**Introducing Linear Programming (LP) – Practical Aspects – Working Towards Cost Optimization / Profit Maximization Strategies**

Just a brief overview of LP – As I see it, in multi-product / multi-plant scenarios, where overall profitability needs to be improved from the present levels. I am not going into explain what Linear Programming is – Those not aware about these basics may refer elsewhere as many resources are available on the internet for understand that.

I am also not delving to the the technical side of solving an LP problem. We will leave that to Operations Research / Mathematics / IT teams. I will just give a passing reference at the end to some of them. We are more concerned with how to use LP in a live production / business scenario for solving business problems and reaching planned top and bottom-line growth objectives. Methodical steps to use LP:

1. Deciding the objective – What is the purpose or what needs to be achieved by LP exercise – cost optimization (minimize the overall cost of production), profit maximization by changing sales mix, planning of capital structure (mix of instruments – Debt, Equity, other innovative financial instruments like derivatives, etc.) – to optimize financial leverage costs. The equivalent of this in LP technical term is called Objective Function.
2. Gathering information: When the objective is decided, next step is gathering required information: variable costs, fixed costs, revenue, etc. The entity with a more disciplined MIS structure like monthly cost sheet, review of budget and standard costs (with periodical revisions in standards to account for inflation and other external changes triggered by dynamic business environment in which entity operates), etc. will find it quite easy to gather most of the information – in fact, majority will be on the fingertips (Meaning, it can be easily accessed and used with minor modifications).The nature of the information to be gathered will depend on the objective formulated in step 1. So, identifying specifics will not be possible here – No one-size-fits-all solution.
3. If the information as required (mentioned above) is not readily available, some basic building blocks needed for MIS needs to be put in place so that the information is accessible – initially with somewhat lesser accuracy and as the MIS structure becomes more refined, LP model will also be reviewed and be more successful in schieveing the objectives.
4. Information gathered in step 2 or 3 will be used in formulation of “Constraints” required in an LP problem. To explain in simple terms, constraints are hindrances to achieve targets. Examples are Labour or machine hours availability, raw material supplies constraints, power and other utility availability, market absorption of the product to be sold – to mention just a few. Constraints are external or internal – real or psychological (human) – for example management’s risk appetite or apathy in choosing alternatives.
5. Once constraints are decided, then the next step is simply writing down objective function and constraints equations on a piece of paper.
6. Finally solving Linear Programming problem. Suggested methods range from manual (through simplex method (using metrices) or plotting on a graph and finding feasible region) to using tech tools like excel solver (the handiest) or python libraries (SciPy, Pulp, Matplotlib, NumPy, Sympy are some options – there may be more) – not mentioning R libraries here. Selection of tools will be based on number of variables and complications involved and the decision may be left to the tech team.

1. I have attached here excel example - using solver add-in for solving an LP problem. There are 2 examples. In the second example, feasible solution is possible only if production is not raised beyond 3 UOM. In such cases, when faced practically, constraints or objective functions may need modification till a feasible solution is found.
2. For those interested in other methods or examples of LP (using Python), please explore using following links:

<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwippLTi_cSBAxWXTWwGHePbBOoQFnoECAgQAQ&url=https%3A%2F%2Frealpython.com%2Flinear-programming-python%2F&usg=AOvVaw1GC0TrlqadMuVmezmBeT9I&opi=89978449>

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