THE HOUSE OF THE RISING VALUE

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ABSTRACT

Construction is a practice-oriented business, partly due to its long history. The practice-oriented approach leads to the fact that the focus of management is on getting the building constructed i.e. on transforming inputs to outputs. When the focus has been heavily on transformation, enough weight has not been given to value generation process to fulfill customers' needs and expectations. Recently a new vision of the theory of construction has provided us the basis to understand the problems and essence of value generation. Value process consists of three phases: (1) finding out the customers' requirements, (2) creating solutions to conform these requirements and (3) verifying during the project that these requirements are met in the best possible manner. Even though interest in value generation is rising among practitioners, lack of practical and applicable tools still causes problems.

This paper presents the current problems in the value generation of the design phase and discusses their consequences to the project and to the end product. A tool providing assistance in the project definition phase is introduced. Experiences from piloting the tool, EcoProP, in building construction projects are described. The tool is based on a generic classification of building properties. The tool supports documentation of requirements in a form of values or classes so that their conformity in design can be verified. Its intended use is to produce the design brief and to serve as a guide for designers. The decision-making procedure with EcoProP is transparent and the well-documented objectives can be revisited in need of change. The tool is currently implemented in projects of different building types with the emphasis on eco-efficient facilities.

KEYWORDS

Construction, value, performance approach, customer, ecoefficiency

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INTRODUCTION

The lead author's last experience on the construction company's ability to deliver value for its clients in a Design&Build –project was an example of a typical cutting-costs –oriented effort. The design brief was created by the project manager of the construction company describing briefly some technical details of the customer's new head office. Rest of the technical requirements was left to be decided during the design phase. Design was based on the blurred instructions by the project manager since customer requirements were not captured during the project-definition phase. The obvious consequence from this was that customer requirements arose during design causing extra iteration rounds and rework. The project manager and the other representatives of the construction company (main author included) focused during the design phase on decreasing the cost of design solutions. Customer naturally expected much more than the construction company offered and since there was nothing to what technical solutions could be compared, trust between project stakeholders was a vanishing item. The end result of the project was a fairly cheap, fairly well functioning office building but considerably unsatisfied customers. Sadly, this is a typical lose-lose situation in the construction industry.

The inability to study and consider the clients' needs and lacking value creation process is widely acknowledged in literature (Huovila et al. 1998, Kumaraswamy 1997). Also the importance of fulfilling customer expectations to attain satisfactory end product is known (Lindqvist 1996, Smith et al. 1998). Still the problems of the briefing are mainly the same as they were thirty years ago (Barrett et al. 1996). Kamara et al. (1999) state four deficiencies of briefing process:

1. often no formal or structured procedure in the evaluation of the brief is applied
2. horizontal integration among stakeholders is inadequate (communication problem)
3. lack of information technology support causes problems when chances to requirements occur
4. traceability of design decisions to client requirements is inadequate

Value means different things for different stakeholders of the project. Developer sees value as the difference between capital costs and income ie. profit *(Exchange value)*, owner/occupier adds occupancy and maintenance costs and apart from avoided rent, value also include issues concerning corporate image *(Use value)*. Third type of value is attached to the attractiveness and desirability of the building (*Esteem value)* (Best et al. 1999). Authors see that value is created by fulfilling the customer needs and expectations. What is needed, is a shift of focus from transforming inputs to outputs to creating real value for clients. Customer needs to be more heavily involved in the briefing and design process. It is a long and winding road but at the end there is a promise of the house of the rising value.

INVOLVING CUSTOMER

Several methods for involving the customer have been introduced (Preiser et al. 1988, Peña 1969, 1987, Akao 1990, Blachère 1988, Cohen 1995, Eureka et al. 1988, Udwadia

et al. 1991). Next, three customer involvement methods are presented: 1) Post Occupancy Evaluation, POE, 2) Problem Seeking, 3) Quality Function Deployment, QFD.

POST OCCUPANCY EVALUATION, POE

The research shows that by far the most significant source of costs over the life-cycle of a building is salaries of employees (Best et al. 1999). Current focus of the cost optimization seems to be on decreasing the capital costs of the project. This leads to the fact that capital costs are often optimized but the performance of the building from user's point of view is deficient. Next calculation is based on Romm et al. (1994) where the original cost distribution is shown in Table 1.

Table 1 – Average annual office expenditure (Romm et al. 1994)

Cost Item	Cost ($/10.000 m^2 office)
salaries	13,993,084
gross office rent	2,260,421
total energy	194,827
electricity	164,688
repair/maintenance	147,466

The supposition is that the productivity of the occupiers of this office building rises by 1% if the performance of the building is improved. The result from this would be $140.000 savings/year. Naturally, the results cannot be drawn so directly but the direction is clear; the benefits of satisfying the needs of occupiers are obvious.

Post Occupancy Evaluation (POE) is a process where the buildings are evaluated systematically after they have been built and occupied (Preiser et al. 1988). POE is applied to learn more on occupiers' needs on the building. POE is a method for learning and using this cumulative knowledge on creating better performing buildings in the future. POE information can be used as a feedback for problem solving, fine-tuning the occupied building, documenting successes and failures to improve the design criteria and guidelines (Preiser et al. 1988).

POE process includes creating a criterion that will contain relevant information on the performance of the building from the users' point of view. The performance of a single building will be evaluated against this criterion.

VTT Building Technology has applied POE:s together with a large, Finnish facility owner/developer. POE is done after the building has been occupied for one year. Findings clearly show that in order to have an impact on the project definition phase of the future projects, POE measurements itself is not enough. The organization has to give meaning to the results, ie. discuss what the implications are and explicitly state what shall be done to avoid discovered deficiencies in coming projects (Kurki 2000). For example, occupiers complained several years that large glass surfaces cause various problems like chill in winter, heat in summer, draft and leakages. Nothing, however, changed until people responsible for setting requirements started to discuss this problem. Now the problem has been acknowledged and latest POE:s show that problem has been avoided (Kurki 2000).

PROBLEM SEEKING

Briefing (equal to programming) is divided into two phases, first the strategic review of the client's organizational needs and second, the transferring these needs into performance specification (Green et al. 1999). The function of the first phase is to determine whether there is a need for a new building and what the future business

processes of the client should be like. The mission of the next phase is, starting from the results of the first phase, to transfer the client's needs into a brief that describes the expected performance of the building. Design phase is based on the result of this second phase.

One of the most thorough methods to handle the briefing phase is a system called Problem Seeking. Problem Seeking consists of five phases: 1) Goals, 2) Facts, 3) Concepts, 4) Needs, 5) Problem (Peña et al. 1987). Establishing goals states what the client wants to achieve and why. Collecting and analyzing facts leads to describing the edge conditions of the project. Concepts tell how the client wants to achieve goals. Customer specifications are often tighter than the actual needs (Deming 1986). In addition to that, client rarely has money to realize all what he/she wants. The purpose of the Needs-phase is to separate real, important needs and less important wants. Finally the architectural problem is depicted as an explicit statement. The results of each phase include four considerations: function, form, economy and time. (Peña 1987).

QUALITY FUNCTION DEPLOYMENT, QFD

One of the main problems during the project definition phase is to state the requirements in an ambiguous way (Blachère 1988). The process starting from the client's needs arriving at design solutions that meet those needs is a difficult challenge (Kähkönen 1999). QFD is a tool, which gives a transparent way to create requirements from needs and further translate requirements to main technical solutions (Cohen 1995).

QFD was invented in Japan in the late sixties to support the product design process (Akao 1990). QFD provides means to clearly specify the client's needs and clarify how well the proposed solutions answer these needs. The QFD process consists of constructing matrices. In the first matrix the weighted customer needs are on the left column and technical response to these needs are on the top row. After technical response is developed, dependencies between requirements and properties (=technical responses) are added. The properties are evaluated based on the added dependencies and some of them are selected to the requirements for the next phase.

The authors have been facilitators in a session were QFD was used for setting design guidelines for a demonstration project for a housing fair. The house of quality matrices were formed together with ten experts of different backgrounds to judge how well the client's image of the future building meets the original design criteria and, on the other hand, to judge how well the ideas for technical solutions meet the customer requirements. The main feedback from the session and the method are recapitulated in Table 2.

Table 2 – QFD experiences of the authors (Koskela, Huovila 1999, Nieminen, Huovila 2000)

Design sessions	QFD method
• the project goals became clear to all participants • the session results did not restrict planning and designing • in the beginning there was still a large misunderstanding of the original goals and the terminology was not clear • new objectives and innovations were introduced • appropriate innovative design solutions were	• clients were forced to react on requirements and to express their view on the project goals • choice of the working group is critical • QFD provided a method to structure and run the meeting • the decision making process was transparent and traceable • no documentation process was needed afterwards

found • client's needs were documented in a form of performance requirements	• some members of the design team were not sufficiently committed and remained passive

PERFORMANCE APPROACH

Performance approach is concerned with what the building is required to do, and not with describing the technical solutions ie. how it is constructed. (CIB 1982). A preliminary study of applying the performance concept was done in Finland, partly based on experiences from the Netherlands. It emphasized that the approach forces the clients to think what is really needed to support their business processes. The main identified potential advantages of the approach are (Huovila 1999):

- better exploitation of the suppliers' expertise
- design emphasis moves earlier in the process
- communication between stakeholders improves
- competition between different technical solutions based on the same performance specifications is possible

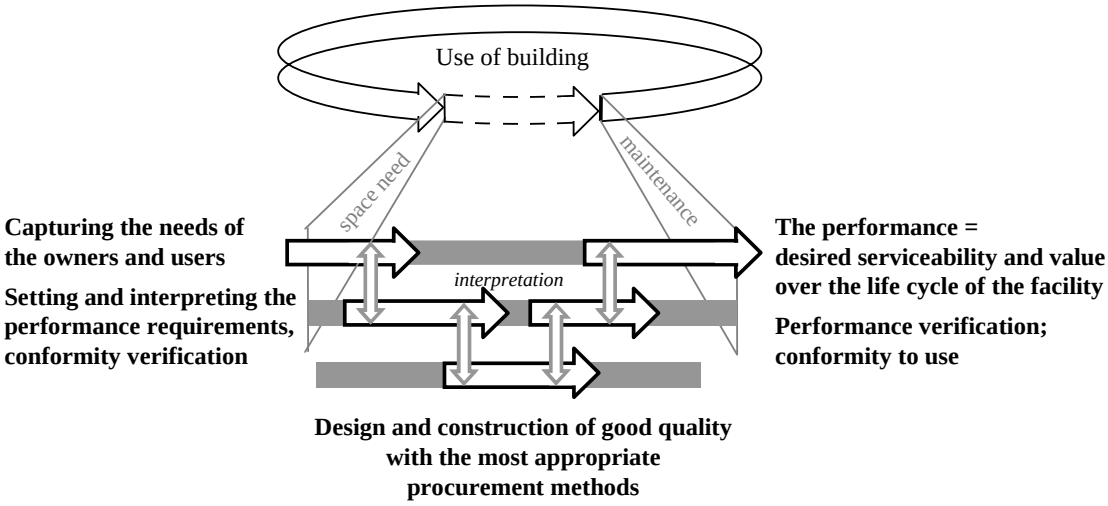

Figure 1 - The performance approach in the building process[3]

ECOPROP

VTT Building Technology has developed a method and a tool, EcoProP, to set and manage performance requirements in a building construction project. It is based on an extensive building property classification, VTT ProP®. In addition to building performance properties VTT ProP® contains also environmental and cost properties and requirements for the realization process. EcoProP provides a path for the realization of a thorough performance based project definition (Figure 2). The performance based

[3] adapted from illustrations produced by Government Building Agency, the Netherlands

requirements give designers/engineers a possibility to fully exploit their knowledge accomplishing creative and flexible solutions. When requirements are performance based the variety of procurement methods is larger. The contractors can improve design and also benefit from this (Lahdenperä 1998). EcoProP has been implemented in different building projects consisting of nurseries, office buildings and housing. The experiences so far have been promising.

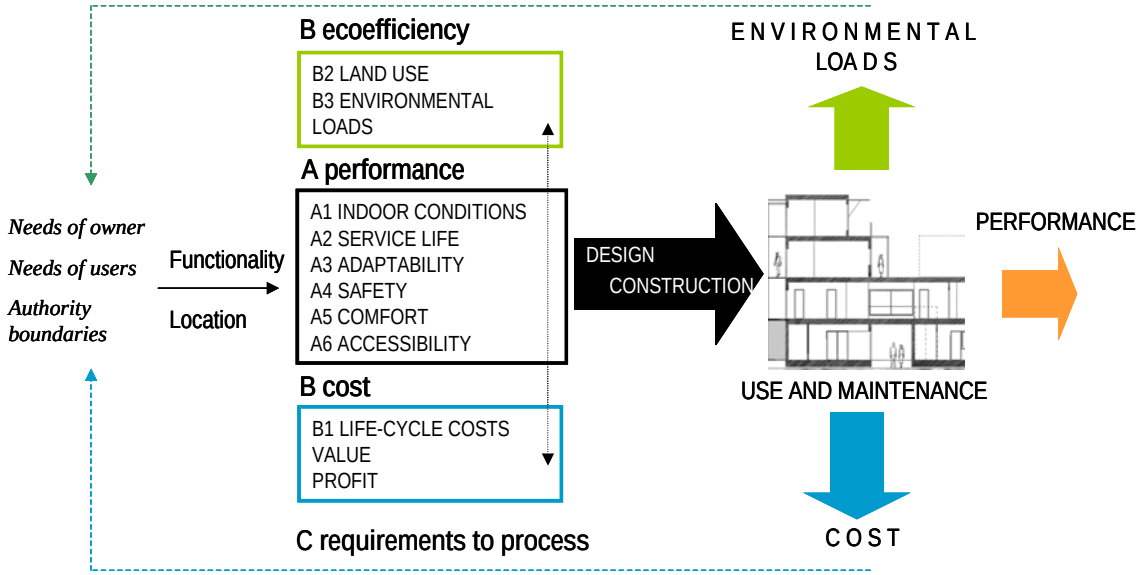

Figure 2 – Performance based project definition

The end-result of an EcoProP based requirements setting is a project brief. Selected requirements are gathered to a single, color-coded Excel sheet. Color-codes give a quick view of the requirements level of the project. This sheet can be saved to a separate file that can be distributed via e-mail or published in the project web site. Furthermore, selected requirements can be copied to Word automatically to offer a possibility to edit requirements in a text file. This Word file acts as a 'project memory' when in the later phases of the project requirements are changed. A profile of the selected requirements can be created after the user has set targets for the project. The profile shows the average requirement level of each property. The profile contains also a reference line. Company or organization can set a reference level to validate requirements of a single project. (Figure 3)

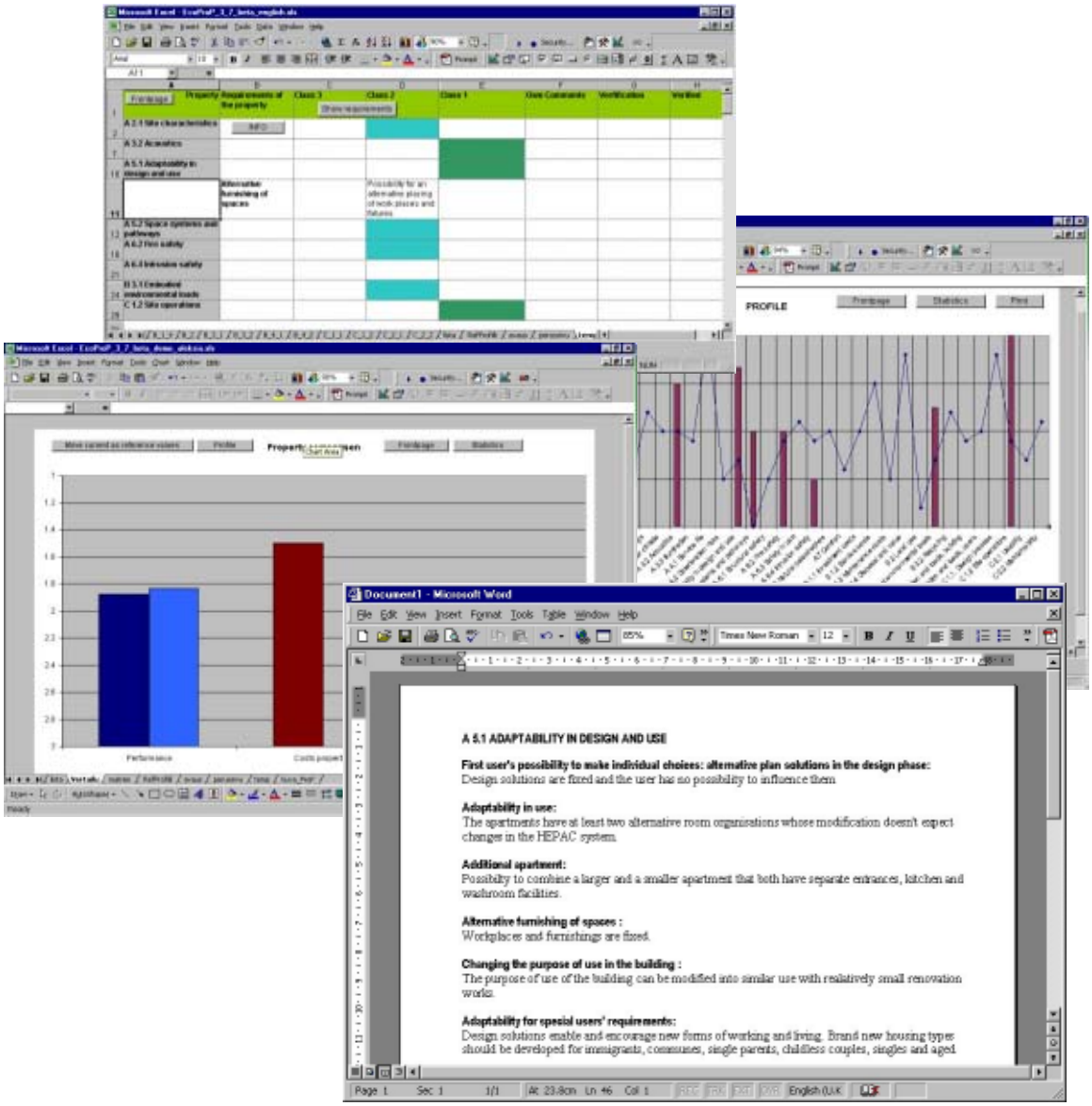

Figure 3 – Results of requirements setting session with EcoProP

EXPERIENCES OF USING THE TOOL

State Real Property Agency (SRPA) has recently added procedures to the quality system to enhance the ecoefficiency of their building construction projects. First step was to add 'green forms' between the other descriptions of work to be done in a particular phase of the project. After the managers of SRPA that people have adapted to use these green forms, color was changed to similar with the rest of the forms. To have also requirements concerning ecoefficiency had become part of normal process. However, the feeling among the project managers was that they needed better tool to tackle to whole requirements setting procedure. Browsing through lists of papers was too time consuming and unproductive. EcoProP was tested in a project where the project manager had already

created a brief focusing mainly on the qualitative requirements of various properties like adaptability and energy consumption of the building. The intention was to transfer these requirements to EcoProP to test the tool. However, it became obvious that it is more beneficial to follow the path provided by EcoProP and also to add requirements that were not in the original brief. The general feeling amongst the participants was that EcoProP makes the user to think more precisely. Also the previous abstract and unclear requirements got a more exact definition. The requirements were set in a session where the project manager, the building services specialist, the architect, the environmental expert of SRPA and two experts from VTT Building Technology were present.

Other test cases included nurseries developed by the Construction Management Division of The City of Helsinki (HKR). HKR provides building construction services to various departments of the City. HKR manages the building project acquiring designers, engineers and builders. HKR creates the brief from the original project definition. The method to set requirements differed from the SRPA case. Since HKR has large a building stock to maintain they have a lot of information on actual energy consumption, maintenance costs etc. They exploited this knowledge to set requirements which necessitate improvement to ecoefficiency of the building. For instance, energy consumption should be 20 % less than in the existing buildings.

PROPQFD

The authors have tested combined EcoProP-method and QFD. Performance requirements for the project are set using EcoProP. After this, selected parts of the requirements are transferred to QFD to further analyze how to proceed with them. Too often also thorough requirements are not met in the final product. There are various reasons for this; cutting costs in some phase of the project, inability to find suitable design solutions to fulfill the requirement, forgetting the original requirement etc. It helps to have a smooth flow from targets through verified design solutions to realized, fulfilling technical solution if the most important targets are analyzed deeper. This can be done using QFD in resolving EcoProP requirements.

CONCLUSIONS

There is a clear evidence that concentrating on creating value to customer is worthwhile. It is as obvious that in the current building construction atmosphere it is difficult to create value. Shift of focus is needed; construction service providers have to see themselves as a short but regularly recurring chain of the client's business processes. The companies should be able to provide space for the customer in its entirety; helping client to define the needs, creating the performance brief based on those needs, designing the building, constructing, maintaining and operating it and finally, demolishing it. When the company controls the whole process, feedback from other parts of the process enables learning and better buildings in the future. This is the direction some construction companies in Finland are moving to have longer value chain ie. more profit.

Methods and tools to enhance the value creation are available but they are not fully exploited. Delivering improved value should and will be awarded. In the future only those companies that are able to deliver more value to clients will survive. Measuring the success and profits of the space provider will be based more on the occupiers' opinions. Focus will be on the performance of the building over its lifespan and life-cycle costs instead of the original investment costs.

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