



## Financial Data Analysis for Contract Planning

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In the maintenance department of a large chemical facility with several plants, we are faced with the problem of budget planning for the future. In this particular case, we are analyzing the last ten years. The first five years were spent doing the maintenance in-house and the next five were spent with the maintenance outsourced to a service provider. This service provider has a fixed-fee contract so that a single yearly price pays for all necessary maintenance activities required so that the plant is running at a certain availability (or better). We therefore have all relevant data, both technical and economic, only for the first five years. For the second five years, we have only the technical data.

The management teams of both the plant and the service provider feel now that this fixed price is too low and must be re-negotiated. There are three possible scenarios for the future: (1) in-source the maintenance again, (2) make another fixed-fee contract with some other fee, or (3) continue outsourcing but agree on a catalog of individual services and prices and thus remove the obligation of a minimum availability from the service provider. The question is, which alternative is better (and why)?

Please keep in mind that "better" is not necessarily the same as "cheaper", for the problem has more facets than money. To name a few of them: the problem of employee (and thus knowledge) rotation, the dichotomy of risk and reward, the tension between saving on maintenance by quickly degrading the equipment, the security and financial



planability in a fixed-cost environment versus the potential saving in a variable-cost environment and so on. All these are interesting features that must also be taken into account. We must essentially consider that each of these risk factors has an associated price and consider the best solution in this complex of possibilities.

The inherent issue is that all the important events, technical and risk factors, will only happen with a certain probability. We cannot be certain of anything and so our approach is necessarily probabilistic.

We shall view the problem from three angles: (1) plants, (2) equipment categories and (3) employees. The whole budget as a single ticket per year is therefore divided into each of several plants, into each of several equipment categories and into each of several employee categories.

The purpose of doing this is that we can anticipate, from our technical records of failures, a certain failure frequency in each plant and each equipment category. We also know, for reasons of technical skill and education, which employee category is needed for a particular failure, and we have trade union tariffs for these categories.

As soon as we know the plant and equipment of the failure and the employee category required to fix it, we know what the cost of the measure is with a small uncertainty. This fact became clear from the first five years in which we had all data. We are left with 20 plants, 128 equipment categories and 4 employee categories. This yields 10240 combinations, each of which was priced for each of the first five years. This means that we must merely know the number of future failures in order to compute a budget. As we have the technical records, we can do this for the second five years and thus determine the real cost of maintenance in those years.

Naturally the future is not the same as the past. Equipment gets older and thus fails more frequently, equipment is exchanged and thus fails less frequently, employees are trained further and become better or change categories, plants are in higher demand one year and less in demand the next year. Such factors must be taken into account in our future projections of the number of failures.

In this way, we arrive at a cost budget for the second five years. The service provider reports the total actual cost of maintenance per year and so we may check his actual cost against our estimate. The estimate agrees with the report for the first four years. In the last year, our estimate is significantly higher than the reported actual cost. As our estimate is based on engineering needs and realistic prices (as confirmed by the correct budgeting for the first nine years), we take this observation as confirmation that the service provider was providing less maintenance to the plant than is normal and was reducing equipment lifetime to save maintenance costs. Using our approach, we have determined a realistic and verifiable method to forecast maintenance budgets for a production plant such that it is kept up in fair condition. We are thus not degrading the



plant in order to save maintenance money in the short term, neither are we over maintaining. If we were to in-source the effort, this number would be the price tag.

This approach delivers specific answers for each strategic option:

1. Outsourcing at fixed fee. We need to negotiate between the problems of underpaying (and then living with equipment maintained at the limit) and overpaying (and then losing money). The fixed-fee must be higher than the above computed price to take into account the risk taken by the service provider in promising a service of unknown magnitude and in order to take into account the benefit obtained by being able to plan a specific cost. As we have computed an uncertainty figure alongside the price, it would be reasonable to set the fixed-fee price at the computed cost plus the full uncertainty.
2. Outsourcing at price list. Our approach delivers the price list: It is the cost projection per category of plant, equipment and employee that we have used above. Plus a certain margin, of course, for factors such as organization, management and liability.
3. Insourcing. Our cost projection provides a detailed cost estimate for this option also.

With any outsourcing partner, there is a cost of communication and a risk of this partner doing what may not be in the interest of the plant owner. Some of these actions may be difficult to trace and may only show effects much later in time. These costs are significant but difficult to estimate in value. Also the benefit of being able to plan a definitive budget is an uncertain benefit that is difficult to price. All in all, the outsourcing partner makes a change to the price tag that is hard to compute and thus it makes a change mainly to the uncertainty parameter. Thus, outsourcing is itself a risk; at least in this constellation of factors.

We conclude in recommending insourcing in this scheme. It has the lowest estimated cost and the lowest estimated risks. The owner is in control and can do to the plant as the corporate philosophy thinks is wise. The lowering of the cost and risk is however "paid for" by accepting a maintenance budget dictated by failure events as opposed to a contract. These conclusions may be drawn simply by carefully considering the data at hand, cleaning the data by putting it into sensible categories and checking the results for plausibility. The central insight of the approach was that this categorization determined the price.

