

Preface

Having been working as a factory consultant for a long time, many images flash through my brain. Both male and female practitioners have been facing the responsibility of production, purchasing, accounting, IT, and other factory functions. They are sincere, alert, and prepared for day-to-day work. Regardless of nationality, they are hard workers.

However, I have found that some young people whose educational background is not in engineering have less knowledge of the fundamentals of production management. Especially, young people working in overseas factories have very few opportunities to attend lectures in their mother tongue and industrial exhibitions to obtain the latest technical knowledge.

In any field, doing something only in one's own fashion will have limitations. On the other hand, doing something in one's own fashion with fundamental knowledge will make great progress, and in some cases will develop a new concept.

Therefore, I made up my mind to convey the fundamentals of production management and my experiences to young people. In 2007, I planned a series of seminars titled "Production Management 1 through 5" for young Japanese people around Bangkok.

Fortunately, a software house offered me a room for the seminars in Bangkok. I started the seminar at a pace of five times per year for more than ten times.

I arranged the handouts used in the seminars into a Japanese book, which was published July 2010 by COMM BANGKOK CO., LTD. This book is an English version of the Japanese book, because I want to share the same knowledge with English speaking people.

The first part, Chapters 1 through 7, covers topics of basic information for production through product costing. Each chapter explains keywords at first, then business processes using the keywords and real examples. A unique point is that this book explains the basic information for production, which is not usually included in a book of this type. With a proper knowledge of the basic information, the reader will understand production management well.

The second part, Chapter 8, explains supplementary knowledge necessary for practice of the theory of this book. The topics with actual examples will cover a code system, a distinction between Eng. BOM and Mfg. BOM, an actual global system, As Is Analysis, and business process improvements in the US, Japan, and Thailand.

At this opportunity, I would like to thank Mr. Ikuo Kasama for his voluntary support. He, a Business Consultant, set up every seminar in the Pan Pacific Hotel, Bangkok. I also wish to thank Mr. Casey Baseel, Instructor of Y.R.C. English Conversation School, Yokohama. He checked my English and revised it as a native speaker. I want to extend my appreciation to Mr. Shinsaku Okada, Manager of Y.R.C. (Yokohama Ryugaku Center) for his coordination.

Finally, I wish to thank Mr. Shigeki Matsuno, General Manager, and Mr. Takeshi Matsunaga, Editor, and the staff of COMM BANGKOK CO., LTD. for continuous support and cooperation.

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1. Business Model and Factory Function

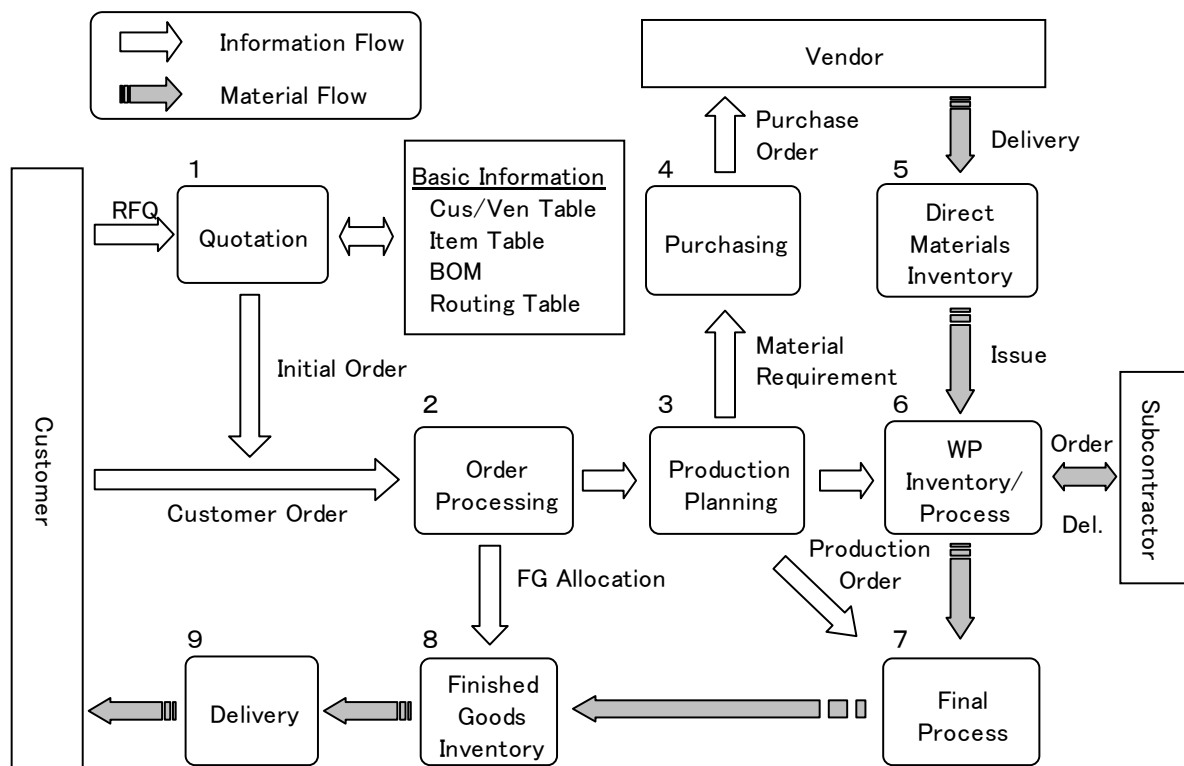
To start, this chapter defines a basic assumption of this book. The assumption consists of a business model, factory functions, a functional hierarchy, and materials used in a factory.

1.1 Business Model

A factory is classified by type of industrial sector such as machinery, home appliance, chemical, food, medicine, textile, cosmetics, and many others. In addition, there are two types of production methods, namely, Production-to-Stock and Production-to-Order.

This book assumes a factory business model as shown in Fig. 1-1, consisting of information flow and material flow within a factory in relation to customer, vendor, and subcontractor. The business model shown below fits almost all types of factories. Of course, the manufacturing processes “6 WP Inventory/Process” and “7 Final Processing” vary a great deal depending on the products, yet the business model does not change.

Fig. 1-1 Factory Business Model



Today, the business functions of factory, customer, vendor, and subcontractor shown in Fig. 1-1 are spread across different locations in both domestic and foreign countries. However, the business model shown above does not change.

In addition, if customer or vendor of Fig. 1-1 is a manufacturing company, the business model of Fig. 1-1 will fit the company also.

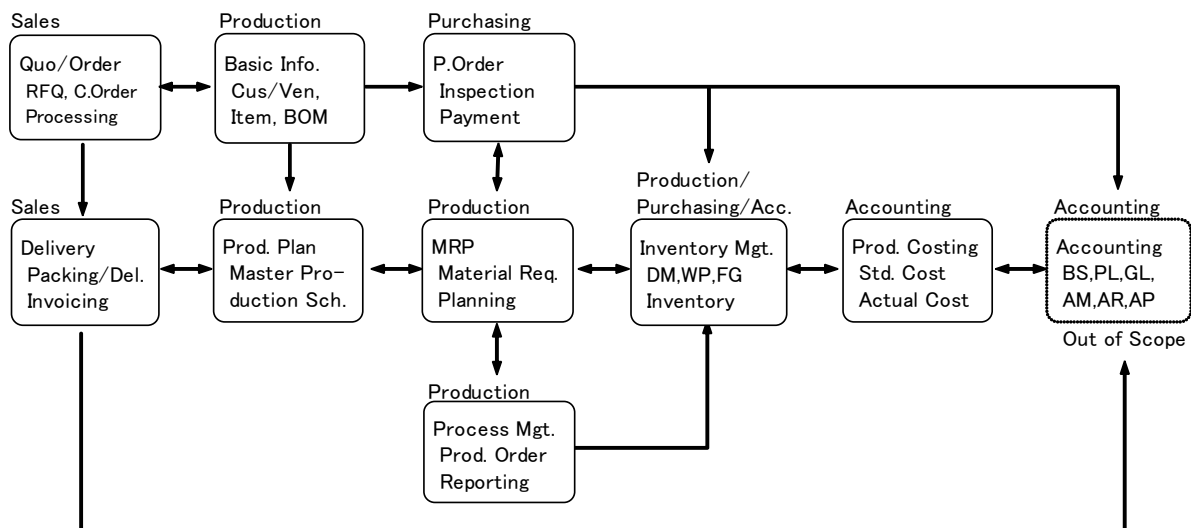
1.2 Factory Function

The business model of Fig. 1-1 on the previous page consists of functional departments. The functional departments will be R/D (Research and Development), product development, production engineering, quality assurance, production control, purchasing, sales, marketing, accounting, IT (Information Technology), administration, and many other departments depending on the organization of a factory.

Fig. 1-2 shows the relation of functional departments and their roles, which directly relate to production. In Fig. 1-2, the following abbreviations are used:

Quo stands for Quotation, Info. for Information, C.Order for Customer Order, Cus/Ven. for Customer/Vendor, P.Order for Purchase Order, Prod. for Production or Product, Sch. for Schedule, Mgt. for Management, Std. for Standard, and MRP for Material Requirements Planning.

Fig. 1-2 Relation of Factory Functions



Because MRP is one of the most common techniques of production management today, this book explains an outline of MRP by a simple exercise. An example of a large-scale MRP system and its impact on a factory will be introduced for reference.

As for inventory, the production and purchasing departments will be responsible for the quantity management of inventory, and the accounting department will be responsible for the inventory valuation, which is a part of product costing. In Fig. 1-2, Inventory Management and product costing are separated.

Note that Balance Sheet (BS), Profit and Loss Statement (PL), General Ledger (GL), Assets Management (AM), Account Receivable (AR), and Account Payable (AP) shown in Fig. 1-2 are topics of financial accounting, therefore, this book will not cover these topics.

1.3 Functional Hierarchy

This section discusses the factory functions of Fig. 1-2 from a different aspect. Fig. 1-3 is a pyramid shaped hierarchy of factory functions.

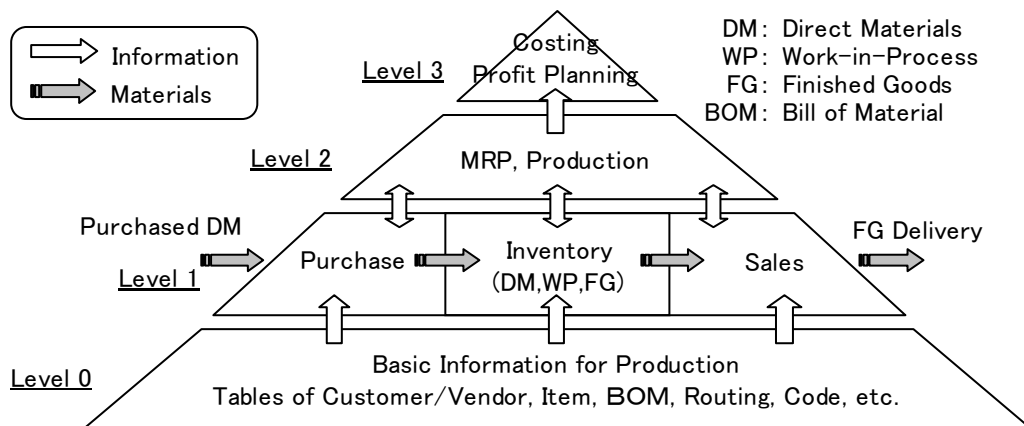
Like a house, Level 0 of Fig. 1-3 is groundwork, which is the basic information for production management. Level 0 includes data tables of customer, vendor, item, Bill of Material, routing, and code definitions. In other words, Level 0 is the database of a factory.

Next, the functions of purchase and sales of Level 1 depend on Level 0. The functions of purchase and sales require material handling and inventory management.

In Level 2, production management may control the material flow within the factory. As one management technique, an MRP system will be used for control of the material flow.

Level 3 is the top level, which focuses on product costing and profit planning of the factory.

Fig. 1-3 Hierarchy of Factory Functions



As seen from Fig. 1-3, the pyramid is a systematic structure of factory functions of Level 0 through Level 3. The levels have been sequenced such that the functions in one level serve as a foundation for the functions of the upper level. Skipping or reversal of intermediate levels will cause failure of the factory management.

For gathering accurate basic information, almost all departments of a company will be involved in Level 0. The top level, product costing/profit planning, can be realized only when the lower levels of the pyramid are properly sequenced as shown in Fig. 1-3. This book explains the fundamentals of production management in the sequence of Level 0 to Level 3.

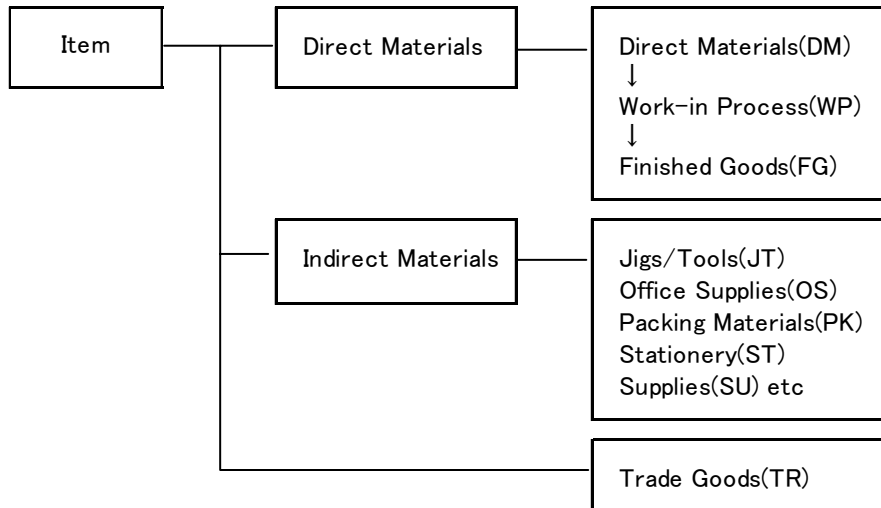
There are a number of possible failures in factory management, for example, failures in an inventory management system, and an MRP system or other production management systems with a big investment. All those troubles are caused by neglect of the sequence of Fig. 1-3.

The ultimate objective of this book is to avoid those mistakes, and realize successful factory management.

1.4 Items in Factory

In this book, materials used in a factory are defined as items as shown in Fig. 1-4, which includes direct materials, indirect materials, and trade goods.

Fig. 1-4 Items in Factory



This section explains three keywords of the items as follows:

- 1) Direct Materials
- 2) Indirect Materials
- 3) Trade Goods

(1) Direct Materials

Direct materials are used for finished products. Such direct materials as steel plates, chemical products, and aluminum ingots are so-called raw materials, and defined as direct materials in this book.

Purchased goods like screws, bolts, and speed indicator assemblies are also defined as direct materials. In addition, direct materials include customer-supplied materials, which are free of charge. Those free-of-charge materials are used for a finished product by customer request. An example of a free-of-charge material is a special alloy block, which will be processed to make a finished product for the customer who supplied the special alloy block.

In summary, raw materials, purchased finished products, and free-of-charge materials are defined as direct materials. The item type of direct materials is defined as follows:

Item Type of Direct Materials = DM

The direct materials are processed to work-in-process materials. Then, the work-in-process materials become finished products. The item types of the work-in-process and finished products are defined as follows:

6. Material Requirements Planning (MRP)

MRP was developed in the late 1960s in the United States. Since then, MRP has become a popular technique of production management.

An MRP system specifies a start date and a completion date of production order. The specification of a start date and a completion date was a very fresh concept in the late 1960s. Consequently, software packages of MRP, as a revolutionary tool, became widely used in the manufacturing industry around the world.

This chapter explains an outline of MRP by using a simple example. For details, a specialized book of MRP is recommended. [Reference] 8.1.3 MRP and Simple Production Plan without MRP.

6.1 Keyword of MRP

This section explains twenty-two keywords of MRP as follows:

- 1) Master Production Schedule
- 2) Planning Horizon
- 3) Time Bucket
- 4) Regeneration Method
- 5) Net Change Method
- 6) BOM Explosion
- 7) Gross Requirement
- 8) Net Requirement
- 9) Effective Inventory
- 10) Lot Sizing
- 11) Order Method
- 12) Production Lead Time
- 13) Purchase Lead Time
- 14) Lead Time Offset
- 15) Order Completion Date
- 16) Order Start Date
- 17) Past Due Date
- 18) Planned Order
- 19) Released Order
- 20) Order Completion Report
- 21) Independent Order
- 22) Frozen Item

(1) Master Production Schedule (MPS)

Master Production Schedule (MPS) is a production schedule of finished products. An MPS becomes an input data to an MRP system. The unit of time is a time bucket, which is usually a day. Accordingly, an MPS is a daily production schedule of finished products.

A daily production quantity of finished product of MPS is a sum of customer orders, backlogs, customers' planned orders, and forecast of the date.

The time span of MPS consists of a current period and a planning period. In general, a current period is one month, and a planning period is two months. In many factories, a production meeting is held at the end of every month. The production meeting determines the production schedule of the next month, which later becomes the current month. At the same time, the meeting determines the production schedule of the planning period.

In recent years, many factories review the MPS in the middle of each month, taking into consideration changes in demand.

(2) Planning Horizon

A total time span of an MPS is called Planning Horizon. The term "Horizon" is used because the near side of the horizon is visible, but beyond the horizon is not. It means that an MPS is a visible production schedule.

The planning horizon must be greater than or equal to the sum of maximum purchase lead time and maximum production lead time. If a maximum purchase lead time is one and a half months, and a maximum production lead time is one month, then, the planning horizon should be at least two and a half months.

A long-range planning horizon, for example, two or three years, will be used for capacity planning of production equipment.

(3) Time Bucket

A bucket is an open container with a handle, used to hold and carry liquids. A time bucket is a unit of time used in an MRP system. If a time bucket is a day, then the MPS becomes a daily schedule. Accordingly, the unit of time of production lead time, purchase lead time, and factory calendar becomes a day.

In the early 1970s, the time bucket of MRP systems was a week, and an MPS was a weekly schedule. The factory calendar was a weekly calendar too. The reason for using a time bucket of one week was that the speed of computers at that time was too slow to calculate a daily production schedule for three months.

(4) Regeneration Method

An MRP system calculates material requirements based on an MPS with level-by-level BOM explosion. When an MPS is changed, the system recalculates material requirements.

A regeneration method recalculates all material requirements from beginning to end based on the changed MPS, disregarding all of the previous requirements.

The logic of this calculation method is simple. However, the recalculation from beginning to end takes considerable time. This method was despised in earlier years because of slow computer processing speeds. Now, computers have advanced, so the processing speed is not a critical problem anymore.

8. Practice of Production Management

Chapter 1 through Chapter 7 has explained the fundamentals of production management. This chapter will introduce practical knowledge of production management based on the author's experiences.

Topics of this chapter cover a broad range. Therefore, to prevent confusion, the topics in advance are as follows:

8.1 Supplementary Note

8.1.1 Code System

8.1.2 Distinction between Engineering BOM and Manufacturing BOM

8.1.3 MRP and Simple Production Plan without MRP

8.1.4 Global System

8.2 Business Process Improvement

8.2.1 Example of As Is Analysis

8.2.2 Example of Business Process Improvement

8.3 Author's Impressions of Factories

8.1 Supplementary Note

This section presents supplementary notes related to production management.

8.1.1 Code System

A code system is the foundation of basic information not only for production management, but also any other database. However, this topic is rarely discussed in a book of this type. Therefore, on this occasion it is better to introduce topics relating to code systems as a very basic knowledge of databases.

Codes like JPN and JPY represent Japan and Japanese yen, respectively. These codes are abbreviations rather than codes. A code "81" of an international call means Japan and this is a numerical code. For this type of code, code tables define Code and Meaning.

There is another type of code which is used for computer systems, namely code systems used in a database. A customer code, for example, is a code representing a set of data items like customer's name, industry type of customer, address, and contact.

An item code is the same type of code as a customer code. A customer code and an item code are a kind of reference number, called key code.

A key code should be unique. A duplicated key code is not allowed.

Essentially, a key code is different from codes like JPN or "81," because a key code plays an important role in a computer system. Therefore, once a key code system is implemented, it is very difficult to change it. The reason is that changes in key code require a lot of changes in the computer system, or in the worst case, the existing code system together with the computer system must be replaced with a new system based on the new code system.

This section explains features of different types of codes, and introduces a case of computer system alteration due to changes in key code system.

8.1.4 Global System

In the early 1990s, at about the same time, two American companies planned global systems using ERP software packages. The companies' mutual data are as follows:

Business: Mfg. and Worldwide Distribution	Head Office: USA
Type of Industry: Electronics, Software	Total Employees: About 1,200 – 1,500

There were no business and capital ties between the above two companies.

Fortunately, the author was given chances to participate in these two projects from the beginning to the end, on a part-time basis. There were similar projects in the United States at that time. However, those other projects were terminated before completion.

This section introduces a summary of the author's experiences obtained from the two projects, both of which achieved their original goals around 1998.

8.1.4.1 Background of Global System and Network Structure

The objective and the network structure of the two global systems were nearly identical. Specifically, it was integration of worldwide business operations.

(1) Background of Global System

Top executives of the American companies wanted to manage all factories and sales offices in the United States, Europe, and Asia/Pacific by an integrated business system. The idea was very simple and straightforward. However, the idea seemed to neglect the regional business practices of the world. Various viewpoints polarized opinions.

The following phenomena of the early 1990s justified the project:

- 1) Popularization of LAN, WAN, and worldwide communication networks
- 2) Downsizing of mainframes and migration to new computer technology
- 3) Globalization of the world economy, especially the Treaty on European Union (1992) and Substantial Vision of Single Currency, i.e. Eurocurrency

(2) Objective of Global System

In the 1980s, many companies developed business systems by COBOL on mainframes. The progress of IT technology quickened the replacement of the legacy systems written in COBOL with the new generation systems.

One idea was an integrated business system on centralized servers, which support all factories and sales offices in the world. The objective of the integrated system was to improve worldwide management visibility.

To achieve the objective, an online business system for regional sales force and hub factory/warehouse of the US, UK, Singapore, and JP was designed.

The scope of the global system covered the core corporate functions of the company. The core corporate functions included sales, distribution, production, purchasing, accounting, and product costing. Fig. 8-3 shows the structure of the global system based on a unified database