

## **A Decision Model to Assess Current Methods in Capacity Planning for Semiconductor Industry**

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### **ABSTRACT**

One of the main challenges of industrial engineering is being able to handle problems that happen in a factory, which consist of many random variables and constraints. Information is typically available with unforeseen uncertainties so that decision making about variables is very complicated. One such problem in high-technology industry like semiconductor that requires high-accuracy decision making in highly dynamic situations is capacity planning. An accurate capacity planning model not only requires correctly calculating decision variables but also requires considering and handling uncertain variables which are unknown like uncertainty in rapid rate of change in technology and products volume and type. The research objectives of this article are (1) to identify capacity planning problems, (2) to determine capacity planning methods, (3) to determine significant criteria for the decision model, (4) to calculate weight distribution of the existing methods with respect to the determined criteria using analytic hierarchy process (AHP), and (5) to conduct a sensitivity analysis to indicate how realistic the final outcome is. The industry chosen for this study is semiconductor wafer fabrication. This study found that the main problems in capacity planning are complex processes, rapid changes in technology and product, long lead time for procurement, cost of tools, uncertain demand, and uncertain capacity. The current methods for capacity planning in this study include spreadsheet, simulation, queuing model, linear programming model, and stochastic model. The criteria that are considered for this study are ability to consider uncertainty, ability to evaluate performance, simplicity of model, and response time of model. The study used questionnaires to identify significant criteria using academic experts' opinions. And also it used questionnaire to determine importance degree of each method for capacity planning using pairwise comparisons through industrial experts. Finally an AHP decision model has been proposed with overall inconsistency of 0.01. It presents that the stochastic method indicated by 33.08% is more suitable than other methods for capacity planning in semiconductor industry.

**KEYWORDS:** analytic hierarchy process, capacity, decision model, semiconductor, pairwise comparison, uncertainty