MRP Simulator Manual

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MRP

American Production and Inventory Control Society defines MRP as:

"A set of techniques that uses bill of material data, inventory data, and the master production schedule to calculate requirements for materials. MRP makes recommendations to release replenishment orders for material" (American Production and Inventory Control Society. APICS dictionary. *APICS Dictionary,*)

Material requirement planning (MRP) was initially developed by Joseph Orlicky in 1961.

Basic assumptions of MRP are:

- Infinite capacity,
- Known and Constant Lead-time,
- Accurate stock status, and
- Constant demand

A typical MRP system works as shown in Fig.1.

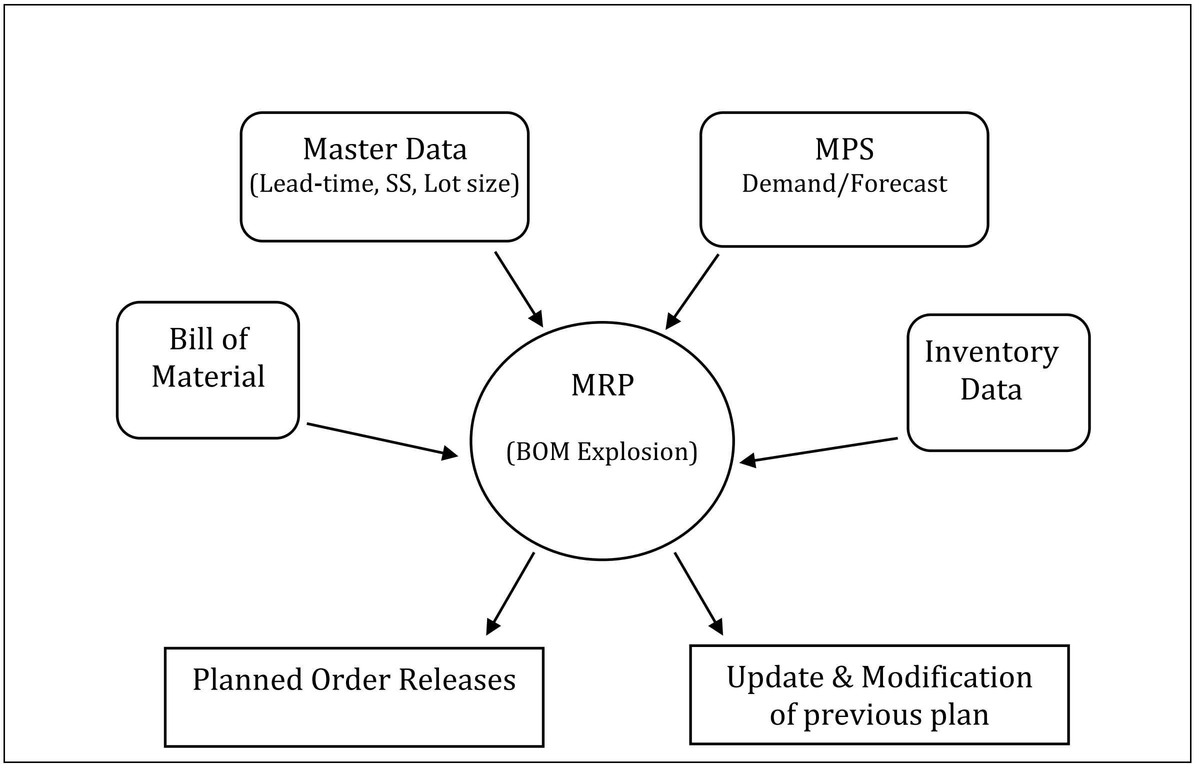


Fig.1. MRP system.

MRP Functions

As we can see in the outputs of a MRP system shown in Fig.1, it has two main functions:

- Determining requirements: By planning and controlling the inventory of components, the MRP system aims to make the right materials in the right quantity to be available at the right time to meet the demand of period (t) .
- Priority Planning: Despite the deterministic assumptions of the system, material planning takes place in a completely stochastic environment in which due to changes in demand, supply arrival time, machine breakdown, and etc. the MRP system should update the plan by planning the priorities at the time.

MRP Processing Logic

Before going through the processing logic let's have a look at some of the terms we will see in this section.

The table shown in Fig.2 can be an example of the plan, output by MRP:

Item	FG1							
Lot-Size	50	Units						
Lead-Time	2	Weeks						
On-Hand	48	Units						
Safety Stock	20	Units						
Week		1	2	3	4	5	6	7
Gross Requirements			50		45	20		40
Scheduled Receipts		50						
On-Hand	48	98	48	48	53	33	33	25
Net Requirements		0	0	0	17	0	0	27
Planned Order Receipts					50			50
Planned Order Releases			50			50		

Fig.2. MRP logic process.

Lot/Batch Size: The number of units of each item that will be supplied in single planned order. For instance in Fig.2 the net requirement of week 4 is 17 units but the order receipt is 50 units due to the lot size. It can be computed using different lot sizing techniques such as Fixed Order Quantity (FOQ), Economic Order Quantity (EOQ), Lot-for-Lot (L4L), Period Order Quantity (POQ), and Least total cost.

Lead-time: Is the total time required for a process to be complete. For example it can be the total time required to manufacture an item or the time from ordering a purchased item and receiving it at the required premise. For example, in Fig.2 the lead-time for item FG1 is 2 weeks. It means that since the order for manufacturing or purchasing of the item is send it will take 2 weeks for the Item to be manufactured or physically available at the right place.

On-Hand: Is the quantity of the item, which is physically sitting in the warehouse. In Fig.2 the on-hand quantity for time (t) is calculated as below:

On-Hand (t) = On-Hand (t-1) + Schedule Receipt (t) + Planned Receipt (t) – Gross Req. (t)

In above example the on-hand quantity cannot be less than 20 units because based on the master data at least 20 units should be available in the inventory to satisfy the safety stock level.

Safety Stock (SS): The level of extra Stock kept in the warehouse to be prepared to mitigate the uncertainties and avoid stock-outs or lost sales. Safety Stock level

$$SS = z \times \sigma\sqrt{L}$$

formula (based on constant lead-time) is:

Gross Requirements (Gross Req.): Total number of an item required to be available at period (t). For example, total forecasted customer orders or total number of units of a component required to manufacture different products in period (t).

Scheduled Receipt: An incoming supply that will be replenished at period (t).

Net Requirements (Net Req.): The minimum quantity required to fulfill the demand at a given time. The calculation of Net Requirement at period (t) is as

Net Req. (t) = Gross Req. (t) + SS – On-hand inventory (t-1) – Schedule Receipt (t)

below:

Planned Order Receipt: The quantity of the item, which is planned to be ordered so that it will be available at the beginning of period (t) to meet the net Req. of that period. The planned order receipts are multiples of the item's lot/batch size (Except for cases that the lot size is L4L).

Planned Order Release: Incorporates the lead-time of the item into the planned order receipt so that the item will be received at the planned period. Planned order release quantity is also a multiple of the item's lot/batch size (Except for cases that the lot size is L4L).

MRP processing logic consists of four steps:

- First, after feeding all the required inputs into MRP, it starts by updating the current on-hand quantities of the inventory.
- Second, it computes the net requirements by deducting total available inventory from total required quantities.
- Now that the Net Req. is known, if it is positive, MRP will plan an order receipt and release for period (t) based on the master data available in the system.
- Finally, the system calculates the on-hand inventory for period (t).

MRP Simulator

Since the introduction of MRP by Orlicky in 1960s many computerized MRP systems have been developed by different software companies. As mentioned earlier the basic assumptions of MRP are deterministic while the real world is dominated by stochastic components such as the actual demand deviating from the forecast or the failure of the supplier in sending the raw material based on the promised date, or a simple machine break-down and so on. In the existing MRP systems the users are not able to apply these probable scenarios and analyze the results in order to be able to make a better decision that fits their individual uncertain environment.

In this simulator, which is developed on excel file using VBA macros, the user is able to receive the MRP analysis for four different scenarios (scenario 0, 1, 2, 3 & 4). That is while other MRP systems provide the report only for scenario 0, which is the deterministic one.

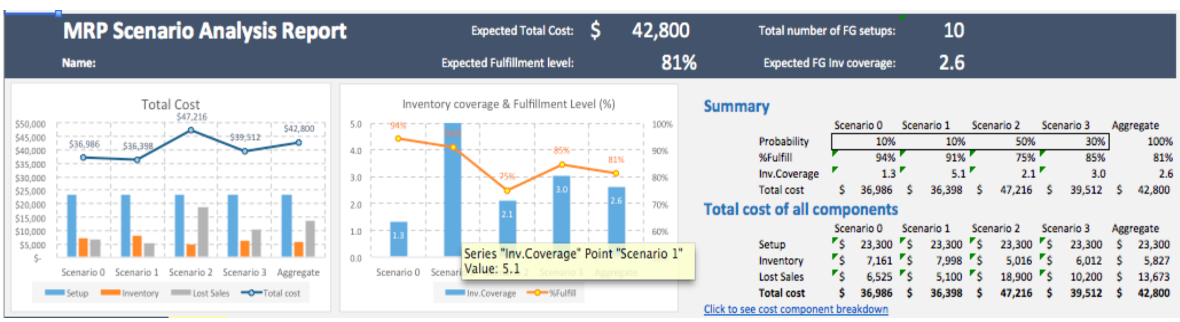


Fig.3. MRP Scenario analysis report

Moreover, the user can simply manipulate the lead-time and the composition of the BOM to make a comparison on different cost components and make the final decision. A screen shot of the file is shown in Fig.4. This MRP simulator is easy to work with and guides the user in every step of the process. As shown in Fig. 4, the user introduces his demand profile to the system in the "demand profile" worksheet and then simply goes through step 1 to 4 and inputs the required data in "START" worksheet. Finally, clicks on the "Run MRP" button and generates the plan. Then the system provides the user with MRP plan and a scenario analysis report.

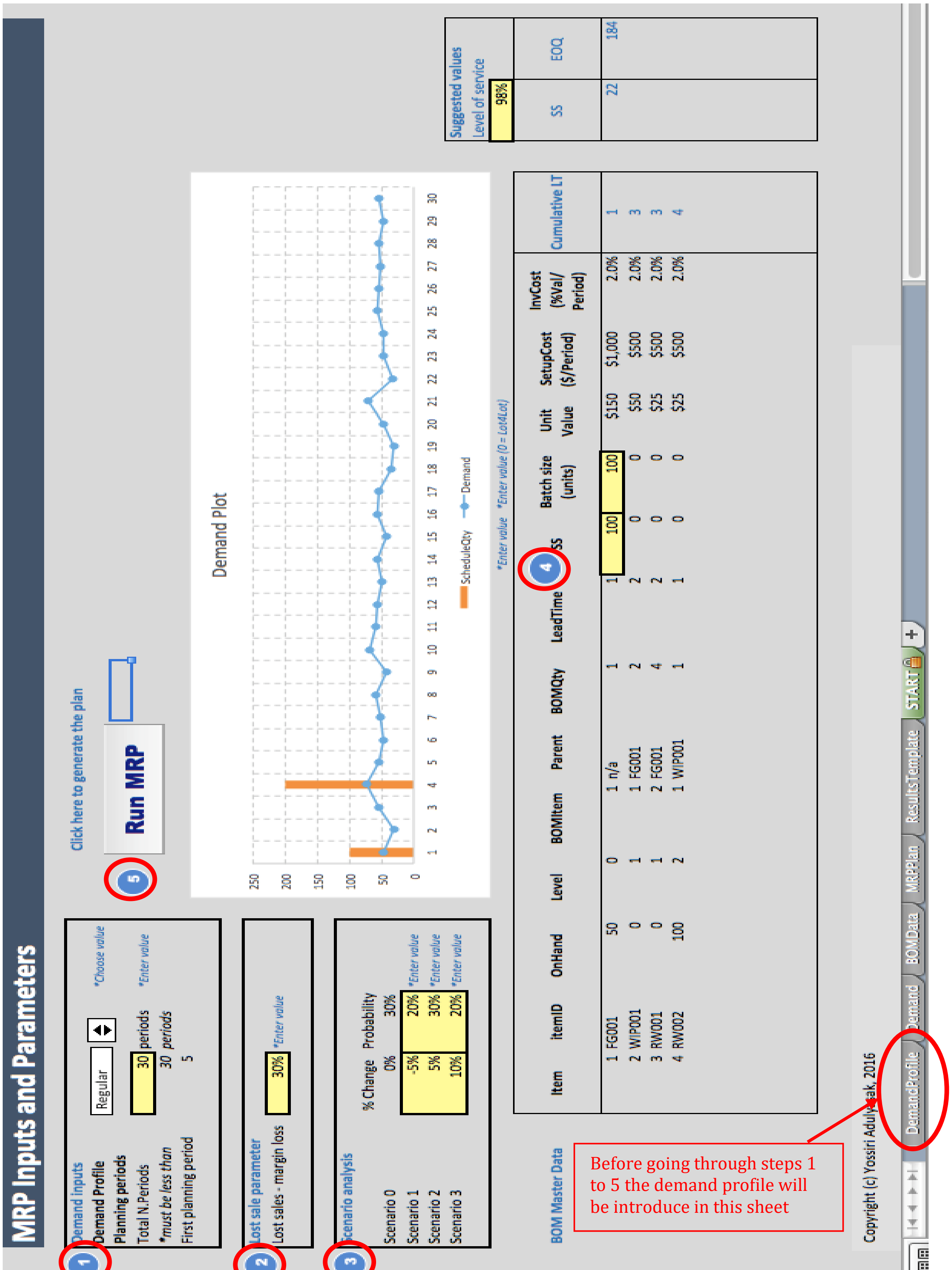


Fig.4. Screenshot of the “Start” sheet

There are 6 worksheets in MRP simulator excel file:

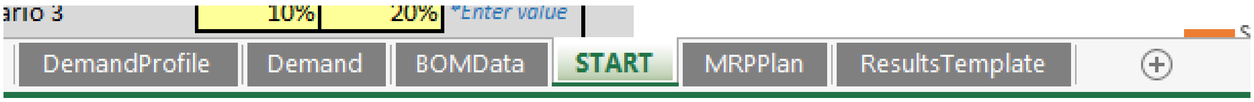


Fig.5.Different sheets in the excel file.

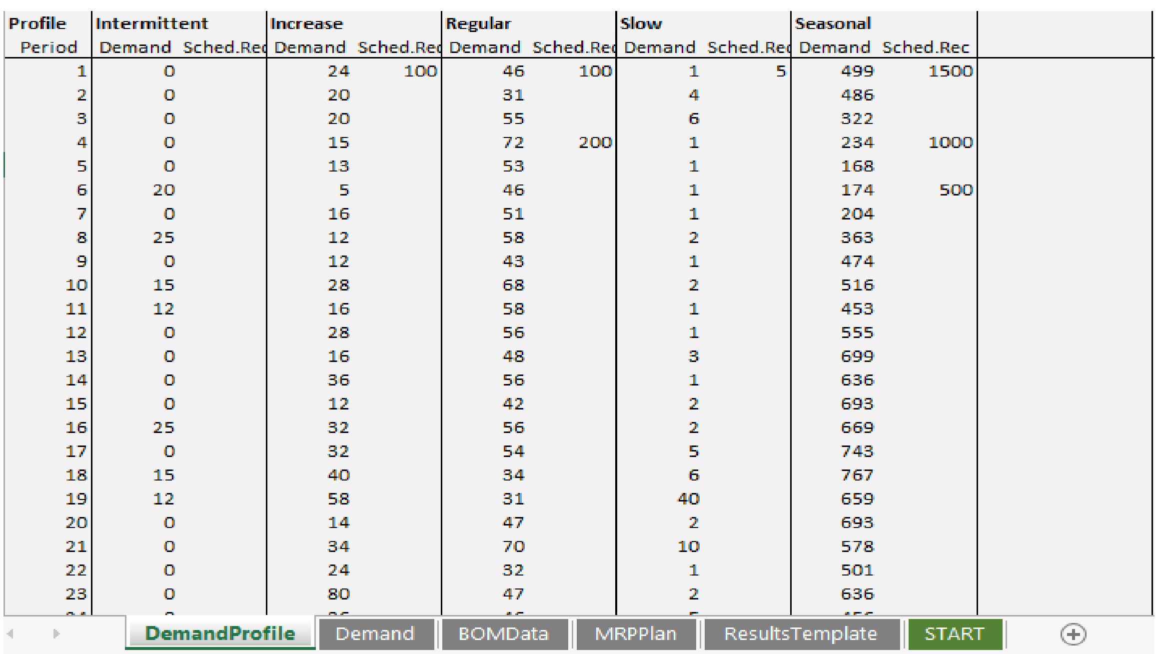
- Demand Profile: Contains the different demand patterns with their quantity per period and their corresponding schedule receipts.
- Demand: The selected demand pattern with its related schedule receipts will be appeared in this sheet ready for the MRP simulator to use it as input for its plan generating process and analysis.
- BOMData: The specification of the BOM will be stored in this sheet.
- START: The sheet that the user enters all the required inputs and runs the system to generate the plan and analysis.
- MRPPlan: The system outputs the MRP plan in this sheet.
- Results Template: An example of the MRP analysis that will be generated after clicking on the “Run MRP” button on “START” worksheet and will be stored in a separate worksheet.

Input

First we should feed the required data into the system before running it to generate the plan.

In this section we will discuss each step in detail.

Demand Profile Sheet

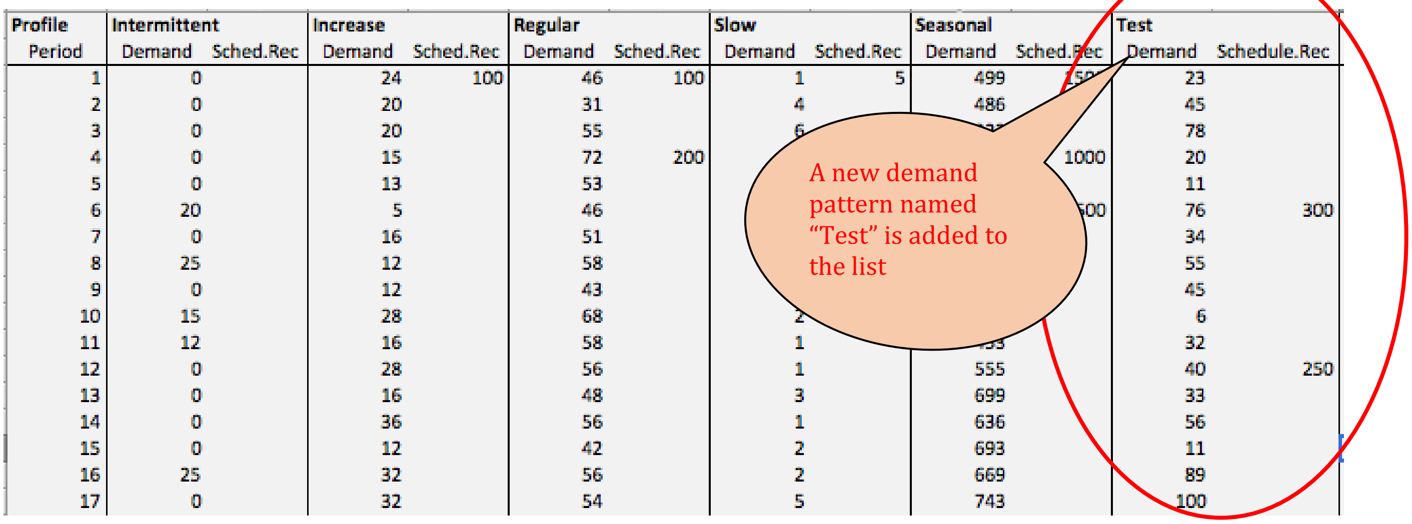


Profile	Intermittent		Increase		Regular		Slow		Seasonal	
Period	Demand	Sched.Rec	Demand	Sched.Rec	Demand	Sched.Rec	Demand	Sched.Rec	Demand	Sched.Rec
1	0		24	100	46	100	1	5	499	1500
2	0		20		31		4		486	
3	0		20		55		6		322	
4	0		15		72	200	1		234	1000
5	0		13		53		1		168	
6	20		5		46		1		174	500
7	0		16		51		1		204	
8	25		12		58		2		363	
9	0		12		43		1		474	
10	15		28		68		2		516	
11	12		16		58		1		453	
12	0		28		56		1		555	
13	0		16		48		3		699	
14	0		36		56		1		636	
15	0		12		42		2		693	
16	25		32		56		2		669	
17	0		32		54		5		743	
18	15		40		34		6		767	
19	12		58		31		40		659	
20	0		14		47		2		693	
21	0		34		70		10		578	
22	0		24		32		1		501	
23	0		80		47		2		636	

Fig.6. Demand Profile Sheet

As shown in Fig.6, five demand patterns already exist in this page. Demand quantities alongside with the schedule recipes are stored here (for the definition of schedule receipts you can refer to the MRP Logic section) for each demand pattern. Any changes to the demand profile including editing the demand and schedule receipt quantities, deleting or adding new demand pattern will be projected to the Demand profile drop-down on "START" worksheet, which we will review in the next part. As mentioned above, the users can edit or delete these demand patterns anytime. They also can add new demand pattern.

To add a new pattern, simply go to the column next to the last demand type and enter the specifics of the new one.



Profile	Intermittent		Increase		Regular		Slow		Seasonal		Test	
Period	Demand	Sched.Rec	Demand	Sched.Rec	Demand	Sched.Rec	Demand	Sched.Rec	Demand	Sched.Rec	Demand	Schedule.Rec
1	0		24	100	46	100	1	5	499	[illegible]	23	
2	0		20		31		4		486		45	
3	0		20		55		6		[illegible]		78	
4	0		15		72	200	[illegible]		[illegible]	1000	20	
5	0		13		53		[illegible]		[illegible]		11	
6	20		5		46		[illegible]		[illegible]	[illegible]	76	300
7	0		16		51		[illegible]		[illegible]		34	
8	25		12		58		[illegible]		[illegible]		55	
9	0		12		43		[illegible]		[illegible]		45	
10	15		28		68		2		[illegible]		6	
11	12		16		58		1		[illegible]		32	
12	0		28		56		1		555		40	250
13	0		16		48		3		699		33	
14	0		36		56		1		636		56	
15	0		12		42		2		693		11	
16	25		32		56		2		669		89	
17	0		32		54		5		743		100	

Fig.7. Adding a new demand pattern to the profile.

In Fig.7 the "Test" demand pattern is added to the profile. After adding "Test" to the demand profile, it will be appeared in the demand profile drop-down on "START" sheet and the user will have the option to select it as the demand type for MRP plan and analysis.

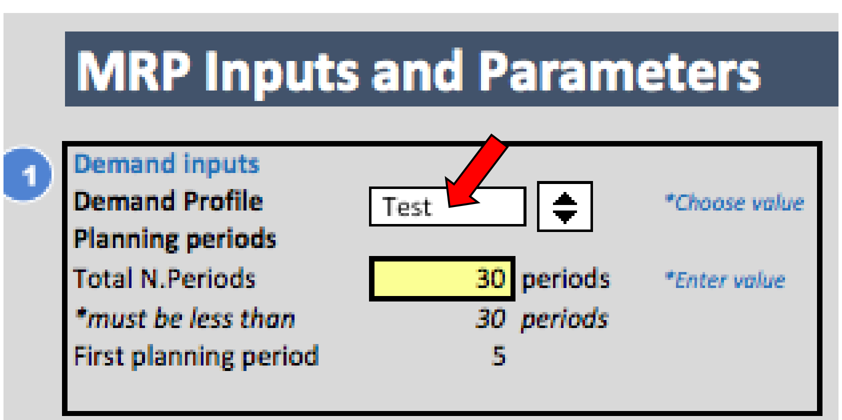


Fig.8. Newly added demand pattern appears in the demand drop-down.

Below you can find a brief definition of the existing demand patterns in the demand profile.

Intermittent demand: This pattern is characterized with several periods with zero demand while the other periods receive lumpy, variable demands coming at irregular pattern. In short, the demand quantity is 0 or a lump sum. For example, in Fig.9 you can see that the demand for period 1-5 is zero. Then it hikes to20 in period 6 and again falls to 0 in period 7.

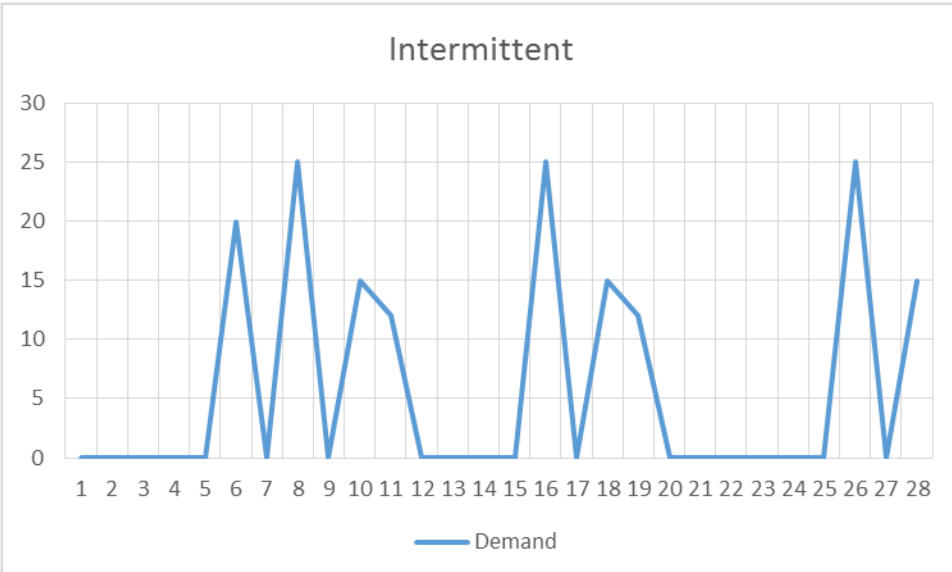


Fig.9. Intermittent Demand plot.

Increasing demand: The general trend in this type of demand is an increase in demand quantity by the time. For example, this pattern happens when a new product is introduced to the market and it has not got to its maturity level in its life cycle yet.

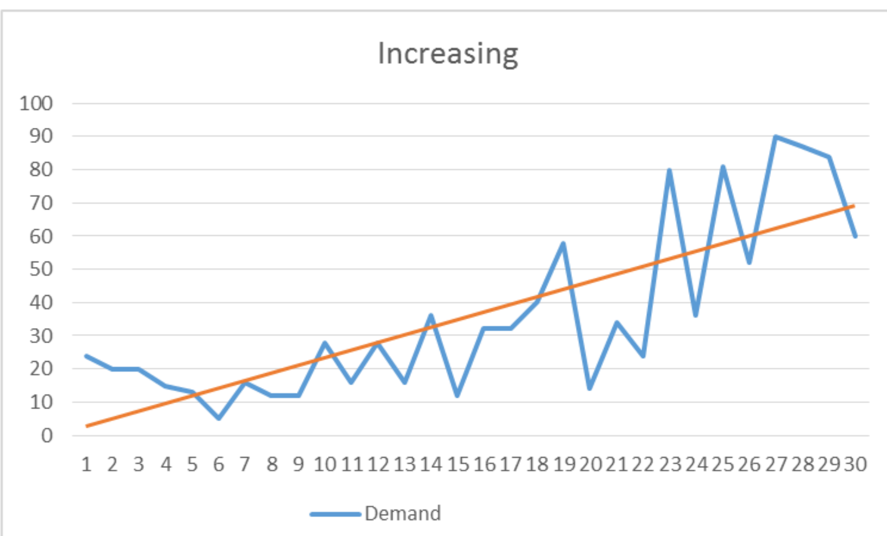


Fig.10. Increasing Demand plot.

Regular demand: This demand pattern follows the normal distribution pattern. The demand occurs regularly at each period in variable quantities but the majority of the demand quantities stay close to the mean. For example, in Fig.11 the average demand is around 50 units. Although there you can see some jumps and drops from the average demand but the demand quantity in majority of the periods stays around 50 units.

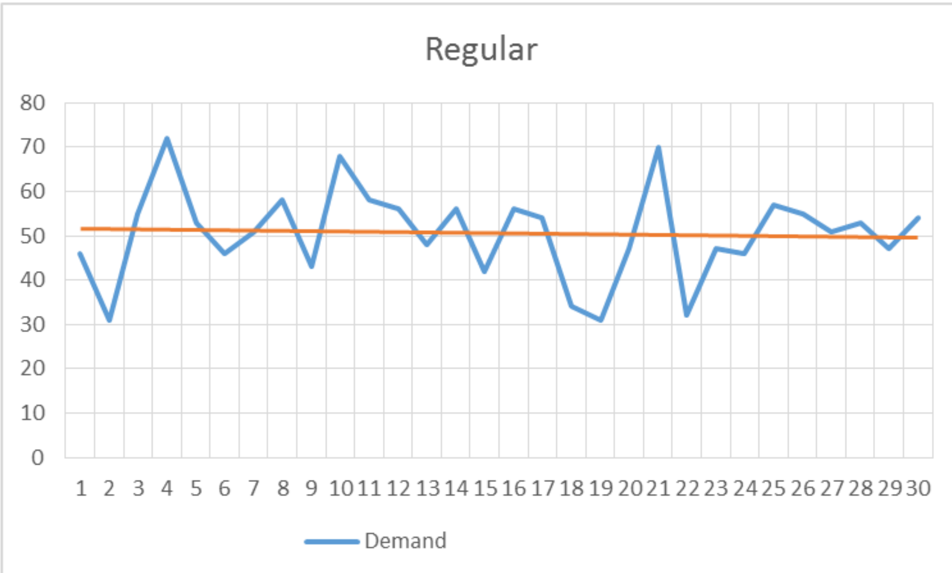


Fig.11. Regular Demand plot.

Slow moving items: As the name suggests these type of products have a very slow movement. They are products with low demand and tend to sit in the warehouse for longer time before they get out as an order.

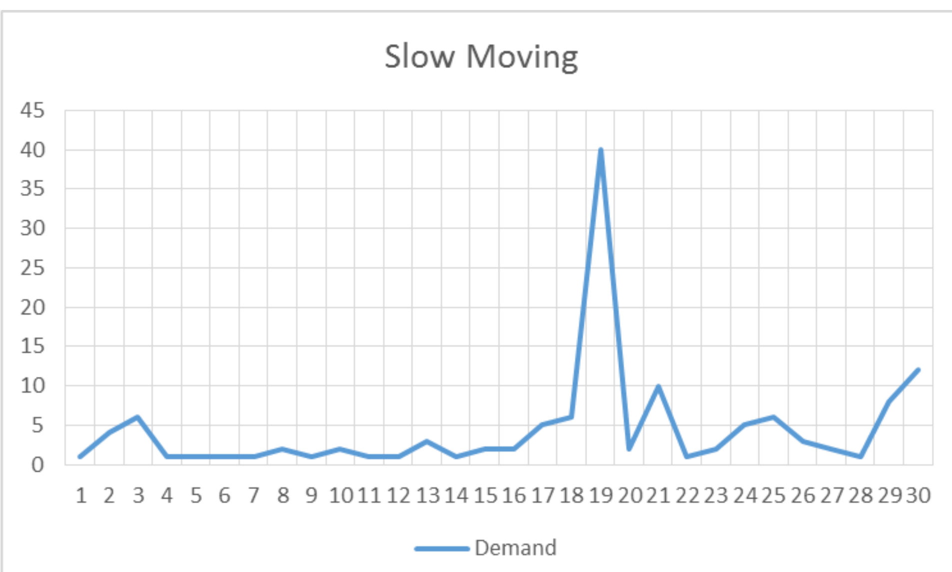


Fig.12. Slow moving item demand plot.

<u>Seasonal demand:</u> The demand for the item is not evenly distributed through the periods. The demand hikes at a specific period(s) and falls until the next cycle. The demand in other periods usually follows a regular demand pattern (normal distribution) with a lower average than the high season. For example, Christmas ornaments or winter equipment possess a seasonal demand with their peak near winter. Depending on the nature of a product, it can have one or multiple seasons a year.

The demand in Fig.13 starts to increase around period 7 and gets to its highest point in week 18. Passing the peak, the demand starts to slow down again.

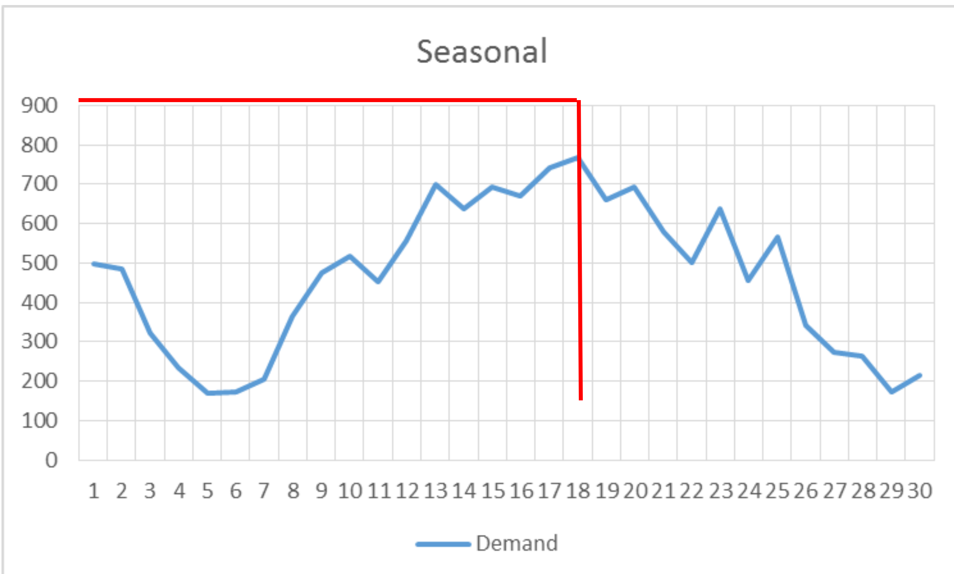


Fig.13. Seasonal Demand plot.

START Sheet

All inputs including demand, scenario analysis, BOM and master data components will be fed into the system through 5 separate steps in this sheet.

Step one: Demand Input

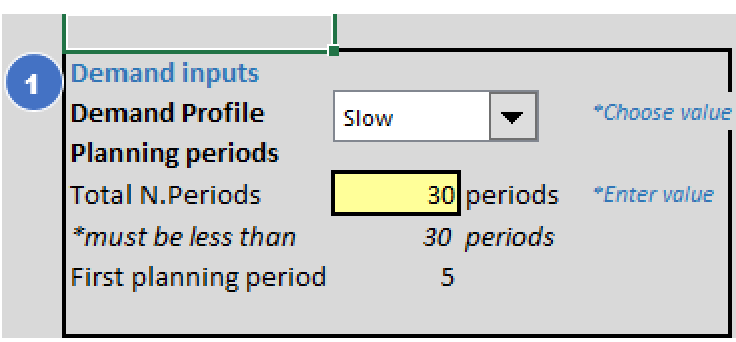


Fig.14. Step 1: Demand inputs.

As shown in Fig.14 this step includes a drop-down list from which the user should select the demand and total number of periods for planning.

The drop-down contains all the demand patterns that the user has already introduced in the demand profile sheet. As soon as any demand pattern is selected its plot will be demonstrated under "Run MRP" button. The plot includes the demand and schedule receipt data. (Fig.15)

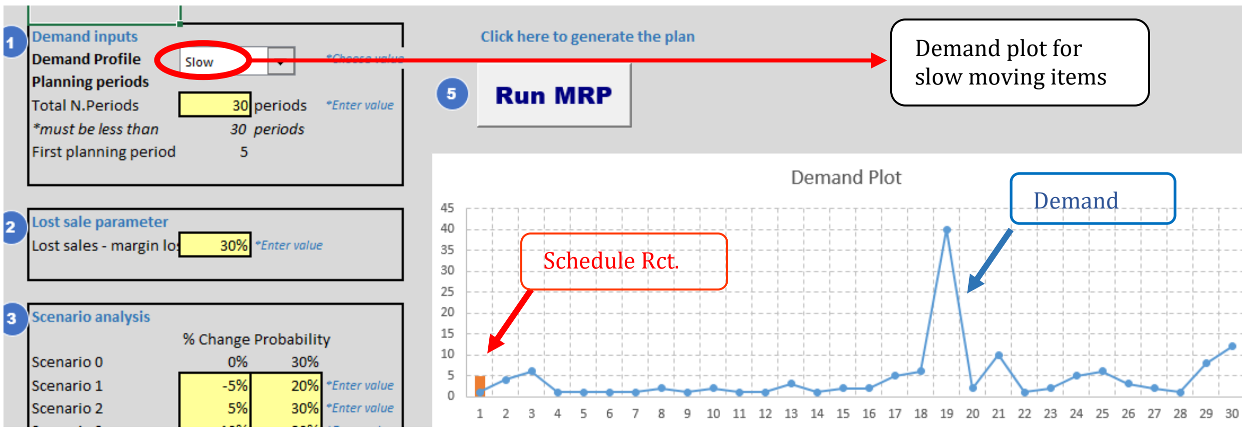


Fig.15. Demand plot of the selected demand pattern.

There are two more options in the drop-down: Enter new demand and Edit demand.

<u>Enter new demand:</u> Redirects the user to the "Demand" sheet so that the user can create a temporary new demand. Please note that the new demand will not be stored in your demand profile. If you intend to create a new demand pattern that will be stored for later use, you should follow the steps that has been explained in the "Demand Profile" section.

<u>Edit demand:</u> If the user wishes to edit the existing demand temporarily, it is possible by selecting the intended demand pattern from the drop-down and then select the "Edit demand" option so that the user will be redirected to the "Demand" sheet and can edit the demand. For instance, the user can change the quantities of demand and schedule receipts or increase the planning period by entering the demand for more periods (See Fig.16). As mentioned above, the changes will be effected once and will not make any permanent changes in the demand profile.

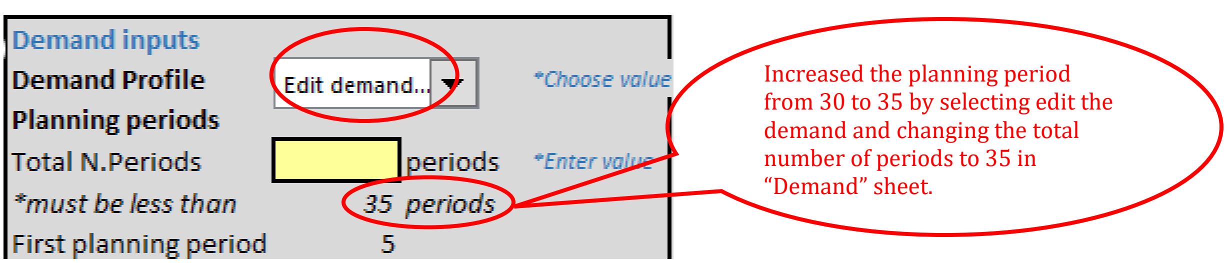


Fig.16. Edit demand from drop-down.

Planning period: Is the number of periods that the system will generate the plan for. By default, the planning period should be less than 30. But, as detailed above, the user can always change this total number of periods for planning in “Demand” sheet. If the user inputs a number higher than the total number of periods in demand data an error message pops up. In Fig.17, following pervious example in Fig.16, after increasing the total number of periods to 35 the user enters 36 in “Total N.Periods” box and receives an error message.

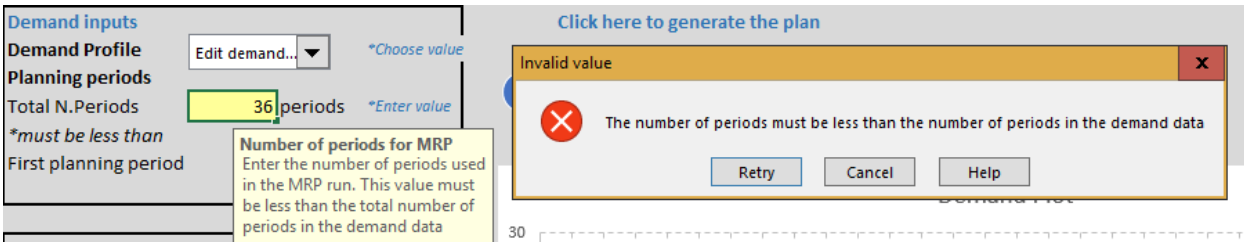


Fig.17. Error message of entering a number more than total number of periods in the demand data.

Step Two: Lost sales parameter

Lost sales happen when the company faces stock-outs so that certain orders cannot be met. In other words lost sales are the potential sales opportunities, which are not realized due to not carrying enough inventory.

Inventory often is translated into cost, so is the lost sales. There is always a trade-off between inventory and lost sales cost. Depending on different entities’ business nature and goals, they try to find the best combination to decrease their costs. There are costs related to lost sales such as loss of good will by losing customers and maintaining lower customer service, and the non-realized profit of the missed opportunity. Yet, calculating the margin loss is not accurate and easy.

One of the assumptions of MRP is that there is no shortage while in the reality stock-outs happen and since there is cost related to lost sales, they can be taken into account in the calculation of the total cost. This simulator fulfills this need.

The user should enter the lost sales parameter as a percentage of the finished good’s cost (Fig.18). This parameter is also called margin loss. The higher the percentage, the more costs will occur with lost sales and, cost-wise, the company will be more sensitive to stock-out.

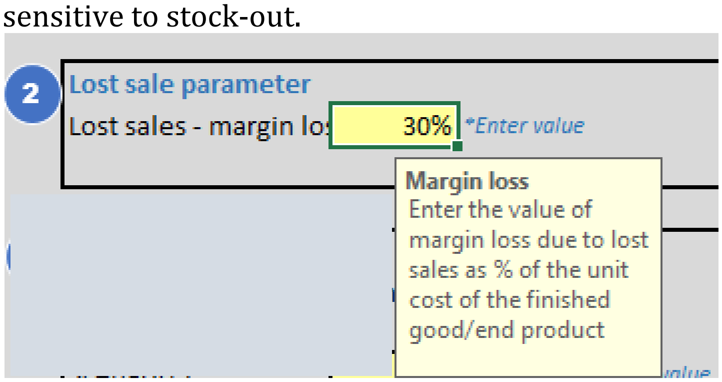


Fig.18. Margin loss.

Step three: Scenario Analysis

In this part the user inputs 3 scenarios of the demand. There are 2 columns in the input box. The user is required to input two figures for each scenario. The cell in the first column includes the percentage of the demand change that is probable to occur. And the cell in the second column include the probability of that demand change happening. For instance, scenario 1 in Fig.19 says there is a 20% chance that the actual demand would be 5% less than the forecasted demand (the one that the user earlier selected in step1).

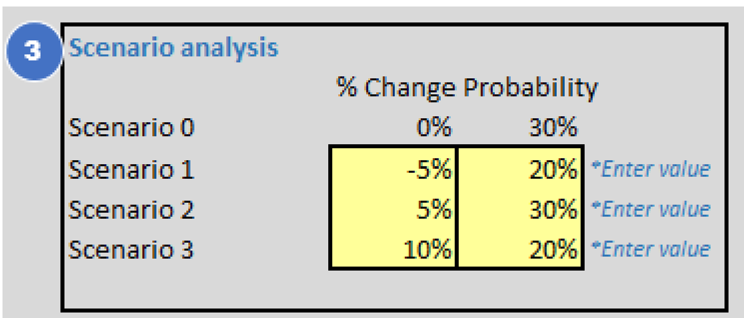


Fig.19. Scenario analysis input.

Note that scenario 0 by default is the deterministic one. In this scenario the change is zero so the actual demand would be exactly like the forecasted one. The total probability of all 4 scenarios should add up to 100%. So the system will set up the probability of Scenario 0 by deducting the total probabilities of other three scenarios from 100%:

Scen.0 probability = 100% – (prob. Scen. 1 + prob. Scen. 2 + prob. Scen. 3)

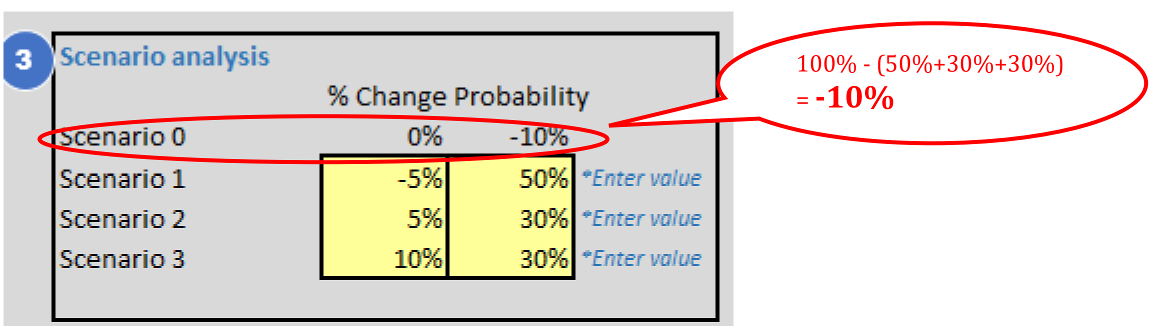


Fig.20. Scenario 0 probability calculation by the system.

Step Four: BOM Master Data

In this part the user inputs the BOM and Master Data components.

BOM data includes:

Item ID: The ID that the component is known with. It usually contains a mix of letters and numbers.

On-Hand: (See MRP Processing Logic)

Level: BOM structure is a hierarchical one with the end product on top,at level zero and its components in lower levels (1 to N). The end product is also called an independent demand meaning that its demand depends directly on the order while other levels' demands are dependent meaning that their quantities depend on the order quantity of their immediate parents. For instance the visual BOM shown in Fig.22 is as below:

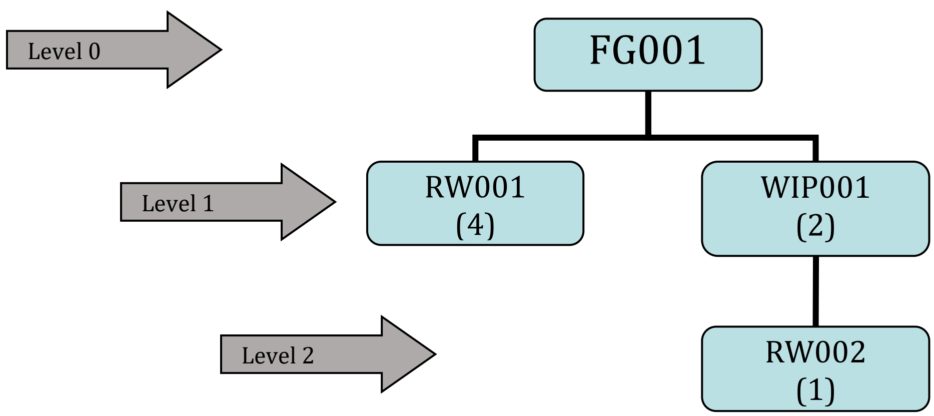


Fig.21. Multi-level BOM.

As you can see this is a 3 level structure with level 0 the highest level and level 2 the lowest.

Parent: The parent of any item is the component or end item which is located immediately above it. For instance, in the depicted BOM, FG001 is the end item and has no parent so in the designated cell it is mentioned n/a (not-applicable), FG001 is the parent for WIP001 & RW001 while WIP001 is the parent for RW002.

*Enter value *Enter value (0 = Lot4Lot)

Item	itemID	OnHand	Level	BOMItem	Parent	BOMQty	LeadTime	4 SS	Batch size (units)	Unit Value	SetupCost ($/Period)	InvCost (%Val/ Period)	Cumulative LT
1	FG001	50	0	1	n/a	1	1	100	100	$150	$1,000	2.0%	1
2	WIP001	0	1	1	FG001	2	2	0	0	$50	$500	2.0%	3
3	RW001	0	1	2	FG001	4	2	0	0	$25	$500	2.0%	3
4	RW002	100	2	1	WIP001	1	1	0	0	$25	$500	2.0%	4

Fig.22. entering BOM and master data.

In the excel file, at the right side of the cell, which the user should identify the parent of the item, there is a pointer by clicking on which a list of all the items will appear

Item	itemID	OnHand	Level	BOMItem	Parent	BOMQty	LeadTime	4 SS	Batch size (units)	Unit Value	SetupCost ($/Period)	InvCost (%Val/ Period)	Cumulative LT
1	FG001	50	0	1	n/a	1	1	100	100	$150	$1,000	2.0%	1
2	WIP001	0	1	1	FG001	2	2	0	0	$50	$500	2.0%	3
3	RW001	0	1	2		4	2	0	0	$25	$500	2.0%	3
4	RW002	100	2	1		1	1	0	0	$25	$500	2.0%	4

✓ FG001
WIP001
RW001
RW002

and the user should select the right item ID. In case of making any mistake in this part the structure of the BOM will change and this mistake will not be detected by the system because the product tree is dictated to the system by the user and can be anything so that the system accept any configuration and provides the user with the plan accordingly.

Fig.23. How to select the parent item.

BOMQTY: The number of units of each item required to make one unit of their parent item. For example, to make one unit of FG001 we need 2 units of WIP001 and 4 units of RW001. Then to make one unit of WIP001 we need one unit of RW002. So in total we need (2 units) WIP001, (4 units) RW001 and 2 x (1unit) RW002 to make one unit of FG001.

The following data is the master data part:

Lead-time: (See MRP Processing Logic)

Safety Stock (SS): (See MRP Processing Logic)

Batch Size: (See MRP Processing Logic). Note that if the lot sizing method is L4L for any item then the user should enter 0 for the batch size. L4L means that the order quantity equals to the net requirement quantity.

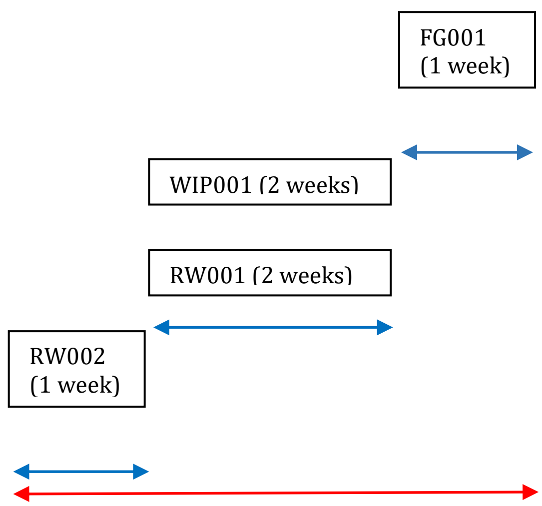
Unit Value: The cost of making one unit of the item.

Setup Cost: The fixed cost related to the machinery set up cost per period.

InvCost: The cost of keeping one unit of the item in warehouse for the duration equal to one period. It should be entered as a percentage of the item's unit value. For instance, the cost of keeping one unit of FG001 in stock for one month is 2% of its unit value.

Cumulative lead-time: It is not an input. After providing the system with data related to BOM structure and lead-time, it calculates the cumulative lead-time.

Cumulative lead-time is the longest time required for an end item to be ready.



Cumulative lead-time: 4 weeks

Fig.24. Cumulative lead-time

Before running MRP there is one more figure to enter: Level of service.

Level of service: It is in percentage and measures the performance of the inventory management. It indicates the percentage of the customer orders, which will be fully satisfied from inventory during the planning period. Or in other words the percentage of not having stock-outs.

Then the system will calculate the recommended safety stock and EOQ for the end item according to service level and the provided demand data. The SS and EOQ formula are as below:

$$SS = Z \times \sigma \times \sqrt{L} \qquad EOQ = \sqrt{\frac{2 \times D \times Co}{Ch}}$$

Step Five: Run MRP

The user simply clicks on "RUM MRP" button and the system opens a new worksheet containing the MRP scenario analysis report. Simultaneously an input box appears asking the user to name the worksheet. After entering the name the user clicks on ok and another message appears advising that the MRP analysis is ready. The user clicks "ok" and the output is available to the user. (See Fig. 25)

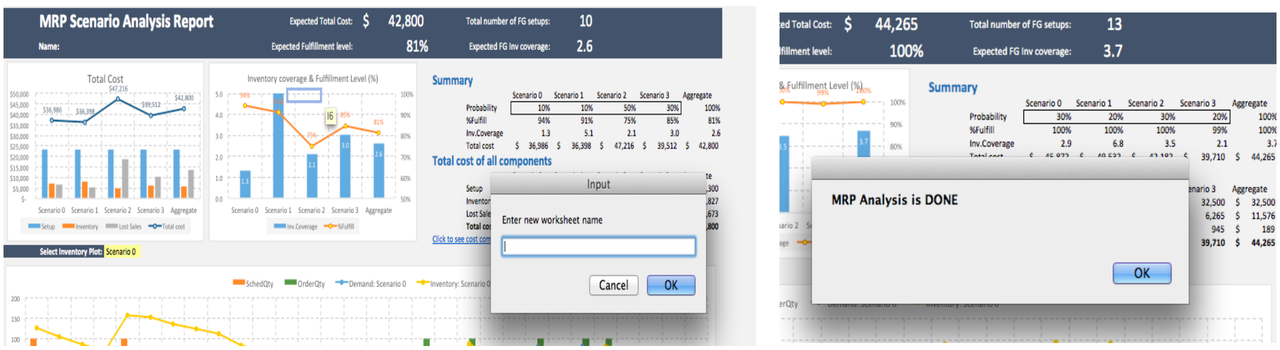


Fig. 25. Worksheet name input box and the end of the MRP run process.

Output

The system provides the output in two separate worksheets. One contains the details of MRP plan and the other is scenario analysis report.

MRP Plan

Simulator generates the MRP plan based on Scenario 0, which is the deterministic scenario and is in line with MRP assumptions. This worksheet contains all the data that we already reviewed in the MRP processing logic, which includes: gross requirement (GrosReq), schedule receipts (Sched), on-hand (OnHand), safety stock (SS), net requirement (NetReq), planned order receipts (PlanRec) and planned order released (PlanOrd) for each period. The most important piece of data that the users need to take action is the last column, planned order release, which indicates the timing to set an order for the item. In Fig.26 we can see that since the item's lead time is 1 week the planned order releases are a week earlier than the planned order receipt, which makes the right item to be available at the right time. Also as explained earlier the quantity of Planrec and PlanOrd is a multiple of the item's batch size that in this case is 100. The plan continues for 30 weeks (as input in the "START" sheet) for each item of BOM.

itemID	Week	GrosReq	Sched	OnHand	SS	NetReq	PlanRec	PlanOrd
FG001	0	0	0	50	0	0	0	0
FG001	1	46	100	104	100			0
FG001	2	31	0	73	100	27	0	0
FG001	3	55	0	18	100	82	0	
FG001	4	72	200	146	100			100
FG001	5	53	0	193	100	7	100	
FG001	6	46	0	147	100			100
FG001	7	51	0	196	100	4	100	
FG001	8	58	0	138	100			100
FG001	9	43	0	195	100	5	100	
FG001	10	68	0	127	100			100

Fig.26. MRP plan.

MRP Scenario Analysis Report

In this worksheet the system is reporting what happen to total cost, lost sales, inventory cost, and etc. if demand is not deterministic and analyzes the differences based on previously provided scenarios. This part is the dashboard of the scenario analysis consisting of different charts and tables that reports the results of the analysis and compare four scenarios based on different terms.

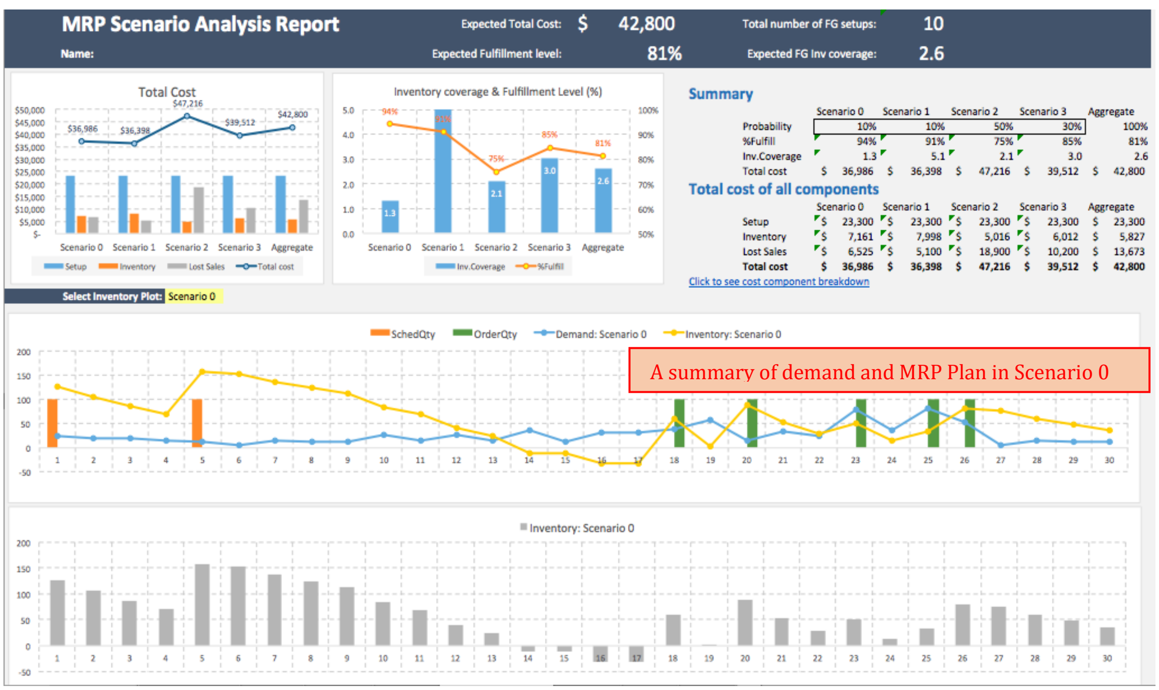


Fig.28. Screenshot of the scenario analysis report (Charts).

Click to go back

Cost component breakdowns

		Scenario 0	Scenario 1	Scenario 2	Scenario 3	Aggregate
End-Products/Finished Goods						
FG001	Setup	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
FG001	Inventory	$ 5,781	$ 6,618	$ 3,636	$ 4,632	$ 4,448
Work-In-Process Inventory						
WIP0001	Setup	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
WIP0001	Inventory	$ -	$ -	$ -	$ -	$ -
RW0001	Setup	$ 6,000	$ 6,000	$ 6,000	$ 6,000	$ 6,000
RW0001	Inventory	$ -	$ -	$ -	$ -	$ -
RW0002	Setup	$ 1,300	$ 1,300	$ 1,300	$ 1,300	$ 1,300
RW0002	Inventory	$ 1,380	$ 1,380	$ 1,380	$ 1,380	$ 1,380

Lost sale parameter

Lost sales	50%

Scenario analysis

	% Change	Probability
Scenario 0	0%	10%
Scenario 1	-5%	10%
Scenario 2	25%	50%
Scenario 3	10%	30%

BOM Data

Item	itemID	OnHand	Level	BOMItem	Parent	BOMQty	LeadTime	SS	Batch size (units)	Unit Value	SetupCost	InvCost	Cumulative LT
1	FG001	50	0	1	n/a	0	1	2	100	150	1000	0.02	1
2	WIP0001	0	1	1	FG001	2	2	0	100	50	500	0.02	3
3	RW0001	0	1	2	FG001	4	3	0	100	25	500	0.02	4
4	RW0002	3	2	1	WIP0001	1	5	0	50	25	100	0.02	8

Fig.29. Screenshot of the scenario analysis report (Tables).

Note that the name of this worksheet in the file is not scenario analysis but the user choose the name after clicking on the "RUM MRP" button. For example in Fig.30 this worksheet is named "September".

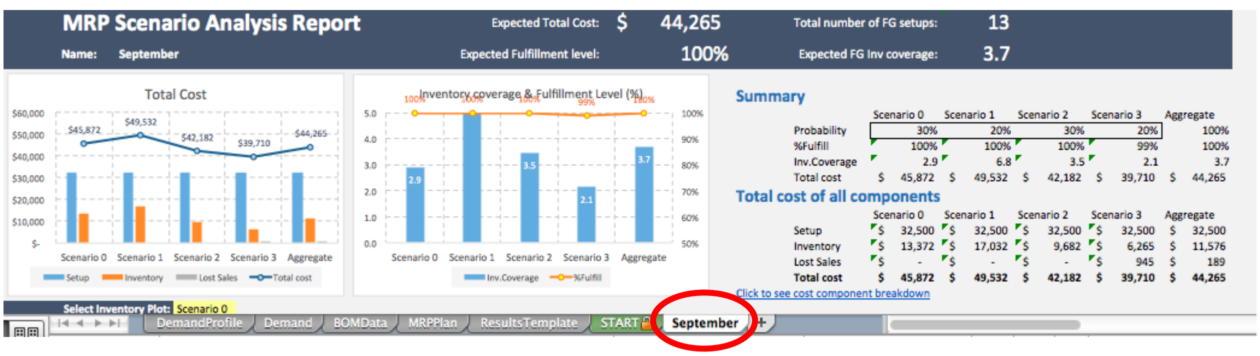


Fig.30. Scenario analysis report worksheet name.

The charts include:

Total cost chart: Total cost is the sum of holding cost (Inventory), ordering cost (set up) and lost sales cost. This chart demonstrates the Total cost and its components for each scenario and the aggregate for the planning period.

Aggregate: For instance, aggregate inventory cost is the average of the total inventory cost of all four scenarios in the planning period factoring their probabilities. In Fig.28:

Aggregate inventory cost=

10% (7,161) + 10% (7,998) + 50% (5,016) + 30% (6,012) = $5,827

Inventory coverage and Fulfillment level: This chart illustrate the inventory coverage and fulfillment % of each scenario and the aggregate.

Inventory coverage: is the ratio, which indicates how many units exist in the stock per one unit of order. For instance in Fig.28 it is reported that in scenario 0 for each one unit of FG001 order there will be 1.3 unit of FG001 available in the stock during the planning period, which is 30 weeks in this case.

Fulfillment level percentage: It shows the average percentage of each order that will be fulfilled during the planning period.

The Demand & MRP Plan chart: The demand and generated MRP plan is demonstrated in this chart.

Inventory: This chart shows the inventory level in each period for scenario 0.

The reporting tables include:

Summary: Details the Fulfillment%, inventory coverage and total cost of each scenario and the aggregate.

Total cost of all components: It breaks down the total cost into its components for each scenario and the aggregate.

Cost component breakdowns: This table details the setup and inventory cost of each item for all scenarios and aggregates.

References

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Ptak, C. A., Smith, C., & Orlicky, J. A. (2011). *Orlicky's material requirements planning* (3rd ed.). New York: McGraw-Hill.