Team Mini Project: Chemical Manufacturing Analysis

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Data Science Senior Capstone

Report on Chemical Manufacturing Analysis

In our project, we utilized Excel and a few of the tools that it offers. The tools we used within Excel were solver and a what if analysis data table. It had been a while since we had used any of the tools, so we had some trouble whenever it came to knowing where to start. We had some experience with the tools in the past, but it was a few semesters ago and they aren't tools that we have frequently used. Because of this, we needed to freshen up on the tools to complete the project and took the time to research how to use them again. One challenge that wasn't technical in understanding the project was that there were some difficulties in understanding the portion of the assignment about costs. The labor for product K and M didn't specify if that included handling following the product being made, since each time it was made, they created two. Therefore, we operated under the assumption that handling included the output as opposed to only how many times a product was produced.

Our optimization model was created using solver in Excel. The way we set up the sheet was we created a few different sections and filled it up with the important pieces to help build our model: times produced, inputs, output, constraints, fixed and variable costs, selling price, and total profit. Our target cell was maximizing the total profit, which was total sales (assuming all products produced were sold) – total costs. It ended up being a loss of $14,490. The cells changed in the model were the number of times each product was produced. Primary product (4500), Product K (3000), and special treatment (1500) were the number of times each product was produced, and since product K produces 2lbs each time, they had an output of (6000lbs).

The optimization model helped us with creating the waste disposal plan considering the EPA guidelines. To satisfy the guidelines, product K and the special treatment would need to be produced. Mentioned previously, Product K was produced 3000 times, and the special treatment was produced 1500 times. The reason for this combination was that all liquid waste needs to be utilized since no dumping is allowed.

Using the data tab in excel, this allowed us to use the sensitivity analysis table to see how the available constraints would affect labor and selling price based on the number of pounds produced. Based on the output in pounds, we used this to form a range of pounds produced. For example, the optimal output in pounds for primary product was 4,500 pounds. We used this to multiply the selling price per pound by the number of pounds produced to get an estimated amount of the total cost. In this table, for 4,500 pounds produced it would cost $25,650. The table also shows how much each pound would cost if more or less of the pounds were produced based on the optimal amount of pounds. We did the same steps for labor cost based on the amount of pounds produced. This table helps us to get a better visualization of how much it would cost to produce a certain amount of pounds.

Primary Product analysis											
		Pounds produced									
selling price		1000	1500	2000	2500	3000	3500	4000	4500	5000	
	$ 5.70	$ 5,700.00	$ 8,550	$ 11,400	$ 14,250	$ 17,100	$ 19,950	$ 22,800	$ 25,650	$ 28,500	
		pounds produced									
		1000	1500	2000	2500	3000	3500	4000	4500	5000	
primary labor costs	$ 0.42	$ 420	$ 630	$ 840	$ 1,050	$ 1,260	$ 1,470	$ 1,680	$ 1,890	$ 2,100	

Following our models, we came up with three different recommendations for the firm that would help them come closer to making a profit for their operations. The first being that they would need to expand their production capacity and inventory. They had very limited inventory available in this month, in the previous month they were able to produce 12,000lbs of primary product, with this amount of inventory they weren't able to come close. It didn't specify whether this was due to production capabilities, but still expanding the amount of inventory of hand will go a long way in addition to the production capabilities being able to handle this. The constraints were too high in this scenario and if it continued, they would suffer more losses and eventually run out of business. The second recommendation would be to slightly increase their prices, especially for the primary product and product K. Product K is being produced at a loss, so increasing the price can minimize it. The profit contribution of the primary product showed that it only contributed $1.03, which is a very small amount. They will need to push towards a profit somehow, and this could be a way to make that happen faster without entirely putting the focus on an increase volume. The final part being research and development. The firm will need to look for ways to decrease their costs,

especially whenever it comes to liquid waste. Finding a cheaper way to dispose of the waste, producing less of it as a byproduct of the primary product are two examples of ways that they can minimize the costs. But all in all, the firm has a lot of work to do if they want to improve their business.