

BROSE

Creating A Cost Model for Capital Equipment

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Brose is a family-owned and self-financed automotive supplier of mechatronics systems. The company consists of three primary divisions: Seats, Doors, and Drives, each with multiple mechanical and electronic products that service the world's largest car brands. Strong company growth has caused the Seats Division at Brose North America to feel increasing pressure to better manage its cash flow planning for capital investments in manufacturing.

The goal of this project was to create a predictive model for investment in production equipment to codify the relationship between product & process characteristics with equipment, improving upon the current heuristic-based cost estimation performed by only a few experienced employees.

The Tauber team first created a process map of activities from customer request to capital purchase. This map surfaced four primary touchpoints where cost estimation occurs, along with four main characteristics of the problem: accuracy, granularity, skill level, and data availability. To address these issues, the team built two solutions: a cost estimation tool and a new quotation template.

The cost estimation tool applied three unique models: Machine Learning, Statistical, and Similar Projects. The Machine Learning model was a Gradient Boosted Regression that iteratively built decision trees to correlate selected variables or "cost drivers" with investment cost in a given dataset. The Statistical model categorized each type of machine and assigned either an average cost for that type or a linear relationship with a cost driver. The Similar Projects model utilized a k-Nearest Neighbor Regression and a Differential Evolution algorithm to calculate a "distance" between two projects given importance weights for each cost driver. The tool used Microsoft Excel to display the user interface, Microsoft Access to store data, and Python to run the analysis.

The new quotation template replaced a long-standing norm during the purchasing process of requesting suppliers to quote a project as a single sum of design, labor, and overhead costs with an updated version that requests a specific breakdown of those costs per machine within the project. The team created a template builder to allow buyers to easily tailor the template to each project and seamlessly integrate it with the existing supplier portal system.

These two solutions, along with a detailed Product Roadmap, provided the company with a working prototype and recommended processes to improve their cost estimation accuracy, increase their information granularity, lower the barrier of skill level required to estimate cost, and ensure that past project data is readily available. These improvements will save the company 80-100 engineering & management hours and \$1.5M - \$3M in cost avoidance per project through faster quote turnaround time, fewer budgetary disputes, and better target costing for equipment.