

CHAPTER 1

INTRODUCTION

One of the most popular production and inventory control (P&IC) systems is Manufacturing Resources Planning or MRP II. A main objective of the MRP philosophy is to generate the production and purchasing plans according to the customer's demand. So far many features have been integrated to the MRP II system and called as Enterprise Resources Planning or ERP. The features added into the MRP II package can be summarized as follows:

1. Finance and Accounting area: Some features such as General Ledger Accounting (GL), Account Receivable (AR), Account Payable (AP), Cash Management (CM), and Assets Accounting (AA) are integrated to the package.
2. Costing Control area: The Product Costing and Cost center accounting are added into the package.
3. Sales and Distribution area: Pricing and Condition, Warehouse Management and Consignment Sales are developed and integrated.
4. Job Scheduling area: Advance scheduling optimizer is integrated to the package in order to obtain the feasible schedule together with the desirable performance measures.
5. Quality Management area: Analysis and Statistical Process Control (SPC) have been added in order to perform the quality analysis in each process.
6. Maintenance area: A Plant Maintenance feature is added to the package for handling the maintenance functions.

The added features are only the examples. Actually, there are so many features added into the standard MRP II package in order to increase its efficiency. There are various ERP packages launched in the world such as SAP, Oracle, Peoplesoft, JD Edwards, IFS, and Microsoft AXAPTA. These ERP packages have been developed based on the practice of the developed country. All features added into the software are the main point to make their price very high. By the success stories of the implementation in the developed countries, the developer of these software try to extend the market to the developing countries such as Thailand. Industries in Thailand can be classified into three categories, small-to-medium, medium, and big industries. Only the medium- and big-sized Thai industries can afford these ERP packages whereas the rest of them could not. A main reason why the small- to medium-sized industries (SMIs) could not afford these ERP packages is that they do not have enough funds to invest on these packages. A minimum budget to implement the ERP package is about 5 million Baht based on IFS and AXAPTA. For the SAP, Oracle, Peoplesoft, and JD Edwards, the minimum budget is about 10 million Baht. The cause of high investment is that there are many features integrated into these packages. Some features are very useful for Thai SMIs whereas others are not necessary. For instance, run application on web browser, advance Planning optimizer, electronic data interchange (EDI) with customers and suppliers, and hi-end database such as the Oracle.

This leads us to study the current practice of P&IC system of Thai SMIs in order to develop a software package which is appropriate and affordable for Thai SMIs.

1.1 Problem statements.

The characteristics of Thai SMIs which create P&IC problems are shown as follows:

- **Vendors are unreliable in terms of both quality and delivery.**

Late delivery of raw materials and purchased parts from suppliers always occurs. Therefore, jobs or orders may not be released to shop floor without material on-hand because there is a high chance that the material will arrive late and the jobs cannot be processed. Moreover, even the material arrived on time, it may be bad quality, and the jobs cannot be processed. This characteristic requires that the jobs, which should be scheduled in immediate future, must have good quality material on-hand in order to avoid a production delay due to unavailability of raw materials.

- **Urgent orders.**

Behavior of Thai customers is that they always place urgent orders. The urgent orders normally require only small amount of product, and very short lead-time. The urgent orders require almost immediate insertion into the current production schedule, and immediate revision of production schedule. This may result in production disruption and confusion. A main reason for placing the urgent orders is an unexpected production quality problem in customer's factory that consumes additional parts and materials. When the customers place the urgent orders, it means that they have strong need for that product. Therefore, the urgent orders cannot be rejected.

- **Promise a reliable due date of new customer orders as soon as possible.**

After customers place orders, sales and planning sections of the company must be able to check available production capacity and possible production schedule for the new orders and negotiate on the reliable due date of the new orders. If the due date is different from what the customer requires, the customer may change his production schedule accordingly or may order from other suppliers. Therefore, this characteristic needs the software which can generate the production schedule in a short time.

- **Bottlenecks and Capacity problems on work centers.**

Because Thai SMIs have limited fund to invest on machines and equipments, the production processes that require expensive machines and equipments tend to be the bottlenecks and have serious capacity problems. In contrast, the process that requires only workforce tends to have excess capacity because the labor cost is relatively cheap. This characteristic makes the performance of conventional MRP system unsatisfactory.

Due to the characteristics above, a computerized system must be applied in order to solve the problems which are caused by Thai SMIs characteristics.

Thai SMIs do not have enough funds to invest on commercial ERP software. A minimum budget for commercial software is about 5-10 million Baht which is still very high for Thai SMIs. Therefore, An ERP software which is appropriate for and affordable by Thai SMIs should be developed.

In this dissertation, we try to develop the software which can serve these characteristics and propose a new method for integrating MRP and Finite Capacity Scheduling (FCS). This method is called Finite Capacity Material Requirement Planning (FCMRP) system. The performance of the proposed FCMRP system will be tested by implementing to some selected manufacturing companies.

The objectives of this study are summarized as follows:

- To study and summarize the current practices of some selected Thai SMIs.
- To develop the P&IC software package which is appropriate for Thai SMIs.
- To develop a new Finite Capacity Material Requirement Planning (FCMRP) algorithm to remedy the capacity problem of conventional MRP systems.

1.2 Overview of this dissertation.

This dissertation is divided into eight chapters. The first chapter deals with introduction, problem statement, objectives, and overview of this dissertation. Chapter two deals with literature review of the P&IC system. The reviews include a brief of the basic P&IC systems namely, JIT, OPT, and MRP, the differences among these systems, shortcomings of MRP II system, Shop Floor Control (SFC) system, Finite Capacity Scheduling (FCS) system, and Finite Capacity Material Requirement Planning (FCMRP) system. Chapter three presents the current practices of P&IC system in Thai SMIs. Chapter four presents a development of Thai Small-to Medium-sized Production and Inventory Control Software (TSPICs). The features of TSPICs and its implementation are discussed in this chapter. Chapter five presents an algorithm of the first generation of FCMRP system and its performance. The FCMRP system in this chapter is developed based on non-optimization approach and called NFCMRP system. This chapter also describes the environment of a selected manufacturing company such as products, bill of materials, work stations, together with experiments and performance measures. The dependent and independent variables of the experiments will be discussed in this chapter. Chapter six presents another type of FCMRP system. The FCMRP system in this chapter is developed based on optimization approach and called OFCMRP system. A conventional FCMRP (CFCMRP) system is also discussed in this chapter. The performance of CFCMRP and OFCMRP systems is discussed in this chapter. Chapter seven deals with an improvement of NFCMRP system called IMFCMRP system. A comparative study of IMFCMRP and OFCMRP systems is also discussed in this chapter. Finally, the conclusions and recommendations for the further research are discussed in the last chapter.