

CHAPTER 7. CONCLUDING REMARKS

The evaluation of the efficiency performance of the manufacturing firm in conjunction with the assessment of other organizational goals leads the analyst to additional insights which are not apparent from just a direct implementation of the *DEA* approach. The *DEA* analysis along with the *SMGP* approach provides richer insights into the performance of the plant. In the present case of a manufacturing firm, the direct comparison of the processes is not very meaningful. This is because of the different technologies used for each process. However, we still need to link the processes to consider the achievement of plant goals. The *SMGP* framework provides with such an opportunity.

From Chapter 6, we have seen that from the *DEA* analysis, process 10 was highlighted as the least efficient process in almost all the models. Process 6 and process 8 figure among high performing processes for all the models. The absence of slacks and surpluses (as indicated by two-stage radial model) signifies that there can be no more improvement possible for the efficient units. The input-reducing non-radial model indicates that the labor outperforms the raw materials in all the processes. In addition, months 3, 14, 15 and 16 were identified as the months with highest average efficiency scores. In fact, months 3 and 15 denote a yearly trend (corresponding to the month of November). These results have to be viewed in conjunction with the goal programming results. Process 9 appears to be the most constraining for planning an output increase while an increase can be planned for processes 2-7; processes 8 and 9 have significant capacity deficiencies at the process level; process 10 has an extremely inefficient utilization of raw materials at the plant level; there is a balance problem between processes 8 and 9 and processes 9 and 10; the first year performs better than the second year in terms of production line-balance. Using the results from both the analyses, a production-planner can thereby assess the performance of the plant, processes and production line balance. The framework also offers the production-planner an additional opportunity to perform sensitivity analysis and thereby determine ideal production goals. The two approaches are therefore complementary to each other and should be used in conjunction to analyze the plant under consideration.

However, the successful implementation of the *SMGP* analysis is contingent upon the availability of some specific type of information. They include

- Actual consumption of all relevant resources at each process for a time period
- Pre-determined targets for all relevant resources at each process for a time period
- Actual outputs at the end of each process (includes scrap and rework) for a time period
- Pre-determined output targets for each process for a time period
- Pre-determined plant-level targets for all relevant resources for a time period
- Pre-determined plant-levels targets for outputs for a time period

In the current analysis, the required data collected was from different sources. The data required for the *DEA* analysis was procured from the accounting department and the data for the *SMGP* analysis was obtained from the production-planning department. The two departments do not maintain the data in the same format and the information is not in the way that can be easily adapted for the analysis. The plant tracked the output targets for both the plant and the processes, but there was no way to obtain the targets for the resources. Hence, the actual usage of the resources was used as the targets. It is these input and output targets that link the anticipated performance to its actual capabilities. Hence, the availability of specific data becomes very critical. This might be one of the limiting factors in implementing the *SMGP* analysis.

An extension to this framework might be to come up with a generic model, which can be used in multiple scenarios. Since this kind of an analysis is particularly useful in manufacturing and service industries (Athanassopoulos (1995) considers a service industry), a generic approach could be a topic for future research.

In the current goal programming model, changing the priorities of the objective function did not alter the solution significantly. Future research could focus on capturing the priorities of the objective functions more distinctly. Another direction in this research would be to articulate ideal target levels. The current research gives an indication on how the plant and the processes perform with respect to pre-determined targets. However, it does not focus on obtaining ideal target levels. Theoretically, the process targets should be derived from plant targets. Future work could focus on aligning the process goals with respect to the plant goals.