of dirt, oil and chemicals in machines or on materials.
- Keeping the work area shining is part of a TPM effort in which unusual occurrences such as drips and abrasions are detected quickly.
- Quality at the source.
 - Seeks to identify quality problems at their source, to solve them and never to pass on a defective item
 - Jidoka – the authority to stop the production line if quality problems were encountered
 - Visual control – kanban, andons, process control chart and tool board
 - Poka-yoke – foolproof device or mechanism that prevents defects from occurring
 - Kaizen – Japanese term for continuous improvements.
- Flexible Resources
 - Multifunctional workers and general purpose machines.
 - Toyota preferred small, general purpose machine

- The waste of movement to other machines, setting up other machines and waiting at other machines was eliminated

2.1.6 JIT Implementation

JIT reduces stock-outs and reduces inventory in the supply chain. Some features of JIT include:

- Shortening of the supply chain
- Centralized forecasting
- Frequent communication of inventory, stock outs, and planned promotion. EDI linkages facilitate this communication.
- No manufacturer promotions
- Trucks are filled prioritized order. For example, items that are expected to stock out have top priority, then items that are furthest below targeted stock levels, then advance shipments of promotional items (promotions allowed only in transition phase), and finally, items that are least above targeted stock levels.
- Relationship with downstream distribution channels
- Results inventory reduction and stock out reduction.

2.1.7 JIT Implementation Challenges

JIT can be made to work, but the problem is not just one in logistic. JIT often encounters resistance from the sales force and distributors. At issue are roles and skills, trust, and power shifts. Some of the sales force concerns are:

- Loss of control

- Effect on compensation. incentive bonuses may depend on how much is sold, but sales force has less influence under JIT.
- Possible loss of job
- Skepticism that it will function well because of technical problems
- Concern that reduced inventory will result in less shelf and therefore loss of market share. This concern can be addressed by filling the shelf space with other stock keeping units from the same vendor.

Distributors also may have concerns about Just in Time, including:

- Inventory will be pushed on them.
- No more promotions, discounts, and forward buying.
- With less inventory, more risk of disruptions due to strikes, adverse weather, etc.
- The vendor enjoys the benefits while the distributor gives up its only lever of power.
- Danger of being replaced vendor may decide to forward integrate.

2.1.8 Addressing Concerns

For JIT system to work, the concerns of distributors and the sales force must be addressed. They can be at least partially addressed by the following:

- Transform the sales role into one of marketing. For example, bonuses can be given on the number of new clients.
- Distributor skepticism can be addressed by implementing a pilot program with vendor-owned warehouse in order to demonstrate that the system works. Introduce system in distributor-owned warehouse on a pilot basis.

- Engage a neutral consultant in meeting among the vendor, distributors, and sales force.
- Allow some manufacturer promotions in transition.
- Extensively simulate the system off-line before implementing.
- Don't aggregate the benefits of JIT. Otherwise, any delay in realizing the benefits may cause the supply chain to lose faith in the system.

2.2 Supply Chain Structure

The performance of a supply chain is measured in terms of profit, average product fill rate, response time and capacity utilization.

Profit projections may improve if another parameter is relaxed, but one must consider the impact of all aspects of the relaxed parameter on profits. For example, if customers are lost because response time is too slow, then the profit projections may be artificially high.

Average fill rate can be improved by carrying more inventories in order to reduce stock-outs. The optimal balance must be achieved between inventory cost and lost profits due to stock-outs.

Response time often can be improved at the expense of higher overall costs. As with fill rate, the optimal trade-off should be found. If response time is sacrificed in order to achieve higher profits, sales forecast may have to be modified if the elasticity of demand with respect to service is significant at the chosen service levels.

Capacity utilization should be high enough to reduce overhead sufficiently, but not so high that there is no room to grow or to handle fluctuations in demand. Problems often are encountered when capacity utilization exceeds 85%. Lower capacity utilization decreases downside risk since costs are reduced, but also limits the upside gain if future demand should outstrip supply.

2.3 Benefits of SCM

Implement SCM give various benefits to the organization. In order to reach maximum benefits in money consideration, each plant have to achieve this benefits:

- Reduced inventory.
- Improved quality.
- Lowering the costs.
- Reduced space requirements.
- Shorter lead time.
- Increased productivity

(Jay Heizer and Barry Render, 1996)