# OUTLINING VALUE ASSESSMENT FOR SOFTWARE REQUIREMENTS

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Abstract: Understanding software requirements and customer needs is vital for all SW companies around the world. Lately clearly more attention has been focused also on the costs, cost-effectiveness, productivity and value of software development and products. This study outlines concepts, principles and process of implementing a value assessment for SW requirements. The main purpose of this study is to collect experiences whether the value assessment for product requirements is useful for companies, works in practice, and what are the strengths and weaknesses of using it. This is done by implementing value assessment in a case company step by step to see which phases possibly work and which phases possibly do not work. The practical industrial case shows that proposed value assessment for product requirements is useful and supports companies trying to find value in their products.

## 1 INTRODUCTION

According to Ojala (2006) the objective of the value-based approach is to explore ways to eliminate value loss in software development, software products, and software process improvement (SPI) using the value assessment framework of Koskela and Huovila (1997). Value-based approach uses economic-driven tools, which are based on economic studies including, for example, the areas of cost estimation, cost calculation (for example ABC and life cycle costing) and investment calculation. The value-based approach prefers calculating costs instead of estimating them, and also considers software development and SPI as investments, on which it is possible to spend too much money. In practice, it takes care that the customer requirements are met in the best possible manner, ensuring quality, timeliness and value in products as well as in processes, over their entire life cycle.

The value-based approach indicates a clear dependency between the process and products. It sees that we need to develop and optimize process activities so that processes produce the products needed. Furthermore, it sees that we must analyze products in order to reveal problems in processes and develop processes from the product point of view as well. This is vitally important, especially for companies respecting customer opinions and aiming to optimize costs in their processes, because the customers are the ones paying for the products and product-related services, and companies have to allocate all costs to products to be able to price them.

The purpose of this study is to collect experiences of using value assessment for product requirements in an industrial case. In more detail the purpose is to answer to following questions:

- How the proposed value assessment for product requirements works in practice
- The strengths and weaknesses of value assessment for product requirements
- Whether the company assessed sees the value assessment for product requirements useful

## 2 VALUE ENGINEERING PROCESS

This study categorizes VE process into three main phases: pre-study (orientation), value study (information, function analysis, creativity, evaluation, development, presentation), and post-



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study (monitoring, implementation). These phases are considered appropriate since they constitute independent areas of VE and have been justified in earlier discussion (Ojala, 2006).

According to Value Engineering, value is a measure – usually in currency, effort or exchange, or on a comparative scale – which reflects the desire to obtain or retain an item, service or ideal. Cost is the price paid or to be paid. It can be divided into elements and, to some extent, functions. Park (1999, 50) defines cost as "an expenditure of money, time, labor, etc., to obtain a requirement." Worth is usually defined as the lowest cost to perform the required function, or the cost of the lowest-cost functional equivalent. The most typical definition for value (Ojala, 2006), is perhaps (1):

$$Value = \frac{Worth}{Cost} \quad (1)$$

where:

Value = The value of some object, product, service or process.

Worth = The least cost to perform the required function (product, service or process), or the cost of the least cost functional equivalent. If possible can also be the worth in money, what customer sees in product, service or process.

Cost = The life cycle cost of the object, product, service or process (price paid or to be paid).

# 3 VALUE ASSESSMENT FOR PRODUCT REQUIREMENTS

## 3.1 Background

Value assessment for product requirements was implemented in a multinational company producing electronic products in fall 2006. The basis of it was the requirement list done by customer and vendor together. The requirement list contained requirements such as: picture call, emergency, user, server, distance configuration, video, service, camera and activities.

Together with the requirement lists, several other documents were analyzed during the assessment as well. These documents included strategy plans, project plans, process descriptions, selling agreement and different financial statements.

## 3.2 Information

The product to be assessed was a electronic product containing software and hardware. It was developed in collaboration, by the vendor and the customer. In the assessment opening meeting, the purpose of the assessment was discussed with the vendor and the customer. The definition value=worth/cost was discussed, and it was seen as extremely important to find out which requirements of the product gave the best value to the vendor without neglecting customer needs. The customer had a strong interest in analyzing priorities and worth in requirements, for further product development work. After the discussion, it was decided that value would be calculated for the requirements described in the product sales agreement. This decision was strongly supported because the vendor's cost accounting system made it possible to track real costs for the specified requirements.

As a final point of the initial meeting, vendor and customer roles were discussed. The vendor emphasized that it would like to undertake the phases from creativity to presentation without the customer being present, since these phases included brainstorming to gain a new understanding of all the processes used to develop products. This point of view was clearly understood by both parties, as the customer was primarily interested in evaluating requirement priorities, in order to see how well the vendor had understood their wishes.

## 3.3 Function Analysis

After the initial meeting it was easy to "start the assessment", because the requirements to be assessed were agreed in the information phase. In the first assessment meeting four customer representatives (referred to as "customers") and three vendor representatives (referred to as "vendors") prioritized the requirements. Afterwards, the customers allocated worth to each requirement using a percentage scale from 0% to 100%. The idea was to identify in percentages what kind of worth the customer sees in the requirements. The vendors allocated costs using the same percentage scale from 0% to 100%. As a result of this, the customers had given worth percentages for all requirements, and the vendors had given cost percentages for the same items. The calculated worth and cost were later compared, using percentages, to the real worth and cost, to find out the difference between "belief" and "reality".

All the interviewees agreed that the prioritization of requirements clearly helped in the next phase, in which the same requirements were analyzed in terms

of worth and cost. The customers found it easy to assign worth to their requirements, based on the customer price. The vendors also considered it easy to assign costs to requirements.

One conclusion of discussions was that worth and cost allocations for all requirements were seen as relevant for both sides, even if only stated as percentages. According to customer they also had their own idea about the actual costs of production, and since they knew the worth they were satisfied for the situation. Figure 1 presents the average worth and cost for requirements. In this figure we can observe how, for example, the customer has evaluated the worth of picture call function as being noticeably higher than the vendor's estimation of its production cost. In practice, this means value for the vendor.

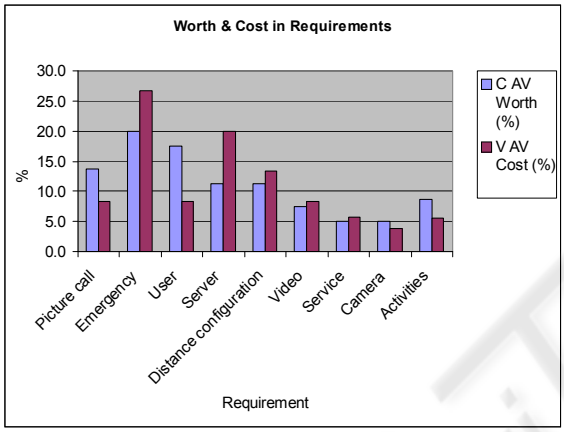


Figure 1: Average worth and cost for requirements including all interviewees (AV=average, C=customer, V=vendor).

On the whole, the experiences of using prioritization in ranking requirements were positive. Even more interest was seen in the analysis of worth and cost for each requirement, and especially in the differences identified between customer and vendor, as well as between technical- and user-oriented personnel.

## 3.4 Creativity

In accordance with the agreement between the customer and the vendor, only the vendor participated in the phases from creativity to presentation. The first step in the creativity phase was to allocate costs to all requirements. According to the vendor it was easy to allocate costs to the requirements.

Based on the figures and discussion it was noted that certain requirements did not create good value. After discussion of this, the project members shared the opinion that this was because of the unfinished architectural plan.

Project members could also see from the charts presented how time-consuming it was to start using new technical environments, without good planning. The new technical environment delayed the implementation of certain requirements significantly. New technical challenges, such as developing software for multiprocessor environments, were also named as one reason for delays. This was because project personnel did not have sufficient training in working in the multiprocessor environment.

## 3.5 Evaluation

At the beginning of the evaluation phase the project team discussed criteria for the evaluation of improvement ideas. The calculated weighted averages for criteria based on discussion were as follows: system stability 25 %, safety 20 %, optimized functioning 7.5 %, ease of use 20 %, maintainability 15 %, and profitability 12.5 %.

After thus defining the weightings of the criteria, the project personnel gave points to each improvement proposal on a scale of one to six, where six indicated maximum points and one, minimum. The points allocated were multiplied by the calculated weighting percentages.

The most surprising result was that the importance of the technical environment was as high as third place. Problems in design and architectural planning were expected, as were problems related to project management. Estimation and multiprocessing got the least points, so their importance to the project was not considered to be as high.

## 3.6 Development

In the development phase, the improvement ideas were separately developed further, in order to examine their practical implications.

**Architectural Plan and Design Plans.** One proposed change was that the number of reviews for the architectural and design plans had to be increased. Project personnel also identified a clear need to develop criteria for these review rounds. Project members did not see any disadvantages to the proposal. They calculated that if there had been support resources for making more comprehensive plans and reviewing them, the project would have been 440 working hours shorter. The potential cost savings would have been about 26 000 €.

**Technical Environment.** At the moment, the ability to use the existing characteristics of technical tools is weak. The use of pre-existing components is also rather poor. The result is that code has to be written from start to finish each time.

The project group evaluated that if basic components for development work had existed, 100 fewer working hours would have been required. If there had been sufficient technical training concerning the new environments (dotNET and ATL 7) for key personnel, 150 fewer working hours would have been required. In total, the potential cost savings would have been approximately 9 000 €.

**Project Management.** From a project management point of view, it is problematic that all the employees are always assigned one hundred percent to a given project. As a consequence, there is not enough support available if needed, and "the wheel is invented several times in different projects."

The project team evaluated that with satisfactory support in evaluating the architectural plan, the design plans, and the extra need for time in starting to use new technologies, 100 fewer working hours would have been required. In financial terms, this would have meant a saving of about 6 000 €.

### 3.7 Presentation

The results of the product value assessment were presented phase by phase to the high-level management. In the presentation, a clear emphasis was placed on presenting customer needs and wants, and the corresponding costs to the company. The value indexes were used to outline the existing value-increasing opportunities. The potential cost saving proposed was approximately 26% of product price.

As a whole, the assessment strongly emphasized collaboration between the customer and the vendor, and all the improvement proposals were in line with the customer's interests as well. All customer and vendor representatives considered product assessment an interesting method for the development of product quality and value, and process capability.

## 4 CONCLUSIONS

Presented product assessment for requirements worked very well in practice. All participants agreed that the value assessment process was clear and practical for their use. Vendor saw it important that the customer was involved to the assessment as it increased the efficient use of resources and brought more business point of view to the assessment, which was considered to be extremely important.

The product assessment for requirements gave more customer-oriented improvement proposals than process assessments. Product assessment also involved the customer in the decision process so that described requirements were in a more solid basis to be implemented. All participants also emphasized that if value assessment is done in the planning phase of a product, it is cheaper for any company than making changes after several months of development work.

There were also weaknesses in the proposed value assessment for requirements. Firstly, the empirical findings of this study are rather limited as this study bases on one industrial case. Secondly, some costs had to be estimated instead of having calculated actual costs.

Generally, all the assessment results in this assessment are reliable. The reliability of the results was also improved significantly because the assessor interviewed several people and went through the same questions with all of them. The interview results were also compared to existing written material to check that they matched.

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