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Stirring the construction project management with co-creation and continuous improvement

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Abstract

Gathering information that is capable to explain customers' needs is usually seen as a quite straightforward part of the traditional construction process: a customer should be able to tell all relevant needs in the first stage so that a building could be designed and built according to the gained information. But the process is lacking of service abilities if a customer wants to modify the given information due to a change in circumstances, albeit such a change is easily caused due turbulent economic situations and long spans in real-estate development projects. Hence the customer perspective regarding the construction management (CM) process should be accommodated better. In this paper, the case studies of the four premises improvement projects are reported upon, where the CM process was altered to include and apply the concepts of continuous improvement and co-creation. The process documentation covered the impacts of the case project on the usability of the premises, the indoor climate conditions (carbon dioxide and temperature) metering, the time lapse cameras and the on-line user feedback system. The documentation consists of the minutes of the meetings, the financial reporting and the time tables. Both the processes and the results of the projects are analysed. Based on the key findings, some suggestions are put forth upon how to improve the CM process to better serve customer interests and quality improvement in the future.

1. Introduction

Significant potential in service innovations is considered to exist in various industries, but in many cases service innovations are understood as improvements in customer services. In practice, this may lead to situations where the

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service perspective has been adopted at the strategic level but the traditional goods perspective is still dominant at the manufacturing level (Grönroos & Helle, 2010).

In the case of University Properties of Finland (UPF) Ltd, the need of general improvement in facility management (FM) services business was recognised around 2010. For this reason, UPF launched a study concerning the implementation of evidence based design and co-creation, based on the assumption that new practices should be developed for improving all stages in construction projects – from concept development to the handover and use of premises. Moreover, a comprehensive investigation was seen essential to reveal a gap between the assumption about premises ideally serving users and the actual uses of premises. The management of UPF perceived this gap to be a bridge that needs to be built as part of a transition towards the service dominant business logic in FM services business. The need to investigate evidence based design practices was framed by studying the actual performance and outputs via the three key aspects as follows:

1. *What is the actual improvement in the utilisation of the premises when a retrofit project has been carried out?* It is quite common that retrofit projects are carried out with the determined objectives of improvement. Very rarely, the actualisation of the improvement and the real current use of the premises is being later confirmed against the target designs, such as: "Do people use the premises in the ways that the architect had imagined in the design phase?", "Has the utilisation rate improved?" and "How has the mood of working changed?"

2. *How should new practices be implemented?* Based on the prior experience within the organization, it was assumed that every new practice causes resistance that disturbs design work, lowers down the features of new premises and slows down occupation. Co-creation practices (Prahalad & Ramaswamy, 2004) were seen as a promising way to confront these problems.

3. *What tools could be used for marketing new ideas*. The idea was to provide information about new solutions in premises from users to users. In this way, information would be in such formats that the users of premises could understand when planning their next facility upgrading projects. Supposedly, this would also ease communication between architects, a PM team and users.

Even if the idea of combining evidence based design and co-creation seemed promising, no relevant method could be identified for measuring the impacts of the adoption of these two value creating practices in actual projects. However, there was a lot of data that was gathered with many kinds of equipment for the evidence based design research. Thus, a novel method was developed to gather data that enhances understanding of the ability of users to benefit from premises.

The focus of this study is on the ability of users to benefit from premises. This was seen as a key to understand real estate development as an activity where products and services are developed, instead of a business where assets are managed. The objectives of PM processes were set to serve the usability of outcomes, i.e. impacts on users are considered before production capability, schedule and budget. The application of co-creation practices is seen as a significant way towards the realisation of this shift. As co-creation took place mainly in concept development phases, it is now assumed that also the other parts of the PM process can be improved in a radical manner.

In the same vein, the PM process was re-organized to utilise practices in continuous improvement (Deming, 1986). Tests of the re-organized process were called process demonstrations. The process demonstrations were implemented as part of four small scale retrofit projects, all constituted by UPF. Each project encompassed a specific application of improved processes ranging between a new way to explore customer needs and a completely enhanced process where the organisation as a whole was re-arranged to apply continuous improvement's work order. The method of action research was applied.

The contribution of this study is a system enabling users to have improved capability to understand the implications of new solutions, i.e. performance is explained with the help of the models and data. Moreover, it seems that this designed and studied approach also improves end users' commitment, by better process understanding.

2. Theoretical background

Economics is seen as a valid viewpoint when discussing added value and total value. In economics, it is supposed that every stakeholder aims to maximise utility and, thus, value is understood as someone's ability to utilise a product or a service. It should be noted that this is not the same thing as market price. The way how market defines prices is explained in economics by equilibrium price, i.e. price where the quantity demanded meets the quantity supplied (e.g. Begg et al., 2008). Utility someone gets from a product probably exceeds market price; why else such a transaction would happen. Moreover, the amount of this excess is not tied to the monetary value of market price from individuals' point of view and why should it. Different persons in different situations may of course gain enormously different amount of utility from a similar product. Based on this reasoning, two questions are posed:

- Whose utility should be measured?
- How to measure value via utilisation, if it cannot be measured via market price?

As the concept of value has rather a subjective nature, Rooke et. al. (2010) suggest that instead of objectivity the concept of intersubjectivity should be used, in which "objectivity is socially established from the stream of our perceptions". Thus, it has been shown that both observing the utilisation of premises by masses and surveying the opinion of masses are suitable ways for researching value.

Utilisation of premises can be understood through the users' functions – tasks that premises are for. The mechanism, how the features of premises affect to users' functions, can be understood through Kano's (1984) categorisation. There are three main categories of products features: must-be, one-dimensional and attractive. All of them play their own part in the value generation of products and each of them has its own characteristic behaviour in relation to customer satisfaction (Kano et al., 1984; Berger et al., 1993).

Customer satisfaction can be used as a vital meter when researching the value of products if it is connected to the recommendation behaviour of customers (Reichheld, 2006; Kähkönen & Savolainen, 2013). Thus the surveying of customer satisfaction is important, but it is also important to observe the actual behaviour of users. Indeed, Zeisel (2006) emphasises that "the better information designers have about how the people they design for behave in physical settings and how those people relate to or exclude other people, the better they can control the behavioural side effects of the design decisions they make."

Pursuing the value maximisation may be also seen as a matter of pursuing for quality, at least if the Juran's dual definition, which is generally accepted, is used, i.e. quality means (i) a product's features that meet customer needs and (ii) freedom from deficiencies (Godfrey & Juran, 1998). The selected combination of features may be seen as a plan to deliver value and the rate of "freedom from deficiencies" may be seen as success rates in the actualisation of plans.

Delivering quality is not a task that is inevitably accomplished. Over the past decades, various attempts have resulted in several systematic methods that make value creation more understandable. The best known methods may be the Quality Function Deployment (Akao, 1990) and Taguchi methods (Taguchi, 1986). Therein, product development is divided into three phases that are shown in Table 1.

Table 1. Three phases in product development and building project development.

Quality Function Deployment (QFD) (Akao, 1990)	Taguchi methods (Taguchi, 1986)	Phase in building project development (applying Smith 1998)
Developing the quality plan and the quality design	System design	Feasibility studies
Detailed design and preproduction (Subsystem deployment)	Parameter design	Design
Process deployment	Tolerance design	Tendering process/ Contract/ Procurement
Production/Implementation		

The common feature in the QFD method, the Taguchi method and the building project phases is the determination of ways of client value generation in the first phase, followed by the design phase. This task can also be seen as understanding the functionality from the clients' point of view. Thereafter, the concepts start to differ from each other. With the QFD and Taguchi methods, the next phase is to determine parameters to provide functionality or technical characteristics to get products work in ways that clients want.

In building projects, the third phase involves the tendering process that results in contractor selection. In reality, this kind of phasing can lead to a situation where the design task is seen as a subtask for the procurement task, i.e. the most important objective of the design phase is to produce technical attachments for requests-of-tender. In such situations, the focus is shifting away from the functionality of products toward the ability to produce them. Moreover, this phenomenon is intensified when the process goes on. Feedback from design work comes from a contractor which mainly evaluates the easiness to implement and gives improvement suggestions based on cost efficiency.

It is herein perceived that it is urgent to avoid such shifts of focus and instead to re-connect the voice of customer to design activities. In the process demonstrations of this study, the re-connection was established by the two distinct concepts, i.e. co-creation and continuous improvement. Co-creation is a new way of viewing customer relationships. In the traditional thinking, value is created into products by companies and customers must either be satisfied with what they get or decide not to buy the products in question. In the co-creative working, the idea is to exploit the client knowhow of utilisation of products by developing ways of interaction between a firm and its clients. There are four cornerstones that are used in understanding the role of interaction: dialogue, access, risk assessment and transparency (often referred to as DART) (Prahalad & Ramaswamy, 2004). The concept of continuous improvement is one of the fundaments in delivering quality (Deming, 1986; Godfrey & Juran, 1998). The concept may be applied by using Shewhard's (1939) cycle: Plan - Do - Check – Act (PDCA), recommended by Deming (1986).

3. Organising process demonstrations

The process demonstrations were carried out as part of the four small scale campus retrofit projects in 2014. The scope of each project was to improve either the single space or a couple of the connected spaces that formed the area of around 300 – 400 square meters. The brief descriptions of Projects 1-4 are compiled in Table 2.

Table 2: Process demonstration projects of University Properties of Finland (UPF) Ltd in 2014. (Key: The feasibility study phase was replaced with the co-creation phase. In some projects, the PM process was improved by using the Plan – Do – Check – Act inspired phasing in the schedule of the meetings. In Projects 2-4, the action researcher was positioned as the design coordinator or the project manager in the improved phases, marked with the bolded text.

Project/phase	Co-creation	Detailed design	Procurement	Building phase
Project 1: Auditorium retrofit to multi-purpose learning environment	Half day workshop to discuss how premises are used	Traditional project management	Traditional project management	Focus on handover
Project 2: Language learning environment	**3-day charrette workshop with rough cost estimating**	Traditional project management	Traditional project management	Focus on handover
Project 3: Learning and presentation environment for music students	**5-day charrette workshop with rough cost estimating**	**PDCA inspired meeting phasing**	Traditional project management	Focus on handover
Project 4: Modern multi-purpose learning environments	**Two half-day workshops for each retrofit area with rough cost estimating**	**PDCA inspired meeting phasing**	**Procurement by negotiation (with PDCA inspired phasing)**	**Focus on the easy beginning of the utilising of premises**

The co-creation was applied by organizing the various workshops in the beginning of each project. The role of the co-creation varied from the few hours check-up meeting to the charrette, which is intensely focused, multi-day session that uses a collaborative approach in order to create realistic and achievable designs that work (Lindsey, 2009). In every process demonstration, the focus was set on the collaborative value creation with the users during the early stages. This focus shift deliberately separated the cost issues away from the value creation dialogues. The cost calculations were made and dealt with after the value creation dialogue.

The detailed design phase was implemented either by the traditional ways or by using the improved process that was planned to use PDCA phasing (Fig. 1). The traditional PM was seen to be a process where the project manager gives the designing task in the first design meeting and follows the actualisation rates in the following meetings. The main difference is between only one (design) meeting as part of the traditional PM process and several meeting types with the determined roles for interaction as part of the improved process.
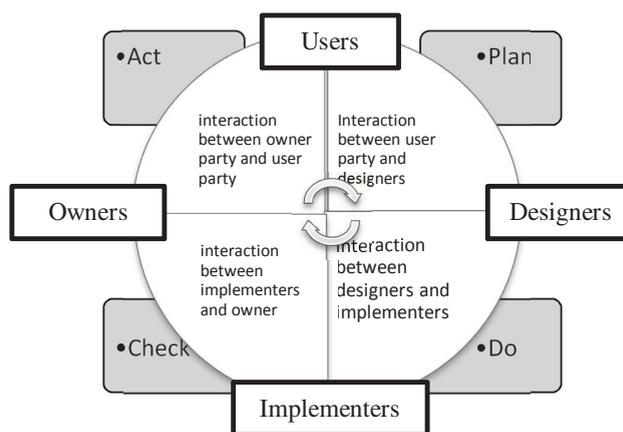
Fig. 1. Plan – Do – Check – Act (PDCA) cycle applied to the interaction phasing in building projects.

The purpose of this interaction division was to determine the two aspects for each meeting as follows:

- What is the perspective of this this meeting? Are we discussing about the planning of the premises, the implementation of designs, the budget and the schedule or the corrective actions, or all of them?
- Who should assume the primary roles during the discussion in this meeting? Who should be present?

The Plan interaction was a dialogue where the main questions were "How are the premises used?" and "How should the premises perform?" The Do interaction was a dialogue between the designers and the implementers where the main questions were "How should the required performance be delivered?" and "What is the most cost effective way to implement it?" The Check interaction was a dialogue between the implementers and the owner where the main questions were "Does the value stem with the cost?" and "Can the project of this scope be financed?" The Act interaction was a dialogue between the owner and the users where the main question was "How should the project be modified, if the scope suggested is not affordable?" In this way, the downshifting of the project was done by those who have to live with the decisions made.

4. Method to measure improvement in utilisation

The idea behind evidence based design is that designers have a database consisting of proven design solutions. The assessment of performance of different design solutions is carried out via observations on the real use of premises as the source for proven solutions. Such a fairly detailed functional evaluation could not be conducted based only on the surveying of customer satisfaction.

In this study, the pre-occupancy and post-occupancy evaluations were conducted in order to estimate the impact of the designs on the environmental behaviour and usability of the spaces. The observational data were collected through the indoor climate conditions (carbon dioxide and temperature) metering, the time-lapse recordings and the on-line satisfaction survey. The idea is to get a comprehensive view on the usability of the observed space.

The indoor climate conditions were inspected to make sure that that there was no obvious but invisible reasons that would have negative effects to the usability. The role of the time-lapse observations was to observe the predicted use of the space. For the quantification, the time-lapse recordings were observed and systematically coded with the pre-coded checklists of the use with the two main categories "work" and "leisure" and the categories of "characteristics of participants" (alone, in pairs or in groups) together with the time frames of the uses. The observations provided the researchers with the replies to the following questions "What kinds of actions happen?", "How is the space used?" and "How do people interact in and together at the space?"

The role of the on-line satisfaction survey was to facilitate the channel for the users to express something unexpected information. The data was collected by using the QR-code posters. The users could give the feedback with their smartphones by simply snapping the link from the QR-code poster, voting plus (+) or minus (–) and possibly giving the explanatory text feedback. The votes were given for the question "Would you recommend this space for studying?"

The fourth data type of this study was the project documentation. The data consist of the minutes of the meetings, the design drawings, the financial data and the schedules. The project data was gathered from many locations, such as the network drives, the project databanks and the cloud drive. The cloud service was selected for the data storage to enable the access to the data for the researchers also in future research projects. The data covers the demo projects that UPF has carried out in 2012-2014. This data can be re-utilised in future research (mainly for the examination of learning environments), the planning of new projects, the development of projects, etc.

5. Discussion

In the paper, only the preliminary findings are reported upon. However, the improved process has already resulted in some promising findings as follows. The co-creation phase has improved the mutual trust among the parties of the project. The cost estimates in the end of co-creation phases did help to begin the prioritization dialogue between the users and the owners. The prioritization enabled the designers and the implementers to come up with the suggestions for the cost savings. Without the prioritization, the cost saving suggestions would have been probably more or less blind vis-à-vis the users' ability to utilise premises. Thus, the continuous improvement had been enabled.

One of the key observations addressed the development of the end users' understanding. The knowledge about how they may and will use the premises actually increased a lot during the project. In principle, premises improvement is only a part of a greater project and when the focus is set on this scale, it becomes much easier to understand how users view a situation, i.e. premises improvement projects should provide stakeholders with data on future premises for business improvement projects. Thus, it is not relevant to think that all information for a design process would be available at once in the beginning of a project.

Probably the most significant finding was the observation on the progress in the users' understanding in the beginning of the project. In principle, users cannot have ready-to-use consensus in the beginning of a project so that this consensus could be used as initial information for design work. Consensus may be reached by a well facilitated co-creation workshop. Moreover, the meaning of the workshop is to guarantee equal voice for each stakeholder so that true mutual understanding is achieved. On the contrary, if a workshop is not deliberately pursued, the strongest voice takes over others and obviously a bias situation is prevailing between stakeholders.

In many projects, the finding of true mutual understanding between stakeholders may be an extremely complex task because many stakeholders may belong both to a customer's side and a producer's side around a table. Moreover, stakeholders in both sides may be arranged by hierarchies where some stakeholders have more power than others. If a project organisation is satisfied with a situation where the executives of both sides find mutual understanding and sign an agreement, then executives have been heard. But there are no means to guarantee that premises will be designed by using best knowhow about utilisation. Mutual understanding must be found between different user perspectives before an agreement between a customer and a producer is signed. Multiple relevant user perspectives may come from the different functions of all departments or from different tasks across all hierarchy levels within organisations.

All this communication between users may appear as irrelevant disinformation from the perspective of building and design organisations. Discussions take time and sometimes have only a small effect on final designs. Furthermore, discussions can complicate PM as power over design decisions is shifted from a design organisation to a user organisation. For some managers, it may be difficult to see the pros of new practices when the cons are so imminent and, thus, they resist such changes. In order to overcome such barriers, the benefits of enhancing customer experience should be put forth at operational levels.

6. Conclusion

Even the preliminary findings of this study highlight a need for a democratic method to provide all stakeholders with possibilities to be heard from every angle. Furthermore, it is of importance that different perspectives are brought on a joint table so that that each project partner can understand pros and cons for certain approvals and/or particular disregards. Within a process, each different view is to be treated equally, i.e. for reaching a balance of different ways to utilise premises.

It is posited that the balance of premises' utilisation is a novel perspective in the area of feasibility studies. This part of feasibility studies is herein called a Balanced Concept of Utilisation (BCU). The BCU is an agreement where multiple user parties recognise how utility is gained from premises by different tasks and functions, and how these tasks and functions are prioritised.

The BCU enables the gaining of benefits from the process enhanced with the continuous improvement phasing. When a BCU is formed and approved, it is easier for designers to understand users' perspective as an entity. This produces the perspective of usability alongside with the perspective of ability to build, which is of particular importance when interaction between designers and implementers begins. A BCU is a document that should be reviewed along cost estimates and schedules. It is important to understand how the ability to utilise is affected if costs need to be cut and what an effect is on a balance between different functions. Such an analysis provides decision makers with relevant information concerning the next phases of projects at hand.

The utilisation of BCUs in PM opens up a plenty of topics for further research in terms of key questions like "How to determine technical parameters for a product by utilising a BCU?", "How to design utility metering based on a BCU and how to combine that information with evidence based design?", "How should a BCU influence a supervision task in a building phase?", "How to design tolerances by utilising a BCU?" and "How should additional information gained during a project influence to a BCU?"

All these topics are related to the dual definition of quality as a product's features that meet customer needs and freedom from deficiencies (Godfrey & Juran, 1998). When a BCU determines the functions and tasks that users want to accomplish, the quality of premises should be determined by how well users may accomplish each task and function. All other measures such as customer satisfaction or project delivery on time should be seen as sub-targets of this main target. It is argued that all other ways leads to partial optimisation. This means that the construction industry should review the responsibilities of each party and investigate the new forms of co-operation, because it is perceived to be unlikely that a contractor, a consultant, a designer or even a real estate owner single-handedly shifts its focus on the suggested scale.

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