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DEVELOPING A BUSINESS CASE

TOOLS FOR CHOOSING IN FAVOR OF OR AGAINST INVESTING IN AUTOMATION by Johannes Ritter

When it comes to successfully managing a laboratory, the challenge is to think as a business manager and as a scientist at the same time. What seems so obvious—at face value—is much more difficult to achieve when it comes to evaluating vendors' products. Evaluating a new product's capabilities with scientific criteria and judging its influence on the laboratory's efficiency is one thing; evaluating a new product using financial criteria is another. It is obvious that a new product's potential improvements to the laboratory's efficiency and quality have to be considered when evaluating the costs and benefits of new solutions. The question that remains is how to capture the laboratory's new workflow and potential performance within its business analysis.

"THE BUSINESS CASE ANALYSIS STARTS BY PRECISELY DEFINING THE PROJECT'S SCOPE."

A business case that is developed with appropriate methods considers the necessary intertwinement of financial and technical criteria so that it is a meaningful decision tool for choosing in favor of or against investing in automation. An actual business case for a medium-sized food and beverage company that considered implementing Laboratory Information Management Systems (LIMS) in its laboratories exemplifies a method that is applicable to any laboratory automation project. The company's starting point for considering a new LIMS was the need to increase throughput in order to remain competitive. The efficiency of the laboratory also needed to be increased when, in times of crisis, testing of raw material was necessary to reassure customers of the quality of a product. The vendor's proposal included all elements the company was hoping for, but the decision nevertheless could not be made. The investment of $500,000 CAD was considered too high and the benefit of the new system too unclear, leaving the decision makers hesitant. In order to solve the dilemma, in which a good solution seemed so near but could not be reached, a business case was built.

The business case analysis starts by precisely defining the project's scope. What aspects of the laboratory will be affected, and how can the impact on the company's financial results be measured? In order to understand the close link between technical laboratory know-how and financial criteria, a project group begins by building an influence matrix. In order to define the project-specific scope, the influence matrix is a visualization tool that lists and structures all elements of the project (Figure 1).

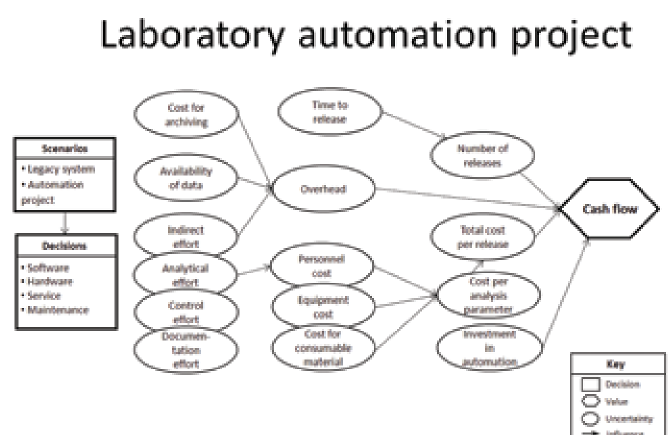

Figure 1. Influence matrix

Laboratory automation projects are complex, and in order to reduce that complexity, it is useful to differentiate between four categories into which any project can be divided: values, scenarios, decisions, and uncertainties. The value is the criterion by which it is decided if the project will be launched or not. The food and beverage company in our example chose cash flow as the decisive value. There are at least two scenarios that are compared in any business case: the project in question and the business-as-usual scenario, which is the legacy system. Comparing the two scenarios answers the question of what the difference in financial results will be if a new LIMS is implemented. Decisions and uncertainties are those elements of the project that are either controllable or not controllable. Decisions such as type of software and hardware, the scope of service, and maintenance are clearly controllable. Unfortunately, that is not true for either the availability of data or the amount of analytical effort required in comparison to control and documentation efforts. Moreover, personnel and equipment costs are not entirely controllable over the next three years. There are uncertainties on the benefit side—such as time to release and number of releases—along with those previously mentioned on the cost side. The quantification of a project's financial impact is often seen as an almost impossible task due to all these uncertainties. It is true that there are a number of unclear variables and that they also interrelate, but as this condition cannot be changed, it needs to be embraced. That is exactly what the influence matrix does. It not only lists all uncertainties, but also illustrates how they are interrelated.

"DECISIONS AND UNCERTAINTIES ARE THOSE ELEMENTS OF THE PROJECT THAT ARE EITHER CONTROLLABLE OR NOT CONTROLLABLE."

By having listed and structured the project's elements, major preparatory work for the financial model has already been done. The structure of the influence matrix is repeated in the financial model, and the interrelation of the influence matrix's elements is captured in simple algebraic formulas within the financial model. Basing the financial model on the influence matrix ensures that every relevant element is included and that the financial model is absolutely specific to the project. When it comes to filling the financial model with data, the uncertainties need to be assigned numerical values. That might sound counterintuitive at first, but there is a way to combine the necessary with the challenge. It would be hardly convincing if, suddenly, the uncertainties were taken for certainties and were attributed a precise number that was taken for granted. Instead, the uncertainties are quantified by ranges. A business case always evaluates a project with respect to its financial impact in the future. As no one can foresee the future, the magnitude of each uncertainty needs to be estimated. Because point estimates are doomed to be inaccurate and therefore unreliable, each uncertainty is quantified with a range estimate.

In the case of the food and beverage company mentioned earlier, the firm has a lot of benchmarking data for the last several years that help to estimate narrow ranges, but they still cannot replace the estimates. Therefore, actual data is collected in the form of expert interviews. The best experts are employees of the company, specifically the laboratory. They know the procedures well; therefore, their experience allows them to estimate the amount of analytical effort that is currently possible as well as the amount that will be possible with the new LIMS system. By how much will the documentation effort be reduced? By how much will LIMS accelerate the control procedure? Specific experts among the company's employees are asked these questions, which they answer by naming a minimum, a most likely, and a maximum value. Each uncertainty in the financial model is then populated with these three values. The financial model considers both scenarios listed in the influence matrix, and therefore, each uncertainty is quantified for both scenarios. This procedure allows a first result; the most likely incremental cash flow is $6,748,219 CAD. On basis of that cash flow, the net present value (NPV) at a discount rate of 14% is $5,077,269 CAD and the payback period is 1.07 years.

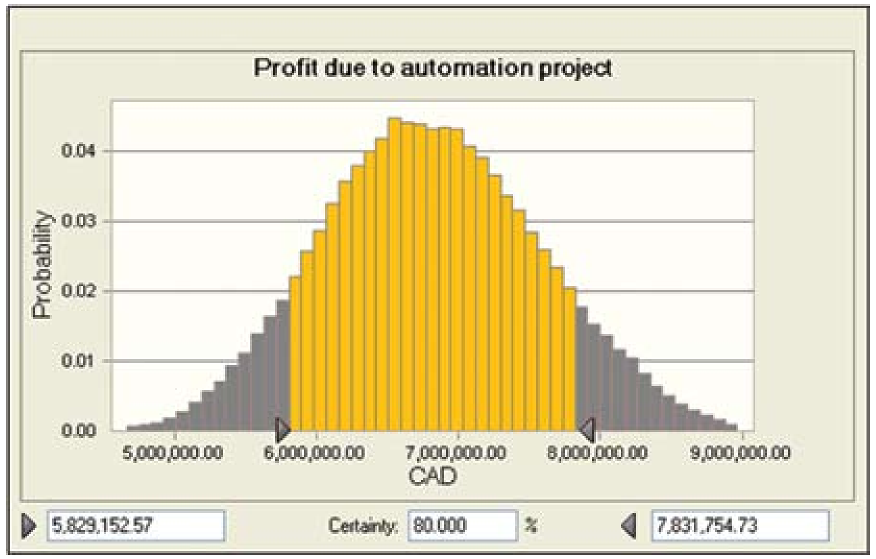

Figure 2. Range of possible results

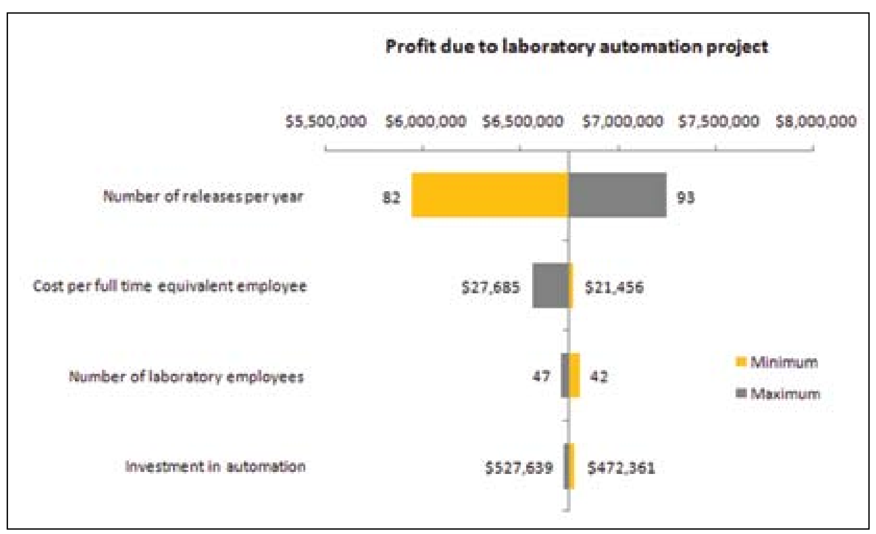

Figure 3. Greatest risk factors

In this first result, the ranges were not considered; however, in order to have a reliable result, they need to be. The appropriate solution is found in the realm of statistics, combined with risk and sensitivity analysis. Computer simulation software considers all values within the stated ranges. The first question that needs to be answered is how 'likely' the most likely result actually is. A Monte Carlo simulation answers this question by selecting one value out of each range at a time, calculating each value's respective interrelation with the range, and then running 100,000 trials to determine whether the result has statistical validity. With an 80 percent probability, the incremental cash flow over three years if the food and beverage company installs a LIMS system will be between $5,829,153 CAD and $7,831,755 CAD (Figure 2). With this information in hand, range planning can be more realistic. The next important question is by which risk factors the most likely result of $6,748,219 is influenced. A tornado chart, the second tool within the risk and sensitivity analysis, answers this question precisely in dollars and cents. Whereas the Monte Carlo simulation considered the interaction of all elements within the financial model, the tornado chart looks at each uncertainty separately. That way, the biggest risk factors that cause the biggest deviation of the most likely result can be identified and quantified. In the LIMS project being considered in this article, the biggest risk factors are the number of releases per year and the cost per full-time equivalent employee (FTE) (Figure 3).

"THE QUANTIFICATION OF A PROJECT'S FINANCIAL IMPACT IS OFTEN SEEN AS AN ALMOST IMPOSSIBLE TASK DUE TO [THE] UNCERTAINTIES."

The middle axis of the chart marks the most likely value of $6,748,219 CAD, while the minimum and maximum bars name the possible impact of each uncertainty. If there are 93 releases per year, the final result will increase to $7,249,735 CAD. If there are only 82 releases per year, the cash flow will decrease to $5,941,682 CAD. The cost per FTE is the next-biggest, yet already less-decisive, risk factor. The investment in automa-

"THE BUSINESS CASE DELIVERS THE FINANCIAL DECISION CRITERIA IN FORM OF THE INCREMENTAL CASH FLOW."

tion, on the other hand, has only a minor influence on reaching the most likely result. The tornado chart at the end of the business case analysis is often a surprise when the risk factors that were discussed with a great deal of enthusiasm and spirit turn out to be of rather minor importance.

After the three steps of building an influence matrix, developing a financial model, and running a risk and sensitivity analysis, the business case analysis is complete. The business case delivers the financial decision criteria in form of the incremental cash flow, on which various financial ratios can be based. That all aspects of the new LIMS system that influence the laboratory's workflow and results are considered is guaranteed by the influence matrix. This first step prepares the laboratory to translate the product's technical capabilities into the financial impact each of them brings. The actual translation takes place within the financial model and is statistically validated in the risk and sensitivity analysis. Because of the risk and sensitivity analysis that is performed in the last step, the business case is more than an economical decision tool. The knowledge of the risk factors enhances the project's success because implementation can be steered accordingly. For the food and beverage company in question, the business case answered the decisive questions in such a way that management no longer needed to be hesitant. Cost, benefit, and risk could clearly be seen, and the new LIMS system was implemented shortly thereafter.

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