

Case 19

Crummy Casting

Net Shape Casting, Inc. (NSCI) is having problems with a titanium alloy part cast for an Air Force contract. The part has an extremely complex shape. Nearly 70% of the castings are produced with unacceptable voids. NSCI “solves” this by producing many extra castings and recycling defective ones into scrap/raw material.

This solution more than triples the cost of labor and energy during casting. It also contaminates the alloy during the pouring and remelt stages. Problems with voids are obvious before the expensive machining stages begin, or annual costs would be much higher than the \$36,000 extra it now costs. In the long run (an extra 3-year delay), the problem can be solved in the next redesign cycle. The problem stems from the most recent design revision, which was just instituted.

The foundry’s floor supervisor believes that better understanding of the flow patterns in the mold and some mold modifications may solve the problem. He asked engineering to estimate the cost of a “research” study. They propose spending \$50,000 for lab work, which they estimate has a 75% chance of leading to a workable solution. They believe spending an additional \$10,000 for an outside consultant specializing in flow simulation would increase the probability of success by 10%.

Note that the contract requires a fixed number of acceptable parts per year in which the number made (M) times the success rate equals the number needed (N). With the current success rate, $M = N/(1 - 0.7)$. The extra cost per year for the unacceptable voids is proportional to the number of defectives $= M - N$.

If NISC uses a discount rate of 10%, should the research study be conducted and should the consultant be hired?

Options

1. Analyze the sensitivity of your recommendation to the estimated probabilities of success.
2. The basic problem has modeled the outcomes of the two study versions as complete success or complete failure. Instead assume that the internal team with or without the consultant would improve the current 30% success rate as shown in Table 19-1.

Table 19-1 Success Rate After Research Study

Probability <u>Outcome</u>	.1 <u>Terrible</u>	.2 <u>Pessimistic</u>	.5 <u>Expected</u>	.2 <u>Optimistic</u>
With consultant	50%	70%	85%	100%
Without consultant	40%	60%	75%	100%

3. The internal study could be started immediately, and then the decision on the consultant could be made in three months. If this option is selected, the internal study will reliably indicate the outcome. If the consultant were hired, it would add two months of delay, add \$7000 in internal lab costs, and would halve the consultant's fee. When should the consultant be hired, and what is the expected value of the delay?

Suggestions for the Student

1. The first step is to find the expected value of the three alternatives: two versions of the study and continuing as is.
2. By equating the Step 1's expected-value equations, breakeven probabilities can be found.