

CHAPTER 3

METHODOLOGY

3.1 Project Planning

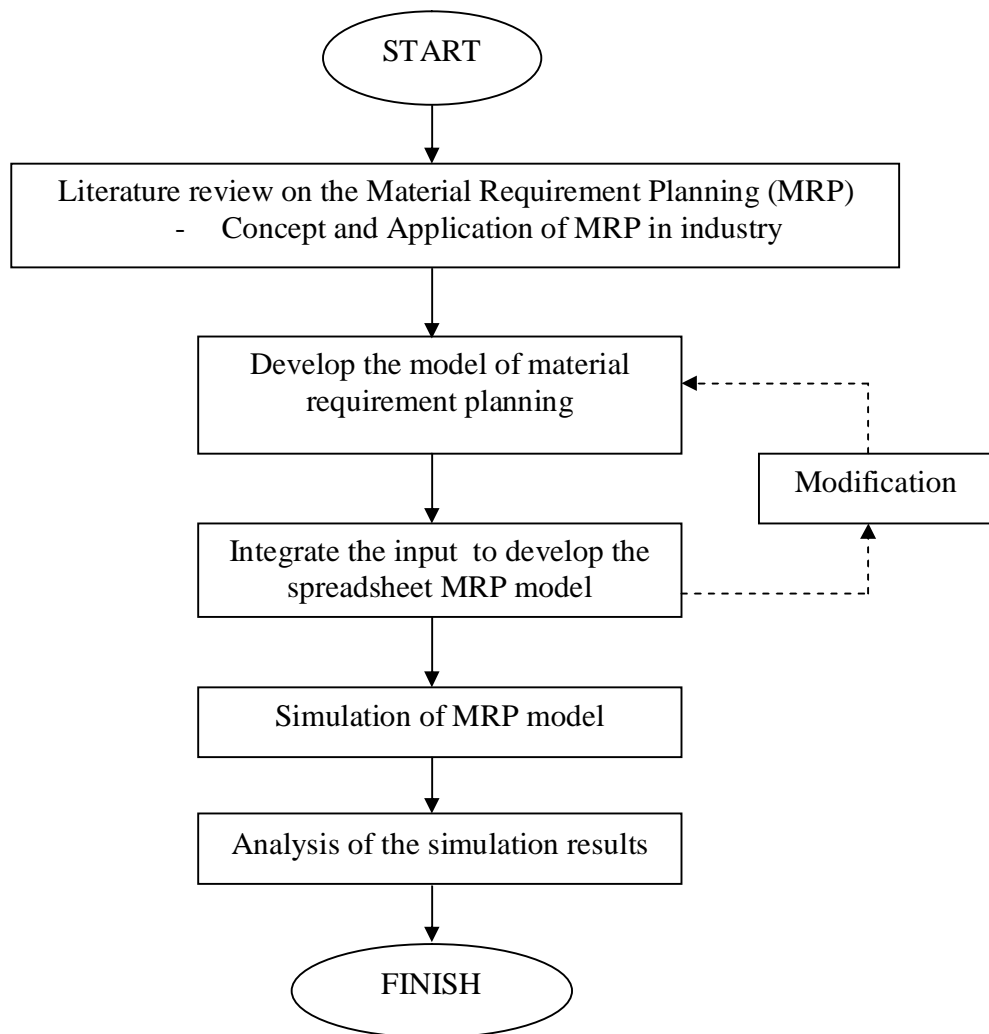


Fig. 3.1: Methodology Approach

As seen in Figure 3.1, the methodology approach begins with the find literature review on MRP. This phase consists in obtaining an adequate understanding the theory and application behind the MRP in order to develop the spreadsheet model. The process continues with developing of MRP model. The mathematical model related to MRP will establish to represent the MRP system. There are few criteria to build the MRP model. Before build the model, the overall system that the company used needs to consider like gross requirements, scheduled receipts, on-hand inventory and net requirements. After develop the mathematical model for each criteria above, next step is to integrate all of controllable input to get the output (result). Integration process take 4 steps: explosion, netting, offsetting and lot sizing. If there are some corrections or adding the controllable inputs, the process goes back to developing model. Last step in this methodology approach is simulation of MRP model using software. In this project, the software that suitable for this simulation is Excel 2007. Mathematical model that we used above will be insert into the software and integrate with bill of material of product. From the simulation, analysis will be conduct to test the model is able to solve the problem.

3.2 Develop the model of material requirement planning

Before starting to develop the model of MRP, an MRP system requires four specific types of information: a schedule of planned production for end of product or master production schedule, a list of all components of the product according to the product structure (BOM), lead times for producing, purchasing and assembly all components and material required and information about current inventory levels. The master production schedule for a product specifies how much of the end product is needed or is to be produced and when. The MPS is divided into time periods called time buckets. These time buckets are usually conventional units of time, most frequently weeks. The bill of material lists for each end product all assemblies, sub-assemblies, components and raw materials necessary to produce the product. A BOM, shown in Fig. 3.2 is product that will study to develop the spreadsheet model. The more detail of this product can refer to Appendix I.

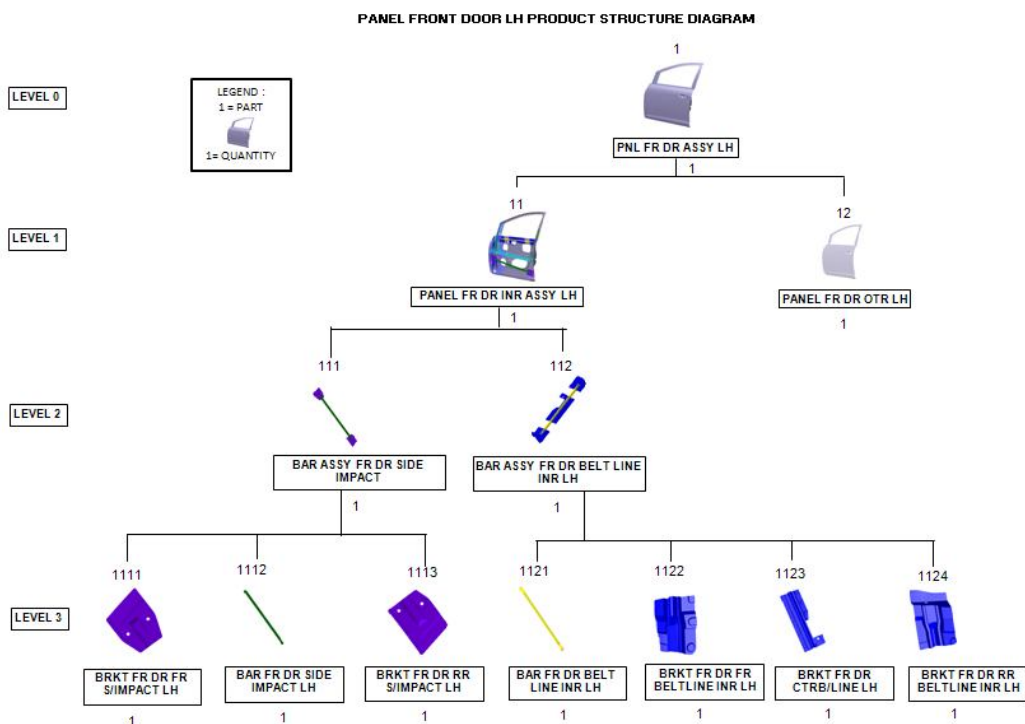


Fig. 3.2: Bill of material for Panel Front Door Left Hand Side Assembly. [6]

The lead time in MRP is often dynamic and highly variable. In such situations, the statistic used for lead time is, at best, the latest available value. As the lead time changes, the entire materials plan changes. Thus, the lead time statistic must be kept as accurate as possible. In situations in which the lead time is hard to estimate, the system should be given a longer and safer estimate. The lead time for all the components in the Panel Front Door Left Hand Side Assembly are shown as in Table 3.1.

Table 3.1: Lead time for Panel Front Door Left Hand Side Assembly

Level No.	Item No.	Item Description	No. Required	Lead Time
0	1	Panel Front Door LH Assy	100	1
1	11	Panel Front Door Inr LH Assy	100	1
1	12	Panel Front Door LH Otr	100	3
2	111	Bar Assy Fr Dr Side Impact	100	1
2	112	Bar Assy Fr Dr Belt Line Inr Impact	100	1
3	1111	Bracket Fr Dr Fr S/Impact LH	100	1
3	1112	Bar Fr Dr Side Impact LH	100	1
3	1113	Brkt Fr Dr Rr S/Impact LH	100	1
3	1121	Bar Fr Dr Belt Line Inr LH	100	1
3	1122	Brkt Fr Dr Fr Beltline Inr LH	100	1
3	1123	Brkt Fr Dr Ctr B/Line LH	100	1
3	1124	Brkt Fr Dr Rr Beltline Inr LH	100	1

The manufacturing process explosion and lead time system follows the master schedule update and extends the finished goods orders to purchasing and shop orders. The process explosion is not a bill of material that merely lists the quantities of each item in the final product; rather, it is a manufacturing process breakdown of the product. In the explosion process, the end products will disassembly into its component. Using the assumption of master production schedule and the BOM as in Fig. 4.1, the product structure will descend and evaluate for each parent its required quantity of children. This gives gross requirement for each element of the BOM. This process is demonstrated in the Table 3.2

Table 3.2: Explosion Process for Panel Front Door Left Hand Side Assembly.

	Item number	Gross requirement
Level 0	1	100
Level 1	11	100
	12	100
Level 2	111	100
	112	100
Level 3	1111	100
	1112	100
	1113	100
	1121	100
	1122	100
	1123	100
	1124	100

In brief summary, the manufacturing parts explosion and lead time system translates the finished goods demand schedule into a plan for when and how many of each item must be in the inventory. This system is, therefore, at the heart of MRP. It generates the materials requirement plan for all inventories, from purchased items through finished product.

The process continues to identify the mathematical model to develop the MRP model. First step is to calculate beginning inventory. It's the number of items in the inventory at the beginning of the period.

$$\boxed{(BI)_t = (BI)_{t-1} - (GR)_{t-1} + (SR)_{t-1}} \dots \text{(Equation 3.1)}$$

Where

$(BI)_t$ = beginning inventory at t ,

$(GR)_t$ = gross requirement for t ,

$(SR)_t$ = scheduled receipts in t .

Obviously, if the calculation gives a negative $(BI)_t$, then $(BI)_t$ is set to zero. Next step is calculate the netting requirements, quantity actually needed to be received or produced in a particular period. This is found by

$$\boxed{(NR)_t = (GR)_t - (SR)_t - (BI)_t} \dots \text{(Equation 3.2)}$$

Where

$(NR)_t$ = net requirement

The last two steps in the MRP process are offsetting and lot sizing. In offsetting, the timing of order released is determined. In order to meet net requirements, an order released is offset by the production lead time or supplier delivery time.

$$\begin{aligned} (\text{POR})_t &= (\text{NR})_t \text{ for } (\text{NR})_t > 0 \\ &= 0 \text{ for } (\text{NR})_t \leq 0 \end{aligned}$$

..... (Equation 3.3)

Where

$(\text{POR})_t$ = Planned order receipts at t

Lot sizing is the step in which the batch size to be purchased or product to be determined.

$$(\text{PREL})_t = (\text{POR})_{t+L}$$

..... (Equation 3.4)

Where

$(\text{PREL})_t$ = Planned order released

All of the mathematical model shows above will be used and apply to develop the spreadsheet MRP model for Panel Front Door Left Hand Side Assembly.

3.3 Integrate the input to develop the spreadsheet MRP model

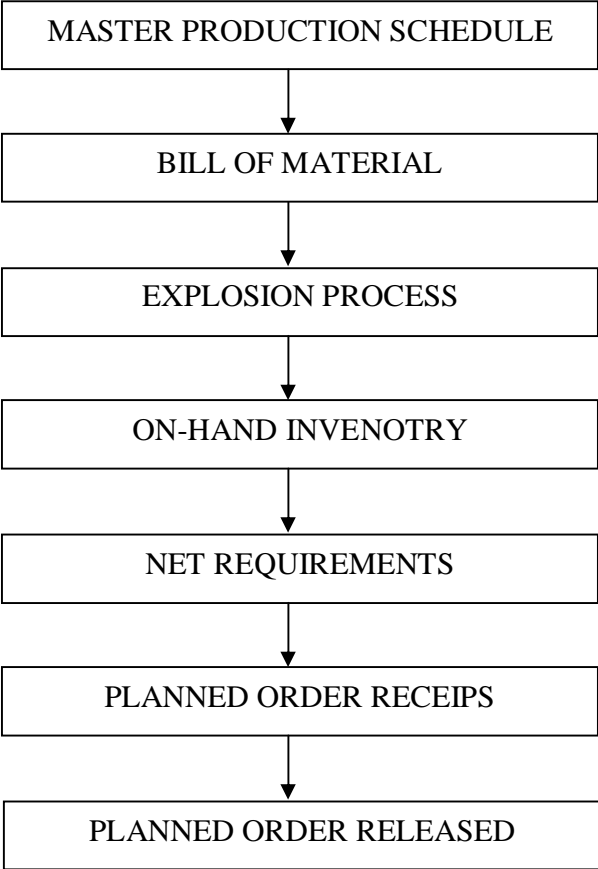


Fig. 3.3: Flow of MRP model.

3.3 Simulation of MRP model

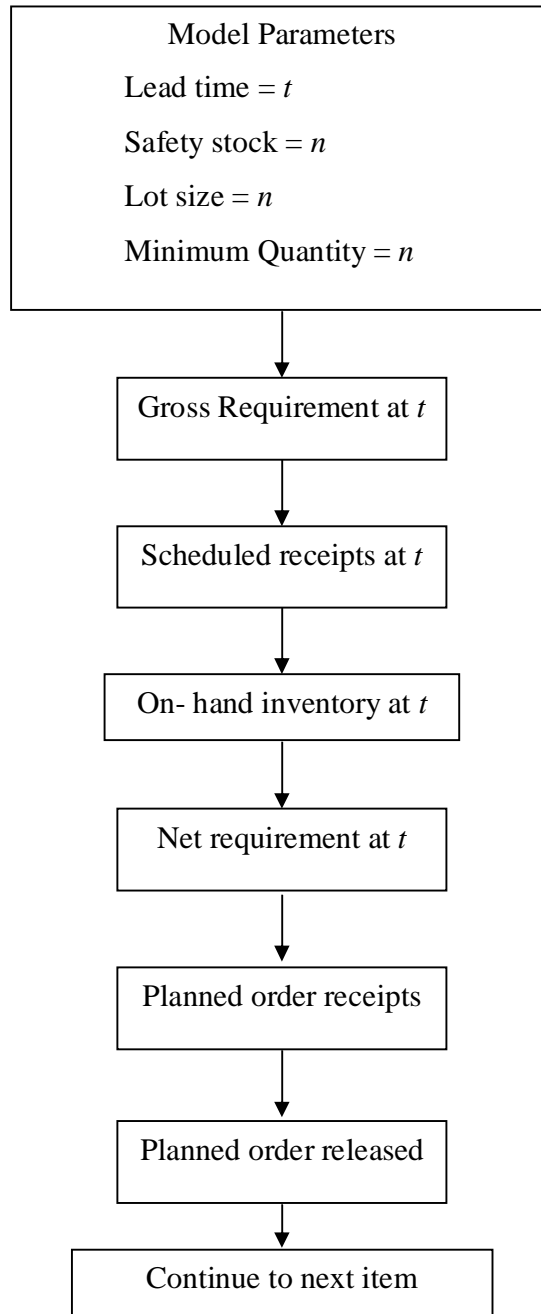


Fig. 3.4: Flowchart of MRP Simulation

Using simulation to perform MRP model for Panel Front Door Left Hand Side Assembly need a lot model parameters and inventory status before MRP model can be simulated using Excel 2007. The advantages of simulation are it can reduce the risk of quantity orders and lead time uncertainties.

Excel MRP module requires a careful entry of several pieces of data. The initial MRP screen is where developer enter (1) the total number of occurrences of items in the BOM (including the top item), (2) what we want the BOM items to be called (i.e., Item no., Part), (3) total number of periods to be scheduled, and (4) what developer want the periods called (i.e., days, weeks). Excel second MRP screen provides the data entry for an intended bill of material. Here developer enters (1) the name of each item in the BOM, (2) the quantity of that item in the assembly, and (3) the correct indent (i.e., parent/child relationship) for each item. The indentations are critical as they provide the logic for the BOM explosion. The indentations should follow the logic of the product structure tree with indents for each assembly item in that assembly. Excel third MRP screen repeats the intended BOM and provides the standard MRP table for entries. Model parameters of each item need to be highlight before develop the spreadsheet modelling. As in Fig. 3.4, there are four model parameters: lead time of product, safety stock, lot size and minimum quantity. The MRP simulation start at entering the gross requirement unit for Item at Level 0 at time, t . Then, the current status inventory of Item at Level 0 is detected: scheduled receipts and on inventory status at time, t . The program calculated the net requirement by unit of gross requirement minus the unit of scheduled receipts and on hand inventory using mathematical model apply at spreadsheet modelling. If the value of unit of net requirements is positive, the planned order receipt is detected and finally the planned order released, the output from this spreadsheet is measured. The simulation continues to the next item of part from Level 0 item to the last level of items.