Use of Simulations and Managerial Dashboards for Product Mix Decisions: Model and Case for MSME

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Abstract:

Production planning & control are the most important processes for any organization in manufacturing industry. The product mix decision in uncertain environment is very crucial for the organization to maintain profits and healthy financial status [3]. Such situations are occurring very frequently now a days because of volatile market conditions all over the world [1]. Nobody can remain unaffected from such effects because of many aspects of globalization.

In such environment, the only thing to do is to empower the decision makers to take correct decisions any time when ever required. For that matter every decision maker right from shop floor engineer to senior managers should have skills to understand the data and information to take such decisions which affects financial health of the organization.

This Case Study model aims to empower the production managers forproduct mix decisions quickly and able to do simulations to get maximum profits for the organization. The model uses Excel Solver facility with using proper templates to simulate and achieve best results in such cases. This model is very useful for SME, MSME as well as all functional managers working in the MNC's because everyone at his desk/laptop uses MS-Excel for managing and analyzing his data. This also helps to improve efficiency and accuracy in taking decisions for the managers in any function.

Keyword: SME, MSME, Product Mix Decisions, Simulations, Scenarios.

I. Introduction

Company's Product mix is also known as product combination which refers to the total number of product lines that a company offers to its customers [3]. For example, Dish Washing Liquid and Dish Wash Bar are similar product lines and Deo's and Bath Soaps are very different. There are four dimensions to any company's product mix which include width, length, depth and consistency.

Width: The width of a company's product mix is the number of product lines that a company sells. For example, if a company has five product lines, its product mix width is Five [3].

Length: Product mix length is the number of total products in a company's product mix [3]. For example, ABC Company may have five product lines, and two brands within each product line. Thus, ABC's product mix length would be 10.

Depth: Depth of a product mix is the total number of variations for each product. Variations can include size, flavor, color and any other distinguishing characteristic. For example, if a company sells three sizes and two flavors of Dish Wash Bars, that particular brand of Dish Wash Bar has a depth of six.

Consistency: Product mix consistency is to how closely related product lines are to one another; in terms of use, production and distribution [4]. Most of the time a company's product mix may be consistent in distribution but vastly different in use. For example, SME/MSME may sell its health bars and health magazine in retail stores. However, one product is edible and the other is not. The production consistency of these products would vary as well.

Product Market Mix Strategy: SME/MSME's usually starts with a product mix limited in width, depth and length; and have a high level of consistency. However, over time, the company may want to differentiate products or acquire new ones to enter new markets.

Product Mix Decision Making

To utilize the all resources (Men, Material, Machine) as efficiently as possible, a company has to determine its product mix correctly [3]. The company, which is able to establish the right combination of products, will gain a competitive advantage over competitors in the market. Determining the optimal product mix is a short-term decision of accepting and scheduling customer orders based on the availability of the resources best possible manner.

Many authors have discussed ABC and TOC approaches to determine any firm's product mix [1]. The difference between these approaches is an issue of time. In the short term, labor and overhead costs are fixed whereas, in long term, every cost is variable. It is then essential to agree with Kee and Schmidt (2000) that ABC and TOC are based on different assumptions about the behavior of the costs.

II. Case for Discussion:

This case study is prepared for one of the SME from Nasik Industrial Area and optimized solution is framed for the organization by using Excel Solver for their short term scheduling requirements and gaining optimum profits from the available inventory resources.

The case talks about one of the production unit of FMCG product from Nashik Industrial area in Maharashtra (India). The company has four dimensions in their product mix which include width, length, depth and consistency as defined above. It is extremely cumbersome and difficult to conduct product mix analysis at the lowest product classification level with thousands of categories. Aggregation is always needed. Hence for the simplification yet effective product mix, the management identified8 product lines, of which2 product lines have 5 product types and others have 3 each. Thus product mix length for the company is 28, hence mean average length is 3.5 which is very crucial for getting reasonable profits and keeping the company ahead of its competitors. The product mix consistency of this company is high and products vary from types of chocolates to different types of chips like potato with different flavors.

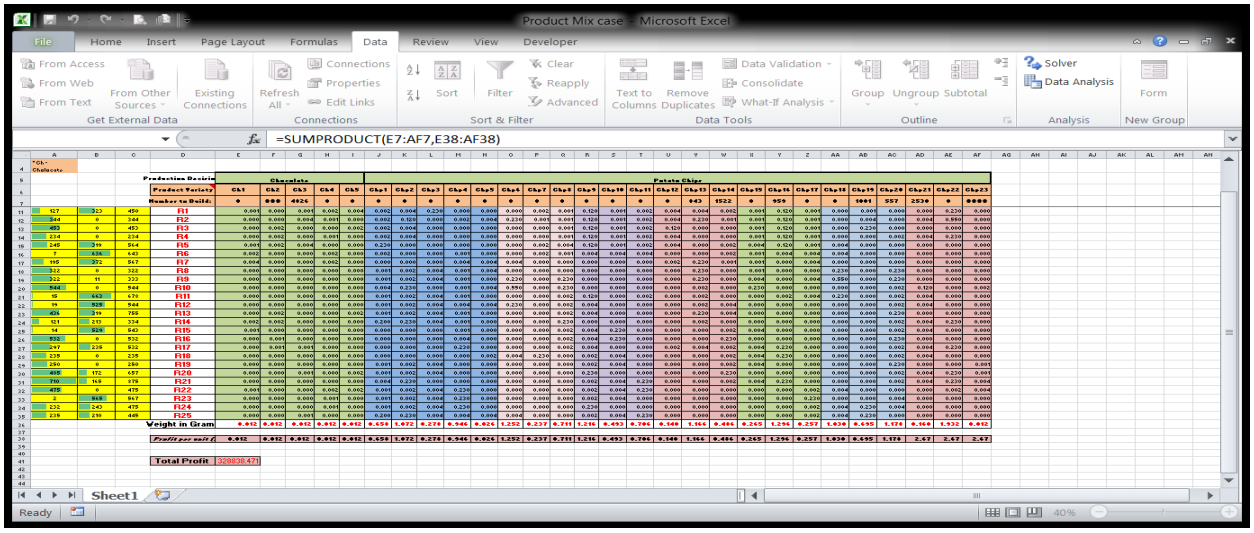
Step 1:

Required information is collected for company's product mix analysis such as product price, product costs — fixed, variable and overheads — and estimated demand for the product at the planned horizon, in this case monthly. The demand related information is collected from the sales and marketing group as well as from past three years of company's sales data of each product. Processing information for each product such as equipment usage requirements for key equipment and resources is also collected. We Identify the key constraints in the production process first, and then collected equipment usage requirements for the potentially constrained equipment only.

The company was facing the problem of underutilization of resources as well as not certain about which variety should be produced and how much quantity to maximize profit.

With all the information collected in a spreadsheet, the model is framed for the given situation using the spreadsheet solver as shown in Figure 1. It took 2 months to get the proper data and fit the same in proper format so as to use it for the case.

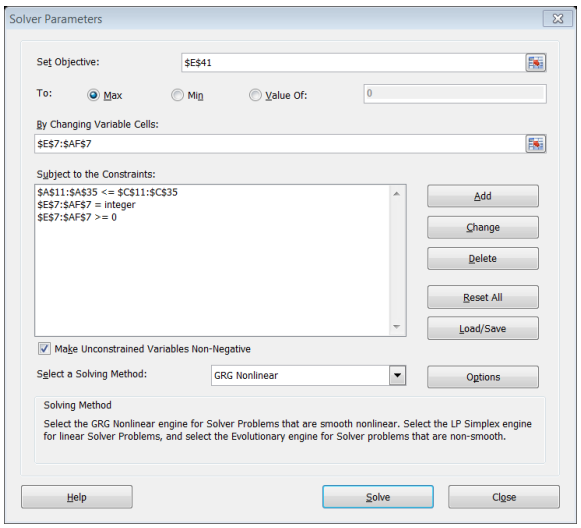
Figure1: Solver Model for company's product mix



Step 2:

Excel's Optimization Tool: Excel Solver is a decision tool that uses linear programming (LP). This is a mathematical approach for practical problems with many constraints to find the best use of company's limited resources. One equation, called the objective function, represents the overall goal or objective of the given situation. In this case it is maximize the Total Profit. Solver requires additional equations that represent each of the constraints in the process, and it provides the optimal solution to the objective function that also satisfies each of the constraint equations. In other words, the LP solution represents the best feasible decision. Solver parameters are provided for this case as shown in Figure 2.

Figure 2: Solver Parameters



The formulation of the model is important skill to be developed for any manager. One can solve most of the complex product mix analysis problems with Excel Solver if it is modeled properly.

In this Case, the objective was to maximum profit under different constraints of resources i.e. E41 cell as seen in figure 2.

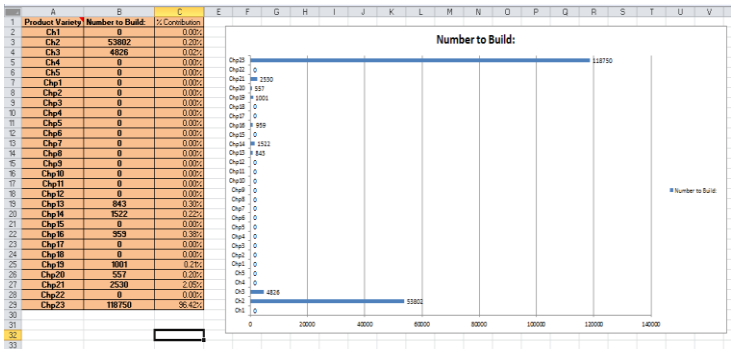
The variale cell range is the number of products to be build for maximising profits under given circumstances.

The constraints are to be mentioned very carefully and properly. The interger and non-zero constraints are always there in such product mix problems. Apart from that if company has sales order of some of the products and wants to satisfy the same, the constraint can be added for that. The inventory used should not exceed than the available is also one of the importatnt constraints for such cases. The constraints make your model very perfect and reliable. If one forget the constraints, the model becomes weak and give results which are not practical and achievable.

Step 3:

The output of the product mix profile is best presented in a graphical format as shown in Figure 3 with the bar chart for all products vs quantity to be produced for getting maximum profit.

Figure 3: Bar Chart for Product Mix Decision

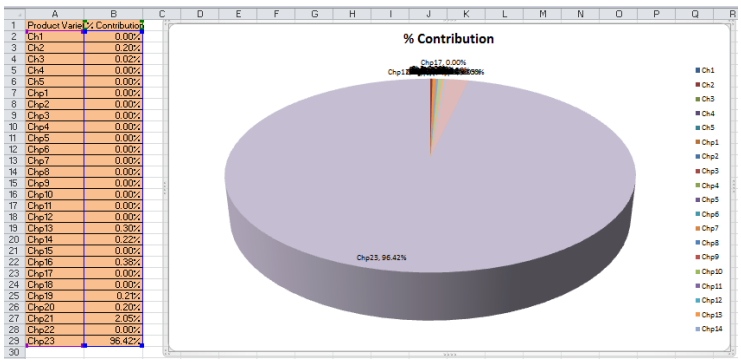


We have shown the results in a bar Chart. Here for this case Ch2 and Chp23 are the two products which are to be produced more to maximize the profit of the company.

One can represent the percentage contribution to overall revenue of each product by Pie Chart also as shown in Figure 4 as following for this case.

Figure 4: Pie Chart for Product Mix and % Revenue contribution for the same

The chart shows that 96% of the revenue is dominated by only one product i.e. Chp 23 in this case because of the constraints and conditions.



There are many different potential combinations using this method. Multiple charts may be necessary to present all desired output information.

Outputs of this step will usually include at least two parts:

1. The existing product mix, and
2. The "optimized" product mix,

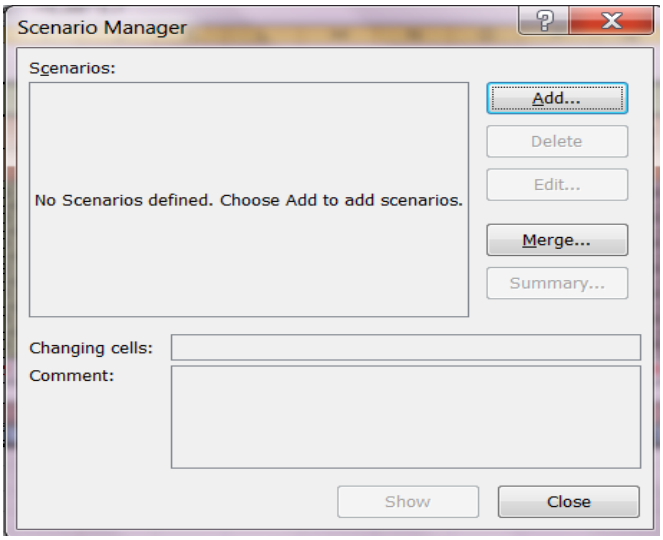
Both of which are derived from the currently available equipment/resources and existing processes.

For this case, we found that their existing product mix were earning profits of INR 2,12,000/- where as the optimized product mix suggested were earning INR 3,29,000/- , which is almost 50 % higher than the existing methods they were following.

Step 4:

Develop new scenarios for additional product mix analyses.These scenarios can be saved and compared for decisions by management whenever the complex situation arises [2]. This is also available in excel under Data – What if analysis – Scenario Manager as shown in the Figure 5.

Figure 5: What if Analysis and Decision Making using Scenario Manager in Excel



The so-called "optimized" product mix output from Step 2 is the current best under a limited scope — no changes are made to the currently available equipment and resources.

The real challenge of a product mix analysis is to create new business and production scenarios that frequently require major "structural" changes [5].

The structural changes might involve the bold "re-engineering" of the business; for example, shutting down some portion of the operation thereby eliminating some product lines, or adding some product lines by realigning existing equipment/resources among several production sites or acquiring new equipment/resources etc.

The main concept in the scenario development is to come up with a viable and feasible business plan and structure that will improve the bottom line [1]. The scenario development is by far the most challenging part of a product mix study because it involves business strategy, breaking the existing product mix pattern and invoking "out of box" thinking to brainstorm about scenarios for the business.

For each scenario, appropriate data will of course be needed and incorporated into the existing data structure discussed in Step 2. Optimization for all such Product mix analysis will need to be conducted for each scenario. Results will need to be evaluated for assessing the viability of the scenario. Frequently, the result of one analysis will direct the development of a new scenario for further analysis. Thus, the product mix analysis is iterative in practical applications.

The authors suggested the organization that, they should carry out such optimization every month taking into account the changes in the major resources and market conditions like availability of raw materials and their prices to get the updated and reliable output in terms of profits.

Step 5:

Select an optimal product mix profile from analyzing different scenarios available. Since the product mix analysis involves multiple scenarios and the process of searching for the best scenario, the process is usually iterative. So in actual practice, Step 3 and Step 4 are closely linked.

In this step, the following questions help the selection process:

1. Does the solution (i.e., the proposed product mix profile and the resultant profit estimate) meet the objective of the company?

2. What criteria are used for comparing various proposals and solutions?

3. In what ways are some product mix scenarios more desirable than others?

4. What is the best solution?

The answer to these questions helps managementto be objective in selecting the best product mix scenario and production profile.

Step 6: Mapping the actual production sequence to verify the feasibility of the optimal production profile. The optimal product mix profile obtained in Step 4 may not necessarily be feasible to execute on the production floor.

The product mix analysis is usually conducted at a macro level where only major constraints are considered in the optimization formulation [4]. Additionally, some of the constraints on the production floor cannot easily or even possibly be handled by a mathematical programming formulation. As a result, the "optimal" product mix profile obtained in Step 4 is in fact an upper bound. Actual profit figures may be lower due to additional practical constraints that fail to be included in product mix optimization formulation.

To overcome this possible gap, it is necessary to map out the production runs using the optimal product mix profile and to verify production feasibility [3].

III. Conclusion

We used the above five-step process with successful results for the MSME under study. The results were very fruitful and organization has adapted the process and training of the production managers under way. The organization is now getting the profits 150% than the previous before this study. We can suggest every organization should implement such simple but useful tool like Solver in Excel to achieve better profits.

Additional comments on the application of product mix analysis are:

1. Product mix should be updated regularly as demand, prices, costs and structure change.

2. Product mix analysis can play a central role in the annual strategic and business planning process. It provides objectivity to an otherwise qualitative-natured strategic planning process.

3. Also, product mix analysis can provide insight for major restructuring or acquisition considerations.

4. Developing new scenarios for product mix analysis is a real challenge.

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