FINANCIAL RISK MANAGEMENT FOR THE CAPACITY PLANNING OF FACILITIES ASSOCIATED TO NEW PRODUCTS AND UNCERTAIN CONTRACTS

Miguel J. Bagajewicz[(+)], Zack McGill and Ryan Posey

University of Oklahoma,100 E. Boyd St., T-335, Norman, OK 73019

[(+)] *Corresponding Author.(bagajewicz@ou.edu)*

EXTENDED ABSTRACT

We consider the case of a new product, a gas tank to be included in new automobiles, for which some preliminary testing will be conducted. After such testing is performed, the plan is to approach potential customers to raise interest. Based on the outcome of such interest, one has to craft a plan to build a production facility for which one has to determine its location and capacity. While this facility is being build the prospective clients are approached for contracts. Clearly, the probabilities of obtaining these contracts are a function of their initial interest, which in turn is also unknown. In addition, this initial interest is also a function of the amount of testing of the new product: the more tests are shown to the potential customer the larger the probability of raising interest, but also the larger the cost and time of this pre-testing period.

There are therefore several decisions to be made in this process, some that can be made when uncertainty unveils (production levels, personnel hiring, etc), but some other that need to be made upfront, like the number of tests. The purpose is to analyze what are the financial risks involved in this decision making. To assess and MANAGE those risks, we constructed a dynamically allocated PERT/decision tree that allows us to assess risk. By looking at the risk profile of different “here and now” decisions, we can identify less risky (but also less profitable) decisions.

We designed a basic model of a gas tank made out of a composite material and we calculated all the manufacturing costs as well as all the fixed capital investment needed as a function of capacity.

We considered the following car models: Nissan Altima, Honda Civic, TSX and TL and GM Impala, Montecarlo, Century, Regal and Grand Prix. We considered the following situation:

- A prototype is build and is subkjected to testing.
- If it fails a test, a new prototype will be built.
- The project will be dropped after three failed tests.
- The probabilities of passing tests #1, #2 and #3 are 40%, 60% and 80%.
- The costs of each test were estimated.

Thus, there is a 4.8% chance that the investment will be reduced to building the prototype and paying for the development and testing, after which the project is disregarded. Thus, there is 95% chance that the project will go through.

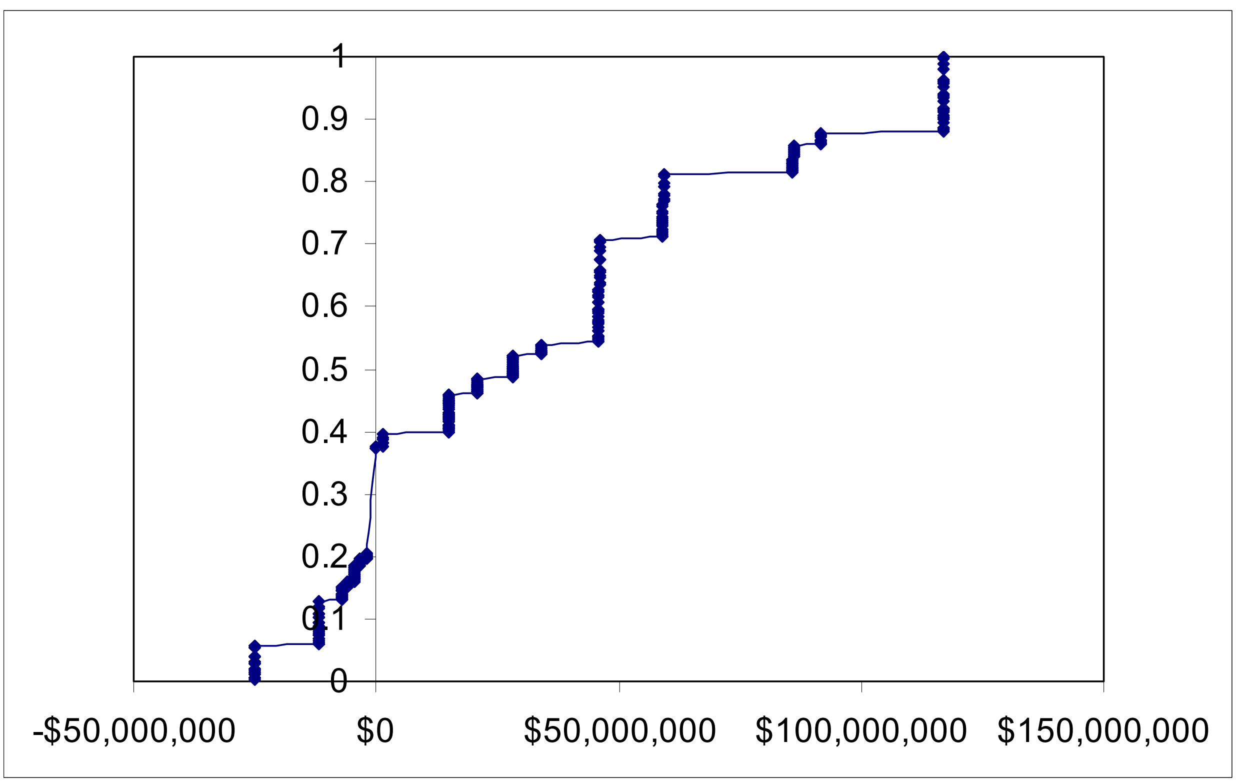
We considered that after developing a successful prototype, General Motors, Nissan, and Honda will be approached to investigate their interest in using the polymer composite tank. If these companies are interested in using the product, but not yet showed their commitment, then we will move on and decide plant location based on the level of interest.

The procedure to decide on the level of interest is a simple one: We classified interest as high, medium and low and we assigned certain probabilities to each event for each car. If the interest is medium or high, then the new facility would include capacity for such demand. If the ineterst is low, the rule that was set is that planning to attend such demand will be dropped and the installed capacity will be low.

Finally, we consider the probabilities of getting a contract with each of those companies that have expressed medium or high interest. Such probabilities are higher if the interest shown is high and smaller if the interest shown was medium.

We then run evaluated the full spectrum of possibilities and calculated a cost and a revenue for each one. To each of these we also calculated the probability of such outcome. One example of a scenario would be that the gas tank needs two tests, that GM and Nissan express high and medium interests and that Honda expresses small interest. Then under such scenario, the decision is to build capacity to sell only to GM and Nissan. The last part of the scenario is that GM signs a contract but Nissan does not, which would leave one with extra capacity.

We then constructed a risk curve (cumulative probability of profit):



The expected net present value for this project is 34 million, with an investment varying from 3 to 7 million depending of the scenario (one needs to remember that the investment is a function of each different scenario). The conclusion one makes from this curve is that there is almost 40% chances that the project will loose money. In addition, the value at risk is around 59 million. We used value at risk because it is a popular measure of risk these days (the other one is variability). In addition, the downside risk at a zero target (Expected loss) is 2.7 million and the worst case scenario is a loss of 24 million with a 0.4% probability (really low). This is much larger than the investment costs, which means that we consider that once a contract is made it has to be honored.

Conclusions

We have created a model that helps asses the expected profit and the risks associated to the introduction of new products that depend on obtaining contracts with potential clients who have been already identified. We expect to enrich this methodology by considering plant location and time to market as a variable. We plan to add transportation costs that are scenario dependent and most important a pricing model. We currently used a fixed price. Finally the model will introduce demand variations that are uncertain through time.

Acknowledgments: We would like thank Lucio Boccacci, Jaime Erazo and Nick Harm for performing the gas tank design and making the capital investment calculations.