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Design and Development of Material Requirement Planning (MRP) Tool for an Electronic Product Manufacturer

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Abstract

Material Requirement Planning (MRP) has been widely used in the manufacturing industries as a tool to determine the purchase of the correct components in order to meet the delivery date of the customer demand. The current method to plan material purchases has caused the company various material discrepancies and human errors are unavoidable. Therefore, the aim of this project is to design and develop a MRP system to improve the efficiency of the material planning and ordering process. Databases were developed using extensive data on Bill of Material (BOM), inventory, lot sizes and customer demand and were integrated to produce a report on planned order release for the purchasing department to execute. In addition, the MRP system is also able to provide information regarding the capability of the production line to complete the customer demand on time.

Keywords: Material Requirement Planning (MRP), Bill of Material (BOM), Planned Order Release

1. INTRODUCTION

For a small business owners inventory can be one of the more visible and tangible aspects of doing business. Inventory refers to stocks of anything necessary to do business. These stocks can represent a large part of the business investment and must be well managed in order to get the optimum profits. Many small business cannot absorb the types of losses contribute from poor inventory management [4]. Companies need to control the types and quantities of materials they purchase, plan which products are to be produced and in what quantities and ensure that they are able to meet current and future customer demand, all at the lowest possible cost. Making a bad decision in any of these areas will make the company lose money.

In manufacturing industry, two types of system has been used which is push and pull system [3]. For the push system, the manufacturers produce without considering the customer demand. Manufacturer will allocate the entire source and produce as many as they can do. While, pull system is a method of controlling the flow of production through the factory based on a customer's demand. Pull systems control the flow of resources in a production process by replacing only what has been consumed.

Implementing pull system in manufacturing industry can contribute to waste elimination in handling, storing, and getting products deliver to the customer. In order to implement pull system, MRP is one of the important tools that can be used and can reduce the inventory level. MRP is said to be used in for companies seeking for perfection and also a planning and scheduling technique used with fixed lead time [2], [6].

2. MATERIAL REQUIREMENT PLANNING (MRP)

The Material Requirement Planning (MRP) has being developed around 1960 by Joseph Orlicky and Oliver Wight in USA. The main objective of using Material Requirement Planning (MRP) is to determine number of raw material, components and finished products needed for production at the right time, right part and in the right quantity. MRP is a system that attempts to reign in material needs [6]. This is important in order to maintain the lower level of raw material in inventory. MRP system is also more often adopted by manufacturing companies with complicated manufacturing process (assembly and fabrication process) than companies with continuous process flow [1].

Material Requirement Planning (MRP) has been the most widely implemented large-scale production management system since the early 1970s, with several thousand MRP type systems being implemented in industry around the world. MRP is a time series analysis tool which used to plan purchasing and production to meet customer demand. This tool is really helpful because it will determine the entire components at a right time, right part and right quantity. Furthermore MRP also will provide a time schedules to order a parts or raw material. A complete MRP system (Figure 1.0) will consists of the input, process and output.

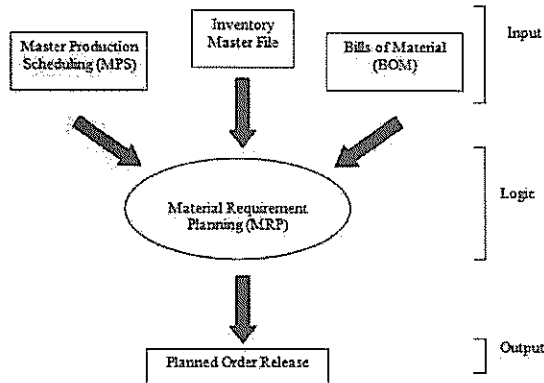


Figure 1.0: A Complete MRP System [5]

3. MRP SYSTEM DESIGN

The design of the MRP system began with the requirement gathering through discussions with various department personnel to identify the issues with the current material ordering system. Initial data gathering was also conducted to analyze the critical data availability and the need to design spreadsheet templates for the MRP database. Table 1.0 shows the basic design of the MRP system consisting of the input, logic and also the expected output.

Table 1.0: Basic MRP System Design

No	MRP System	Data Requirement	Remarks
1	Input	a) Master Production Scheduling (MPS)	-customer demand -date -lot sizing technique
		b) Bill of Material (BOM)	-define the product structure -lead-times for each components
		c) Inventory Master File (IMF)	-on-hand inventory -schedule receipt -specific lot size
2	Logic	EOQ Model	-data interpret -determine lot sizing
3	Output	Planned order release Order release	

In addition, a database for the production standard time was also added to the MRP design for the purpose of human resource planning. Table 2.0 shows the departments responsible to provide the required information for the purpose of the database development.

Table 2.0: Department and Data Requirement

No	Departments	Data	Remarks
1	Planning	a) Customer demand	-Master Production Scheduling
		b) Working Hours	-Human Resource Planning
2	Engineering	a) Product Structure and Usage	-Bill of Material
		b) Standard Time	-Human Resource Planning
3	Inventory	a) On-hand Inventory	-Bill of Material
		b) Schedule Receipt	-Inventory Master File
		c) Previous Order	-Inventory Safety Level
4	Purchasing	a) Lead times	-Bill of Material
		b) Safety Level	-Inventory Safety Level

As a result, a total of seven databases were required to be developed for the MRP system namely:

- a) Master Production Scheduling (MPS)
- b) Bill of Materials (BOM)
- c) Inventory Safety Level (ISL)
- d) Inventory Master File (IMF)
- e) Material Requirement Planning (MRP)
- f) Planned Order Release (POR)
- g) Human Resource Planning (HRP)

The databases will then be integrated using computer programming logic in Excel Spreadsheet to produce the expected output of material Planned Order Released. The database integration is the critical stage in the MRP system development and requires skills in programming to translate the formula to calculate the ISL, MRP and HRP into logic for data interpretation. Figure 2.0 illustrates the conceptual database model design for the MRP system being developed.

MRP	HRP	MPS
5	237.5	0
5	132	0
5	165.5	0

Figure 4.0: Human Resource Planning Screen

These reports were verified using two case studies data and then validated using actual company's data. To guide the users on the MRP system usage, a standard operating procedure was developed. During the MRP system testing stage, the users were required to provide their feedbacks regarding the new MRP system effectiveness by responding to the questionnaires provided by the MRP systems developer. From the scoring matrix result, the users agreed that the software is 72.75% more efficient than the current method of material planning.

5. CONCLUSION

The design and development of the MRP system for the electronics product manufacturer has proven to be very helpful and a more efficient alternative to the material planning department of the company. The system is now able to calculate the buffer stock level due to the availability of inventory safety level (ISL) information from the system. In addition, the additional tool on human resource planning (HRP) integrated to the master production schedule (MPS) provides the much needed information on the operator's availability to meet the required customer demand.

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