IMPLEMENTING A VALUE-BASED APPROACH TO SOFTWARE PROCESS AND PRODUCT ASSESSMENT

Pasi Ojala

Nokia Ltd., Hintanmutka 17 A 6, Oulu, Finland

Abstract: Recently more and more attention has been focused on the costs of SPI as well as on the cost-effectiveness and productivity of software development. This study outlines the main concepts and principles of a value-based approach and presents an industrial case where value assessment based on value-based approach has been used in practise. The results of the industrial case show that even though there is still much to do in making the economic-driven view complete in software engineering, the value-based approach outlines a way towards a more comprehensive understanding of it. For companies the value assessment offers useful help when struggling with cost-effectiveness and productivity related problems.

1 INTRODUCTION

Using the framework presented by Koskela & Huovila (1997), the value-based approach is understood in this study as a process. The main principle of this process is to eliminate value losses in software development, products, processes and SPI. It 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, the value-based approach 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. In particular, the aim of ensuring quality connects it to the other methods aiming for quality improvement.

The value-based approach also 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 happier the customer is, the more worth he sees in buying the products from us. It is also clear that when we know our process and product costs, worth and value, our ability to estimate, budget and control future risks will improve significantly.

Therefore it is surprising that several studies in the area neglect the importance of product value by assuming that it is only achieved by improving processes. It is also just as surprising that many researchers do not examine the value of SPI itself. Studies are mostly carried out on assessing the value of processes, if they are carried out at all, but the improvement decision and initiative itself, which in many companies is difficult to make, is not considered from a value point of view at all. To be effective, the value-based approach to successful software engineering should evaluate processes and products as well as the economical benefits of starting and implementing their improvement. Regarding to value-based approach the purpose of this study is to collect experiences of using Value Assessment for products and processes in using industrial case.

2 VALUE ASSESSMENT FOR PRODUCTS AND PROCESSES

There are four ways to enhance a standard software process assessment using Value Engineering (VE) (Ojala, 2000, Ojala 2004, Ojala 2006). The first possibility includes an addition of defined VE process into the existing process models of used capability assessment method (for example in CMMI or SPICE).

The second possibility covers Value Assessment for processes defined in used process model. The main idea of this enhancement is to run through all defined VE phases and as part of it calculate costs, worth and value for each assessed process existing in used process model.

The third possibility includes Value Assessment for processes without process model. The purpose of this enhancement is to find out from company's own defined process descriptions all process practises which are then examined from cost, worth and value point of views using VE process.

The fourth possibility includes Value Assessment of a product. This enhancement examines Value of product components and requirements and reveals value improvement possibilities in them.

3 VALUE ASSESSMENT FOR PROCESSES AND PRODUCTS: COMPANY A

3.1 Background

Value assessment was implemented in Company A in fall 2004. Because company did not know whether its cost accounting would be able to provide the necessary cost data for all processes and product components, one purpose of the assessment was also to help to give information on how to build a cost accounting system for tracking process and product costs using identifiers.

The main problem presented by Company A was that there was no real understanding of all the product environments and their profitability and value. Some processes were attached to value assessment, because Company A saw that they were closely related to product development, and value information was needed for them as well.

The definition *value=worth/cost* was discussed, and it was seen as extremely important to find out which components of the product gave the best

value to the vendor without neglecting customer needs. Since there were several customers for the product in question, it was not possible to include all customers in the assessment. Therefore, Company A decided to base worth calculations on ideal production costs, which represented the cheapest way of building a product or running a process.

3.2 Information

The overall goal of product development was to produce different versions of the product for different operating system environments, using the same base code. Unfortunately, this was not possible because, in practice, there was always a small part of the product that had to be coded separately for each operating system environment.

Company A had a strong interest in analyzing cost and worth in its product requirements and architectural product components for further product development work. However, when planning the assessment it was considered obvious that Company A does not have cost accounting system for architectural components, and simple estimation, not based on real calculated cost, was not considered to be good enough. Therefore it was decided that value indexes would be calculated for the prioritized requirements and component-level assessment would be postponed to the following year, when cost accounting would be able to produce the necessary component-level cost information. Value calculations for product platforms were done using estimates for following operating systems:

- Windows, Linux, Solaris and HP (easy)
- QNK (difficult)
- UX (very difficult).

The value assessment for processes was based on the company's own process descriptions as company saw it more interesting than reference model based assessment. The processes selected for value assessment included architectural design, design, code implementing and testing.

3.3 Function Analysis

Platform-level value indexes (Figure 1) indicate that the easiest platforms produce the greatest value. Since the value indexes for the other platforms are below 1.0, these platforms do not produce as much money as they cost. Generally, it was recommended to Company A to avoid using a lot of resources on this kind of products where value is below 1.0. However, it was also advised that if the Company A wanted to move into new markets, it might occasionally be necessary to create poor value for a

certain time. In Company A's situation, this was not the case.

Value indexes for processes (Figure 2) clearly show that Company A creates most value in design and architectural design. However, Company A should start to look for value improvement possibilities mostly in coding and testing. These processes create more costs than worth.
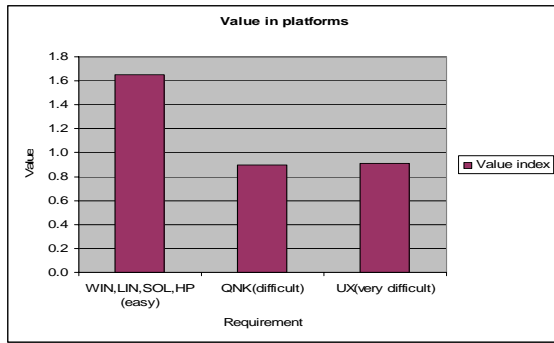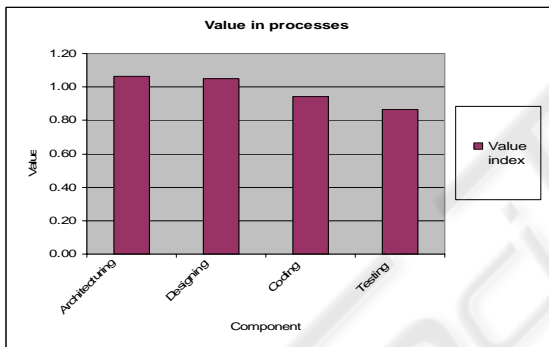

Figure 1: Value in platforms.

Figure 2: Value in processes

3.4 Creativity

Since value determination had been performed for both products and processes, it was decided that both aspects would also be brainstormed. In addition, it was decided that the requirements for a new cost accounting system would also be discussed. All participants were asked to list product-related improvement proposals first, process-related improvement proposals second and cost accounting-related improvement proposals third.

The main ideas were classified in three categories, and included:
Products:
- Someone should be responsible for discussing a move to easier platforms, with customers using "difficult" and "very difficult" platforms.

- The company should announce that it will no longer make products for "difficult" platforms.
- The company should not implement all new features in platforms which it considers "difficult", and some features should be implemented significantly later.
Processes:
- The project managers and testing manager should organize a workshop in which the most time-consuming work practices would be listed.
Cost accounting:
- Accounting identifiers should be created to follow costs in all platforms and main practises.
- Reporting schedules, and templates should be created for cost accounting and value-monitoring needs.
- The working hour tracking system should be improved, to include all value creation-related areas.

3.5 Evaluation

During the evaluation phase all the ideas presented were analyzed and evaluated. It was decided that there was no need to create weighted criteria in prioritizing improvement proposals. It was proposed that all of the ideas should be implemented, except the one suggesting that the company should announce that it would no longer support all platforms. This idea was not widely supported because it was considered to be against the company's strategy and customer service principles.

3.6 Development

Product-related value
According to the benefit analysis, product-related benefits would be achieved if customers changed their platforms from "difficult" or "very difficult" platforms to easier ones. Some customers had already indicated that this would be possible in the near future, but Company A had not been active in supporting it. It was estimated that within a one year timeframe, 60 percent (AV=average, C=customer, V=vendor) of customers could change platform, to an "easy" one. It was further estimated that if not all the new, minor improvements were implemented, the costs involved in "difficult" and "very difficult" platforms would decrease by 25 percent. The total cost savings were estimated at around 50 percent.

Process-related value
Project managers and the testing manager organized workshops with their teams to discuss the most time-

consuming work practices. Based on these workshops participants generated improvement proposals related to processes:

- Each design should be inspected by another designer, who should send design comments, before the inspection, to the project manager, who acts as a chairman in inspection meetings.
- Security testing should be given to test engineers, who have a better understanding of it.
- The test manager should organize module test training for designers and nominate test engineers for each project.
- Testing plans should be inspected by a test team before testing.

It was estimated that the proposed improvements would reduce coding costs by 10 percent over a one-year period. In testing, the cost reduction was estimated at around 15 percent.

Cost accounting system

The third selected value improvement area included the cost accounting system. Since Company A already had appropriate cost accounting software, it was considered possible to use it for the required cost accounting purposes. It was calculated that it would take one person one week to implement the identifiers and train the needed bill approvers in the new practices.

3.7 Presentation

The results of this value assessment for processes and products, including cost accounting system improvement opportunities, were presented to the top-level management. Since the proposed improvements only reduced costs, the top-level management decided to put them into use.

Company A was satisfied with the results of value assessment. However, they announced that since there was no proper time-keeping and cost accounting system in place before the assessment, a new assessment, using the new information, would be carried out in the following year.

4 CONCLUSIONS

In conclusion, the value-based approach to software engineering appreciates the clear dependency between process and product. It helps in developing and even optimizing process activities, while ensuring that processes still produce the services and

products needed. Furthermore, it analyzes products to reveal problems in processes, and develops processes from a product point of view. This is vitally important, especially for companies who respect customer opinions and aim to optimize costs in their processes. Customers pay for products and services, and companies have to allocate all costs to products to be able to price them. The happier the customer is, the more worth he will see in buying a given product.

Perhaps the most significant risk of drawing false conclusions regarding to the presented case study is in understanding the ideal cost that the company had defined for products and processes. This does not necessarily represent the average opinion of all customers well enough, since it is based on the company's own estimate. The use of ideal cost is perhaps even riskier when analyzing the products, because customers usually have a clear opinion of their worth. In the case of processes, the company's own estimates of worth are perhaps more valid, since the customer does not usually see all processes as their main interest for "buying", whereas the company wants to manage them efficiently

REFERENCES

Dell' Isola, A., 1997. Value Engineering: Practical Applications…for design, Construction, Maintenance & Operations. Kingston (MA), R.S Means Company, Inc.

Koskela, L., Huovila, P., 1997. "On foundations of Concurrent Engineering in Construction CEC'97. London, 3-4 July. London, The Institution of Structural Engineers: 22-23.

Ojala. P., 2000. Enhancing Software Process Improvement Using Value Engineering. Working Paper. Series B. University of Oulu.

Ojala, P., 2004. Combining Capability Assessment and Value Engineering: a BOOTSTRAP example. Proceedings of the Profes 2004. 5th International Conference. Kansai City, Japan, April.

Ojala, P., 2006. Implementing a Value-Based Approach to Software assessment and Improvement. Doctoral dissertation. University of Oulu, 2006.