FACILITATING VALUE CREATION AND DELIVERY IN CONSTRUCTION PROJECTS VIA FRONT-END LOADING

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Abstract:
The potential and the need for the construction industry to improve performance are recognized in a vast amount of literature from all over the world. The literature addressing this issue and the initiatives being taken in attempting to enhance productivity tends to focus on the construction phase of the building projects. However it is in the early design phase that client value is established and the scene is set for everything that follows. Productivity in the construction phase is strongly dependent on performance of the design team and real client value will not be achieved if the building design does not meet client expectations (understanding the client as a wide range of stakeholders). Therefore a holistic view of the building process should be applied with a greater focus on the design phase and value creation. In Denmark a consulting engineering company has together with a major contractor developed a value based work-shop model that seeks to capture client values and manage the subsequent stages of the building process within a Lean framework striving to maximize value and reduce waste. This paper reports the initial findings of a joint research project between academic and industry practitioners developing the work-shop model to create a state-of-the-art approach to design management that is usable for practitioners in the construction industry and is based on a solid theoretical foundation and comprehensive practical experience.

Keywords: Briefing, Client, Lean design management, Value, Value-based management

INTRODUCTION

Relevant stakeholders are seldom sufficiently engaged in the early briefing phase and the outcome is often an inadequate project definition leading to misinterpretation of client values among the design and delivery team (Koskela et al, 2002; Thomson et al, 2003; Ballard, 2006). If client values are not fully understood at the outset of a construction project it is likely to result in either low fulfillment of client expectations or multiple design alterations during the process which leads to additional costs and frustration among the project participants. However, when starting to analyse and articulate client values there are (at least) two fundamental questions that must be tackled. What is the nature of value, and Who is the client? Simple questions for which there are many different interpretations and answers. Initially this paper briefly makes an attempt to answer these questions as a basis for improving a value-based workshop model, which aims to facilitate client value creation. In addition experiences
VALUE

Even though most people have a feeling of what is meant by the term “value”, it seems to be difficult to formulate a common definition. In construction one of the first known attempts to define value was made by the Roman architect Marcus Vitruvius Pollio (died about 25 BC) who wrote that all architecture should possess strength, utility and beauty or firmness, commodity and delight depending on translation of the ten books of Vitruvius (book 1, chapter 3). It is often overlooked, that Vitruvius also mentions the importance of considering “the nature of the place” or suitability to surroundings in his sixth book, chapter 2 (Vitruvius). This highlights the range of the value concepts in construction. However recent attempts to try to define value are more mathematical, according to Kelly the most common definition is (Kelly, 2007):

\[
\text{Value} = \frac{\text{Function}}{\text{Cost}}
\]

However, value can also be looked at from a more philosophical point of view which to a great extent complicates the conception of value. On the basis of literature review (see Thyssen et al, 2008a), the following characteristics have been identified that should be taken into consideration when addressing the concept of value:

- Value will in most cases be a subjective judgment depending on human interest (Perry, 1914; Korsgaard, 1986; Thomson et al, 2003)
- The term “value” (a judgment) can be distinguished from the term “values” – the individuals core beliefs, morals and ideals (Thomson et al, 2003)
- An item can in some cases be objectively measured as more or less valuable compared with another item (Moore, 1922, p. 256; Thomson et al, 2003)
- The objective valuation (often) depends on context e.g. what the environment can supply, group consent etc. (Moore, 1922, p. 256; Smith, 1948; Thomson et al, 2003)
- Some (if not all) value(s) changes over time (Perry, 1914; Thomson et al, 2003)
- However a valuation can be said to be more durable if many people agree on it and it is based on “right” assumptions/information (Perry, 1914; Bonke and Winch, 2002)
- Value can be instrumental (Smith, 1948; SEP, 2007)
- Value can be found not only in connection with a physical object, but also in activity, love, goodness, friendship, knowledge etc. (Aristotle, 350 BCE, book 10 § 8; Kant, 1785, 1. section; Bradley, 2006)
- Value can be experienced within a process towards a goal (Perry, 1914; Rice, 1943)
- Value is also distinct from quality which can be viewed as the level of objective fulfillment of prescribed requirements (Rice, 1943; Thomson et al, 2003)

1 The workshop model has been described in earlier publications (Emmott et al. 2004, 2005a, 2005b), now the intention is to critically evaluate the workshop model. Thyssen et al, (2008a) challenges the workshop model from a theoretically point of view via an in-depth exploration of the concept of value, whereas this paper reports the experiences from a case-study of applying the workshop model. A third paper (Thyssen et al, 2008b) builds on these papers, but with greater emphasis on lean product development.
THE CONSTRUCTION CLIENT

As mentioned earlier the term “client” usually covers a wide range of stakeholders with different and often conflicting values and needs (Bertelsen and Emmitt, 2005). Differentiation is often made between experienced, inexperienced, public and private, short term (developers) and long-term clients (owners) which all represent different perspectives regarding the construction process. In addition the client will often comprise end-users, the surrounding society, legislators, funders, the project champion, who leads the project for the client organisation and who may be supported by a business case team and client advisers. All have different roles and responsibilities and complexity is increased by the fact that the involvement of individuals change during the project (Blyth and Worthington, 2001).

To further complicate the matter, change is embedded in construction projects, which is due to the uncertainties, associated with the development process, the temporary multiple organization, task fragmentation, changes in the environment, resource availability etc. This creates various gaps between the expectations (aspirations, plans etc) and reality and it is the client’s perception of these gaps that forms the basis of client satisfaction (Boyd and Chinyio, 2006). The change process is influenced by the client’s ability to cope with the “knowledge gap” during the project, since inability to handle uncertainty can lead to communication difficulties and irrational behavior (Boyd and Chinyio, 2006). Thus, psychological aspects and human emotions add to the uncertainty in a chain of consequences. This has also been highlighted by Sunding & Ekholm, who argues that psychological defense mechanisms constitute a fundamental problem in construction teamwork (Sunding and Ekholm, 2007).

In summary the client is a complex assembly of different individuals with different values and perspectives. During the construction project the involvement of each individual will change as will their values and perspectives, which may be contradictive and unpredictable due to the change process and the nature of human behavior. Therefore it is vital to identify the client and establish good communication from the outset of a project to create a sufficient amount of trust for parties to both listen and speak “the truth” and thereby enhance understanding of the joint situation in the view of the different parties.

VALUE MANAGEMENT

One way of capturing client values is value management (VM). VM originates from value engineering (VE) that is derived from the manufacturing industry of the USA in 1947, which spread to the construction industry in the late 1960s (Kelly et al, 2004). Green differentiates between VE and VM as respectively ‘hard-systems thinking’ and ‘soft-systems thinking’ where VE strives for an optimum solution (required function at least cost) VM acknowledges that an optimum solution may not exist, but the objective is to ‘develop a common understanding of the design problem, identify explicitly the design objectives, and synthesize a group consensus about the comparative merits of alternative courses of action’ (Green, 1994, p. 51). According to Leung & Liu the primary purpose of value management is ‘to specify the participants’ values and goals through the conflict stimulation and conflict resolution processes’ (Leung and Liu, 2003, p. 18) where conflict refers to both intrapersonal and interpersonal value conflict. VM seems more proactive than VE in the sense that VM is often applied from the outset of the project as workshops in the conceptual phase to determine the way ahead, whereas VE usually is conducted as an audit on the basis of sketch design. However the Japanese approach to VE is different in the sense that it focuses on continuous improve-
ment throughout the process (Kelly et al, 2004). It seems that there is a link to lean product development principles developed by Toyota, which also emphasizes importance of assessing many alternatives, a method known as set-based concurrent engineering, and the focus on elimination of unnecessary costs or waste in the entire development and manufacturing process (Morgan and Liker, 2006). As stated by Haque and James-Moore (2004, p. 9): ‘they [Toyota] excel at value analysis and value engineering but do not use the textbook matrices’. The latest development in VM does however suggest that VM is an all-embracing method that includes VE and can be defined as:

‘Value management (VM) is a service that maximizes the functional value of a project by managing its development from concept to use through the audit of all decisions against a value system determined by the client.’ (Kelly et al, 2004, p. 31).

The workshop model described later in this paper can be viewed as a VM approach because it is consensus orientated and deals with client values in the conceptual phase prior to detailed design. However it has been inspired by lean thinking and can also be viewed as an attempt to adopt lean principles in construction design (see Thyssen et al, 2008 b).

LEAN DESIGN IN CONSTRUCTION

As in manufacturing lean product development or ‘Lean Design’ has received little attention in the construction industry compared to research and application of lean in site production (Jørgensen, 2006). Reviewing the literature on Lean Construction Design there seems to be a skewed focus towards flow management and waste reduction as opposed to managing and enhancing client value (Jørgensen, 2006). It is notable that the same tendency is found in manufacturing (Haque and James-Moore, 2004, p. 29). Accordingly, techniques such as the Design Structure Matrix (DSM) and the Last Planner system of Production Control for coordination and scheduling of design tasks have been promoted in several publications (e.g. Koskela et al 1997, Hammond et al, 2000, Ballard 2000), but a holistic approach with equal emphasis on the value creation aspect of construction design seems to remain absent. However, there appears to be an increasing interest in the ‘value creation perspective’ and some propositions of applying QFD (e.g. Koskela et al 2002) and target costing (Ballard, 2006) can be viewed as developments in this respect, together with the work of the authors (e.g. Emmitt et al, 2004, 2005).

THE WORKSHOP MODEL

The idea is to explore the client values on the basis of the client brief at the outset of the project stage (model process Blyth and Worthington, 2001, p. 204) and incorporate these into the conceptual (sketch) design through a series of creative workshops similar to the Walt Disney film making method of going through the stages of vision, realism and criticism. However, acknowledging the importance of trust and communication, a partnering workshop is held prior to the VM workshops. The four workshops are outlined in figure 1 (obtained from Emmitt et al, 2005)

At the partnering workshop all relevant client stakeholders (funder, representatives of end-users and authorities etc) meet with representatives of the design team (architects and engineers) together with representatives of the construction team. The construction team can be
included via different kinds of contracts, however, no matter what procurement route is used, the aim is to keep the design and delivery team together throughout the entire project and the objective of the partnering workshop is teambuilding to establish the foundation for trust and effective communication. In order to operationalise the concept of value, distinction is made between product and process values. The partnering workshop is concerned with the latter, understood as the values that the entire project team holds regarding cooperation and work ethics. Through discussion and consensus building, a partnering charter is made that reflects the agreed “process values”.

![Figure 1: The creative workshop model (Emmitt et al, 2005)](image)

Workshop 1 is concerned with client ‘product values’ understood as underlying values that determine client needs and expectations regarding the end-product. The aim is to make the product values explicit and reveal potentially hidden values to address potential conflict and also create group consent among the stakeholders. This should give the design and delivery team an unambiguous understanding of the project objectives and thereby reduce downstream uncertainty in design and construction. The client organisation is not asked simply what kind of building it desires, because the client may have a limited point of reference in order to envisage a construction facility. On the basis of the value discussion it is up to the designers to create a facility beyond the client’s imagination. Also the value system gives way for exploring multiple design solutions instead of constraining the project through statements of preferred product solutions. The investigation of client values is done via a standard value agenda, comprising the main headings of: Beauty, Utility, Durability, Harmony with surroundings, Environmental issues, and Buildability (inspired by Vitruvius). A value tree is established from the main headings and prioritizing is made. After the workshop at least three design alternatives are developed by the design team.

At workshop 2 the design alternatives are presented to the client and construction team and the designs are evaluated against the product values. Also time and cost restraints are introduced as well as any authority restraints. A decision matrix, in which the designs are ranked according to conformance to the value system, can be applied for guiding the decision mak-
ing process (a method is described by Green, 1994). A winning proposal is then selected for further articulation.

The winning proposal is evaluated at workshop 3 called the criticism workshop in which all project participants have the opportunity to evaluate and criticize the design solutions in order to secure that the design is truly optimized in accordance with client values and boundary conditions. In addition the process is evaluated against the partnering charter as a starting point for the continuous cooperation in the subsequent stages of detailed design and construction.

**THE CASE STUDY**

The case-study project consists of two buildings of 3 and 5 floors with 42 apartments which cover 3600 m². The client is a non-profit organization that owns 13,000 dwellings in the Copenhagen area. The ‘client’ comprises a board of residents but would be termed an experienced client in a Danish context. The dwellings are constructed with financial support from the city council which therefore has a right of disposal of some of the flats. Within this project, these flats are mainly for elderly people who require care and families with a handicapped child.

The application of the workshop model was set up through earlier cooperation between NI-RAS, who has developed the workshop model, the client and architectural firm and via support of the Danish Ministry of Social Welfare. However, the participants did not have prior experience with the workshop model except for the process-facilitator.

The first workshop (workshop 0) was conducted in the spring 2005 and the process continued into the autumn of 2005 where the last workshop was held after which the contractor withdrew because of financial concerns.

In the autumn of 2007 a new contractor was found and it was decided to restart the project as well as the workshop process, to integrate the contractor and evaluate the design, which, at this stage, was very well developed because of the work performed in 2005. This second round of applying the workshop model was initiated at the same time as the present research project had started and even though it was biased by the ‘first round’ it was found to be a good case for initial investigation of the workshop method. This was confirmed when the workshop model gave way for some unexpected project developments. The results of the case-study, reported below, were obtained through passive participation and observation at each workshop of the second application. Data was collected in the form of written notes during the workshops – no sound recording was allowed. There was no time to arrange a detailed research design and consequently the credibility of the case-study findings are limited by its reliance on these written notes that were not systematically carried out according to any coding scheme or other data-collection methodology. However the notes formed the basis of the minutes of the workshop meetings and were consequently approved by all participants. Accordingly the findings serve as ‘stepping stones’ for future research. The analysis approach adopted in this case-study was to make ‘critical’ interpretations of data in order to elicit limitations of the workshop model that could form the basis for future improvement. Thus special attention was paid to any ‘negative’ utterances about the process and things that did not go as planned.
CASE STUDY ANALYSIS

The workshops were held with an average of 13 participants (some specialists did not attend all of the workshops). At the end of workshop 3 an evaluation of the process was conducted among the participants by means of anonymous questionnaires. The participants were asked to rank the process against each of the initial agreed process values\(^2\) on a scale of 1-10, where 10 was to be considered the best (see table 1 below). The overall average was 9 with a variance of 0.85 which indicates great satisfaction among the participants (9 respondents). The lowest individual score given by any of the participants was 7.

<table>
<thead>
<tr>
<th>Partnering charter (process values)</th>
<th>average score</th>
</tr>
</thead>
<tbody>
<tr>
<td>We will be trustworthy</td>
<td>9.33</td>
</tr>
<tr>
<td>We will respect each other – both personally and professionally</td>
<td>9.11</td>
</tr>
<tr>
<td>We will be loyal to the decisions made</td>
<td>9.13</td>
</tr>
<tr>
<td>We will be ready to make compromises where our initial personal interest needs to give way for other interests</td>
<td>9.00</td>
</tr>
<tr>
<td>We want good communication and we will make sure to inform all (relevant) participants on progress in matters</td>
<td>8.67</td>
</tr>
<tr>
<td>We will be constructive regarding changes and solutions</td>
<td>9.11</td>
</tr>
<tr>
<td>We will keep options open as long as possible (last responsible moment)</td>
<td>9.13</td>
</tr>
<tr>
<td>We will balance expectations and goals and use our resources rationally (no need to ask for CAD drawings if a sketch will provide the sufficient information)</td>
<td>8.67</td>
</tr>
<tr>
<td>We will work according to coordinated schedules and be respectful to other professionals operation</td>
<td>8.50</td>
</tr>
<tr>
<td>We will keep our agreements</td>
<td>9.13</td>
</tr>
</tbody>
</table>

Table 1: ‘process values’ evaluation

The biggest benefit of going through the workshop process again was new insight into the needs of the older end-users, who were less mobile and needed more care than originally anticipated. Representatives of the city council provided this information, which initiated a very creative process to create more space in the bathrooms and bedrooms and supplement the ventilation system with air injection to improve indoor climate – all which were to be accomplished within the budget. This was achieved mainly by removing some kitchen and basement facilities that the older users would rarely use, as well as making some changes to the windows and removing some built-in wardrobes. In this process all participants contributed, however it was critical that the contractor’s representatives were experienced enough to make cost estimates on the spot (which was not the case in the first application of the workshop model and it hampered the decision making process). The client expressed great satisfaction with this change and the contractor found it motivating to know that the facility to a greater extent would satisfy the needs of the end-users.

Some other changes were suggested by the client, which were found not to be feasible, however additional assessments were made to ensure, that these changes technically could be made later on if they were found ‘critical’ and additional expenses were considered to be necessary to accommodate such changes. In this way adaptability was considered.

\(^2\) The process values were established on the first workshop through open discussion and grouping of suggestions facilitated by the workshop facilitator. The partnering charter was subsequently approved on the second workshop. No greater argument about the content was observed within this process. No ranking was performed.
It should also be noted that within this process, it was a supporting factor that the client representative was enthusiastic about the concept of the workshop model and possessed the authority of an experienced professional who were able to make decisive decisions – this had a contagious effect on the rest of the team.

However, some critical observations were also made.

- Several comments were made regarding the workshop model being very time-consuming (each session lasted about 4-5 hours)
- After workshop 3 the architect and contractor were so confident about the way ahead and were so eager to get on with the detailed design and construction that they did not consider a fourth workshop, about integrated design and construction scheduling, to be necessary – so they carried on without it.
- Even though the client was very pleased with the changes being made the architects expressed some annoyance about making the changes – however the changes would have been much more expensive to make, if not impossible, later on in the process.
- The value tree was not rigorously used by the architects when presenting the design solutions. It seemed more like an ad-on explanations for some of the choices being made, rather than an integral part of the process.
- As might have been expected, the participants were much better at discussing technical solutions than talking about value or values.

**DISCUSSION AND SUGGESTIONS FOR DEVELOPMENT**

The case-study shows that even though the workshop model had already been conducted a second round of discussing the client needs gave way for new insights and an improvement of ‘product value’. This highlights the importance of taking the time to understand client needs and corresponds with the notion that needs (value) changes over time. Even though it is not possible to generalize the findings, the case-study also indicated that the workshop model can facilitate good cooperation through a discussion of ‘process values’. Furthermore, the case-study highlighted the importance of the experience of the participants as well as their mandate to speak-up and make decisions on the spot. This calls for a thorough analysis of the potential team participants before making invitations to the workshops. However the professionals’ time is valuable and great effort should be directed towards limiting the duration of the workshops. Also, clear agreement should be made about payment for making more than one design alternative and the subsequent changes to design caused by the workshop approach. Greater acceptance of these changes may also be facilitated by some negotiations of the client values with the delivery team to establish commitment. The extent of frontloading in relation to the type of project should also be considered. The haste of the architect and contractor to progress may be reasonable if indeed they had a clear sight of what was to be done and when to do it. Finally the case-study shows that speaking of value is a tricky thing and a more rigorous use of quality function deployment may help to translate the client values into a language understandable to building professionals.

These findings correspond with the lean methodology in the following respect: (1) the importance of a “Large-project-leader” (Womack et al, 1990, Morgan and Liker, 2006) to be the change agent, (2) the importance of means for efficiency in meetings – there is a great risk of lengthy meetings within the teamwork approach (Morgan and Liker, 2006), (3) the importance of policy deployment as regards to translating client value into understandable design
criteria and facilitating a commitment to accommodate these (Morgan and Liker, 2006), (4) the value of integrating skilled production orientated participants into the early design phase (Womack et al, 1990, Morgan and Liker, 2006) and finally (5) the value of frontloading the process, taking a sufficient amount of time to explore client needs and “make the changes” up front (Morgan and Liker, 2006, Baines et al, 2006).

In addition the characteristics of value and the client complexity should be addressed, which leads to the challenge of predicting the future and understanding the “drivers” for client values in order to predict change in the value system (see Thyssen et al, 2008). There are basically two approaches to this problem; (1) either to increase knowledge to qualify a forecast and anticipate changes e.g. use of stakeholder analysis and scenario building or (2) to accept the unknowns and incorporate adaptability/flexibility in design and the use of the “last responsible moment” principle. Both approaches may be applied simultaneously. In addition a skilled facilitator knowledgeable in how to tackle counterproductive behavior may be very beneficial.

CONCLUDING COMMENTS AND ONGOING WORK

This paper reports the initial findings of a research project which aims to develop a value-based workshop method that can facilitate client value creation in construction. A review of value-theory and the exploration of client complexity highlights the difficulty of the task. However an initial case-study shows good results from applying the method and suggestions have been put forward for future development. These are centered around the need for strong leadership, stakeholder analysis, change management, policy deployment, clear agreement regarding the front loading process as to the use of resources and finally to create a differentiated methodology addressing different types of project characteristics. These issues will be addressed in ongoing research work. A great concern in this respect is that improvements to the workshop model will be difficult to measure due to the technical uniqueness and contextual difference (social construction) of each construction project, which makes it nearly impossible to establish a ‘norm’ as well as standardized comparable data. However interviews, as supplement to observations, can at least provide some accounts of the ‘effects’ of the workshop model via the project participants, who can relate their experience to their ‘normal’ practice. In addition the subjective concept of ‘satisfaction’ or ‘value’ can be dealt with through interviews even though interview accounts have many kinds of bias (Alvesson, 2003).

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