

DESIGN MANAGEMENT: A VALUE BASED APPROACH

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The philosophy of lean thinking has been adopted relatively quickly by contracting organisations, keen to reduce waste in the realisation of construction projects. Given a strong argument for greater synergy between design, manufacturing and construction there would appear to be considerable potential in moving the lean thinking upstream, starting with the briefing and conceptual design stages and managing the flow of decisions through to the completed building, thus helping to deliver value within a lean framework. Value is *the* end-goal and therefore value parameters are key to the achievement of improved productivity and client/user satisfaction. The three-phase Value/Process/Operation (VPO) model starts by identifying value parameters, then moves to designing the process and finally onto the operations. The model lies at the heart of a lean design process model implemented by a consulting company and a contractor in Denmark. The case study helps to illustrate the benefits of taking a more holistic and integral approach based on the agreement of value parameters at the project outset. Through the use of creative workshops, that encourage open communication and knowledge sharing, the lean design process model has been instrumental in delivering value and improving productivity.

Keywords: Communication, Design management, Lean philosophy, Value parameters, Workshop method.

INTRODUCTION

Many of the problems being tackled in the construction phase are the result of ineffective communication and decision making in the design phase, which for a variety of reasons, results in some degree of uncertainty in the production phase, where there is little option but to confront the problem. This appears to stem from a mismatch of values and failure to appreciate the existence of diversity and sub-cultures within the sector, the result being a failure to understand and better manage boundaries between organisations and individuals (Powell, 2001; Emmitt & Gorse, 2003). Work in the lean construction field has tended to focus on 'hard' process tools to identify and minimise uncertainty and hence improve workflow in production. Softer issues concerned with the manner in which people interact and work towards common goals has received much less attention. The lean philosophy (minimising waste, maximising value) should be applied as early as possible in the design and construction process, i.e. at the briefing and early planning phases. It is here that decisions concerning design, procurement routes, timescale and budget conspire to set the scene for everything that follows (in line with the ideals promoted by Womack *et al.*, 1991; Womack and Jones, 1996). Combined with a clear set of values the briefing

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exercise (also known as ‘programming’ in Denmark) and early design operations can be managed in such a way as to reduce downstream uncertainty and associated waste of materials and resources. Instead of a rigid process model, a management framework is required that allows and positively encourages creativity where it is most valuable, at the conceptual stage of the overall design, and also at the conceptual stage of specific details (see Emmitt *et al* 2004), when values are discussed and agreed. Subsequent refinement and confirmation of design intent, which embodies agreed value parameters, is represented by a full set of production information. The focus in this paper is on some of the ‘softer’ issues associated with the use of a ‘lean’ approach to design and construction, with particular attention on interpersonal communication and the use of creative workshops to discuss and agree value parameters.

ESTABLISHING VALUES AND VALUE PARAMETERS

Establishment of common objectives and common values are important objectives in the drive for greater cooperation and reduced conflict in construction projects (e.g. Kelly & Male 1993). Value is *the* end-goal and therefore the establishment of value parameters at the outset of a project are key to the achievement of improved productivity and client/user satisfaction. Following this statement we are concerned with value-based management and the control of values through value management in the early stages of the project and through value engineering to deliver value in production. A number of complementary views of value and value generation exist within the literature. The word value (usually defined as most value for the resources invested) has two characteristics (Christoffersen, 2003a):

- The perception of value is individual and personal, and is therefore subjective. Indeed, agreement of an objective best value for a group will differ from the individuals’ perception of value
- Values will change over time

From these two observations an immediate question is posed: is it possible to discuss and define value at all? The answer to that question is itself subjective, however, if we view value as an output of the collective efforts of the parties contributing to the design and construction process; view value as central to all productivity; and provide a comprehensive framework in which to work, then the answer is likely to be positive. Christoffersen’s argument is that value must be established before doing anything else, an approach now adopted on a great number of projects carried out by the consulting engineers NIRAS where emphasis is both on value creating activities as the initial framework for the entire building process, and the reduction of waste in the later value delivery phases.

Within the construction management literature Kelly and Male (1993) have provided a comprehensive overview of value management and have identified key phases when value management exercises or workshops should be conducted. The view is that these ‘value opportunities’ are best applied early in the design process when strategic decisions are being taken that affect subsequent work. Indeed Kelly *et al* (2003) argue for the use of value management as a tool to aid the briefing process, primarily through the establishment of good interpersonal communication and the sharing of values. The difficulty with the value management approach is that the workshops are promoted as something additional to the management of the process, a tool to enhance value in design management (see for example Gray and Hughes, 2001) rather than value as an integral element of design management. Looking outside construction to

other areas, such as product design and industrial design, it is clear that the desire to maximise value and reduce waste starts at the beginning (with initial team composition) in design and product management models.

At the level of the individual construction project it may be very difficult improve working methods even when all participants and organisations ‘sign up’ to some common values. Work by Maister (1993, 2000) into the workings of professional service firms has argued that many firms do not share values within the organisation and also fail to adequately discuss values with clients early in the appointment process. The implication here is that the sharing of values is a challenge for individual organisations as well as for individual and temporary project groupings. Such concerns are echoed in literature on architectural design management where, for example, Allinson (1993) discusses the different values concerning (amongst others) architectural design and project management. Research by Powell (2001) found that even where designers and manufacturers were making a significant effort to work together, there were still problems with communication, primarily because of the different values held on the supply and demand sides. The integration of design and construction remains a considerable challenge, both from developing an intellectual argument and from a practical stance that delivers real improvements. The challenge is not exclusively with the implementation of process tools to streamline the process, more it is about the interaction of organisations, or more specifically the efficacy of relationships between individuals within such organisations. Communication, cooperation, competences and values of actors are vital components in helping to achieve integration and a level of synergy between these two cultures. Integration is not just a matter of eliminating waste and reducing cost, it is also a matter of understanding the processes, enabling the creation of a built artefact to budget and programme that surpasses the client’s expectations. To do this effectively all actors must engage in dialogue to explore and then confirm a set of values that form the basis of the project, and the most effective way of doing this is through face-to-face meetings that recognise the value of group process (Luft, 1984). Communication is key to the discussion, agreement and implementation of values.

THE IMPORTANCE OF CREATIVE WORKSHOPS

All actors are influenced and equally interdependent on others for the realisation of tasks and projects within the temporary social arrangement of the construction project. This interconnectivity places additional pressures on the ability to communicate and share information and knowledge. Interpersonal communication, intra-organisational and inter-organisational communication is particularly pertinent to the establishment of an effective project communication network (Emmitt & Gorse 2003) and also for enabling learning to take place within the project, helping to improve end value.

Architects Konrad Wachsmann and Walter Gropius introduced a teamwork method for the development of complex building concepts in the 1940s. Although they never mentioned the possible source(s) of their system, the essence of their method can be found in Native American and Indonesian culture where problems were solved in a ‘democratic’ and harmonious way within the tribe. This early work has been further developed into a holistic participation method, which promotes the sharing of values and problem solving in a cooperative environment (see Emmitt *et al*, 2004). The method also seeks to encourage innovative thought and is designed in such a way as to try and avoid ‘groupthink’, which is known to frequently produce poor solutions. Literature on group performance and multi-disciplinary working implies that the

decisions made by groups are more workable, more accurate and more rational than those made by an individual because of the broader range of information and knowledge available to the group; the groups also tend to be more creative. However, the interactions within groups are an extremely complex issue and contradictory views exist as to the ability of a group to reach its defined goals (e.g. Stroop 1932, Bales 1950, Yoshida *et al* 1978, Hartley 1997, Emmitt and Gorse 2003). The current focus on values, partnering and collaborative ventures has once again highlighted the importance of meetings. Meetings encourage face-to-face dialogue and, if managed professionally, can go a long way in helping actors to understand the cultural values of others, thus leading to better integration and realisation of project values. This is illustrated in the following case study.

DEVELOPING VALUE PARAMETERS: A CASE STUDY

The result of an ongoing creative collaboration and knowledge sharing between consulting engineers NIRAS and contractors MTHøjgaard has resulted in a simple process model. These organisations have taken a very open approach to the adoption of lean construction and have published detailed information about performance (see for example Thomassen *et al.* 2003). By discussing and publishing data the organisations aim to continually improve the way projects are realised, being open to new ideas and constructive suggestions. This paper is part of that process, an exercise in critical reflection and appraisal.

A three-phase model

A number of models can be used to provide a framework for the management of construction projects. These range from the well-established Plan of Work first published in the early 1960s by the Royal Institute of British Architects through to more inclusive models, such as the process protocol model (Cooper *et al.*, 2004): the benefits of one over another largely a matter of circumstance and suitability to the context and participating organisations (Emmitt, 1999). The important features of the value based design model featured here are (Christoffersen, 2003b):

- All stakeholders are represented
- All competences/qualifications are represented
- Parallel design work is carried out in workshops, not serially
- A fixed value structure for the product (building) is established
- Stakeholders are guided through the cerebral phases of vision, realism and criticism by a process facilitator throughout the process
- Awareness of 'wicked' problems is essential
- Adequate time for thinking and decision-making must be allowed in the programme, rash decisions must be avoided
- Last Responsible Moment (LRM) thinking is used
- Multiple designs are worked with to explore different value streams
- Think value before price
- Maximise value in both product and process throughout the entire process

Related concerns relate to cultural values, since it is crucial that sub-contractors understand the culture of design and conversely that designers understand the culture of construction. The argument of the case study participants is that engaging in dialogue is the most effective way of achieving better integration. Projects will always be complex undertakings; however, they should not be complicated further by poor information, poor communication and/or ineffective management. Project complexity needs to be dealt with at the front end and a simple system architecture designed to encourage creative activities and the exploration of complexity in the early phases. The front end is about generating complexity within the process framework, identifying wicked problems and setting a time deadline when they must be solved. Decisions are delayed for as long as possible, thus allowing the potential for greater creativity. (Project complexity comprises process complexity and product complexity, both should be simplified).

A three-phase matrix of different values, namely Value/Process/Operation (VPO) has been developed by NIRAS and implemented in partnership with a number of contractors. The partnership between NIRAS and MTHøjgaard aims to capture the entire process through collaborative projects in Denmark. The matrix has similarities with Michael Porter's work, which identified the value envisioned (value), value harnessed (process) and value realised (operation). The VPO model starts by identifying value parameters, then to designing the process and finally onto the operations, thus the process structure forms a framework, a guiding tool. All members of the multi-disciplinary team are deemed to be equal stakeholders; therefore it is necessary to have a process facilitator to guide the discussions and record outcomes, an additional and complementary role to that of the design manager. Key to the model is the use of creative workshops.

The creative workshop method

The workshop model has six stages, from Workshop 0, which is concerned with getting the right people together before proceeding further, through Workshop 1 to Workshop 5. The 'front' end is concerned with optimising and then implementing client value (value management as an aid to client briefing), the later stages with production and embedding of client values within the constructed works, the implementation of design intent. The workshops are seen as 'value generators' (or value drivers) with the delivery of value being achieved between the main workshops. Thus workshops are concerned with problem framing, while problem solving takes place between the workshops. Project team meetings are used between the formal workshops to discuss and agree progress. Using the journey metaphor the design and construction process is a change process, driven by the workshops. A standard value agenda is used in the workshops, 'the basic value structure for buildings', which is based on six key areas of value, namely:

- Beauty
- Functionality
- Durability
- Suitability (for the site and the community)
- Sustainability (respect for the environment)
- Buildability

This value hierarchy addresses the primary project objectives and breaks them down into further sub-objectives as part of an iterative process carried out within the workshops. Each area explored until the value parameters have been mutually agreed through the use of quality function deployment (QFD) tool, essentially a tool that allows values (options) to be weighted in a decision matrix to find the solution that provides the best value in the view of the workshop actors. Workshops continue until agreement has been reached, thus a degree of flexibility in programming is required. Where problems with understanding and attitudes exist, further workshops are convened to help explore the underlying values and tease out the creative input to the project. Thus from the very start the whole process is consensus based. Bringing people together and facilitating workshops is time consuming and hence expensive in the number of hours committed. However, the argument put forward by the consultant and contractor is that the workshops are an essential tool to maximise value and to reach agreement, and hence reduce downstream uncertainty and waste – thus in the long run the workshops are a cost effective tool. Different cultures will exist from concept through to production and the workshops provide a vehicle for the addressing potential difficulties. The workshops are also continued at the production phase to better involve the sub-contractors (not discussed in this paper). The workshops are:

Workshop 0: (Partnering) Building effective relationships

The function of the preliminary workshop is to bring various actors together to engage in socialising and teambuilding activities. The intention is to build the communication structures, the system architecture for the project, thus allowing actors to engage in open and effective communication during the life of the project, the architectural dialogue. In addition to setting the stage for the events that follow the ‘outcome’ of the first workshop is the signing of a partnering agreement between the participants. This confirms the process values for cooperation on the project.

Workshop 1: Vision

This workshop is concerned with discussion of basic product values and the establishment of product value parameters. It is not possible to know the values at the start of a project and so the workshops are primarily concerned with exploring values and establishing a common vision. Knowledge and experience from other projects is brought into the workshop, for example facilities management values, knowledge and experience may help to inform the whole life approach to building design and construction. The main focus of the effort is the establishment of client values (value based parameters); on the basis that the better these are known the better the team can deliver. In the model described here the word ‘client’ is used in its widest sense to include the values of the building owner, the building users, the authorities and the investors; thus it is a very complex system of stakeholders. Arguably, the only way of getting representatives from these disparate groups together so that they can discuss and explore values is via the workshop method.

Early workshops are also concerned with the selection of the most appropriate consultants to deliver the client value. The vision must be developed without any constraints and so consultants are asked to tender based on creative proposals and fee bid. Consultants are evaluated on their ability to contribute to the project, not on the lowest fee basis (as is so common in many construction projects in Denmark). Consultants’ fees are the smallest cost in the project economy chain; therefore there is no need to pick the cheapest, it is more important to pick the organisations and individuals that ‘fit’. Collective dialogue helps to explore and develop relationships that can (or conversely cannot) develop into effective and efficient working alliances,

essentially the preparation for the construction of efficient communication networks. Participants work with multiple alternatives until it is time to choose the ‘best’, i.e. the solution that offers most value for money. Critical connections between decision-making are explored so that everyone is certain before going into production, thus reducing downstream uncertainty. The result of Workshop 1 is the establishment of basic values for the project; a very pragmatic document that does not contain any drawings. These values are prioritised.

Workshop 2: Realism

Workshop 2 aims to discuss how the basic project values may be fulfilled. Project economy is introduced here along with restraints imposed by, for example, authorities and relevant codes. A number of alternative proposals are worked through and ranked according to value. Architects are encouraged to produce at least three schemes that can be presented and discussed at the workshop. During the realism phase normally at least two to three workshops are required, simply because there is a lot of material to work through. The basic project values and project economy are respected in this process and any changes justified within the value parameters. The outcome of the realism phase is the selection of the ‘best suited’ proposal.

Workshop 3: Criticism

This series of workshops is designed to criticise the proposed design solution chosen in the previous workshop. The solution is criticised; is it really the ‘best’ solution? Could it be ‘better’? Detailed discussion is centred on the chosen solution and its improvement within the value parameters. Uncertainty and urgency is high on the agenda prior to the scheme entering the production phases. The project is approved for production and the contractual delivery specifications fixed.

Workshop 4: Design planning

In this model it is here that there is a shift in thinking, as the more abstract work turns into production information. Values are concerned with delivery. The designers, contractor and sub-contractors interface most here as value management techniques turn more toward value engineering and a process management tool, Last Planner, is introduced to help guide the planning of the process. This approach was taken for the first time on the DELTA project and deemed a successful innovation. Here the focus is on improving the constructability of the project, while trying to reduce waste in the detail design and construction phases.

Workshop 5: Planning for execution

These workshops involve interaction between the main contractor and the sub-contractors. A process plan is produced that helps to map the various production activities and help identify missing information. Information flow is an important consideration at this stage in the workshop model. On completion of the construction schedule, in an ideal world, the information should be complete and there should be ‘no scope’ for uncertainty of the delivered value at the production phases.

Meeting schedule

Workshops never last more than one day; although, since value management is founded on negotiation it is common to hold several workshops at a particular stage so that everyone is signed up to the outcome. The schedule of meetings may be extensive on a large project and there is a concern that the cost of the meetings may outweigh the value realised through them. All parties to the project need to constantly monitor the effectiveness of the meetings and critically assess their added value through the use of various benchmarking tools – there is the constant danger of holding too many

workshops and the participants becoming jaded though over-familiarisation. There is considerable pressure on the process facilitator to keep the actors together and thus prevent entropy. It is also critical that the process manager and design manager are able to communicate effectively on an inter-personal level. There are two types of communication in the workshop model; namely, workshop communication (to establish values) and process communication (to implement values). Again, it is critical that the actors are aware of these communication levels.

Customer satisfaction

Feedback into the effectiveness of the workshop method is measured through two tools, a customer satisfaction value control questionnaire and key performance indicators. The value control customer satisfaction survey is used to ask customers if they are satisfied (or not) on a range of areas themed under two headings, the product values and the process values. Here the users/clients are evaluating the result of the process and also the performance of the production team, which can be highly positive and negative. The engineers and contractor have found this to be an important feedback mechanism for continued improvement. From a researcher's viewpoint the tool is likely to produce positive results simply because the participants are evaluating their own performance and a more critical approach to appraisal may be a beneficial development in the future.

REFLECTION ON THE WORKSHOP METHOD

Working closely together by way of a strategic alliance has enabled all parties to develop a simple, yet effective, design management system that appears to deliver value to all parties. The workshop-based design management model is grounded in interpersonal communication and development of effective dialogue. Although it would be possible to criticise the model and suggest improvements (see below) the important issues to come out of this reflection is the concern for people within the model (something that many process models conveniently ignore). The approach is holistic and is aimed at developing a concept for the design(s).

Critical factors for continued improvement

The case study organisation and its consultants have adopted a considered and incremental approach to the adoption of management innovations. This strategy of gradual improvements is, according to the consulting engineer and the contractor's own records, starting to bring about improvements. Some results from the perspective of the consultants are:

- teambuilding was a positive 'side effect' of the workshop approach
- conflict reduction/solution was achieved through discussion of problems
- knowledge and experience was 'captured' for new projects
- a sense of 'ownership' was created with and between the actors
- project management was improved (mainly through improved communication)
- the value of the 'space' for collective decision-making by all stakeholders was recognised by all parties
- improved learning on projects was reported by participants
- positive effects on the management of projects

According to the participants, the clear perception is that the workshops encourage integration. Both consultants and contractor are now committed to the implementation of lean thinking on all projects, supported by training and implementation schemes for staff and project participants. The improvements brought about by the model is confirmed in a small independent study carried out by the national institute for building and urban research in Denmark, which found improved performance across a whole range of performance parameters when investigating one of the projects (By og Byg, 2004). More rigorous work into the effectiveness of the group workshops could produce some useful results for further practical development of the model.

CONCLUDING OBSERVATIONS

The case study helps to illustrate the benefits of taking a more holistic and integral approach to design and construction based on the agreement of value parameters at the project outset. Through the use of creative workshops, that encourage open communication and knowledge sharing through dialogue, the lean design process model has been instrumental in delivering value and improving productivity from the perspective of the project participants. Value (as perceived and shared by the actors) is embedded in the design intent. Although the term 'lean design' is used the model described in this paper is primarily concerned with the creation of workshops to encourage effective communication and create a sense of ownership in the decision-making process. This is a simple design management model that employs a value-based approach and incorporates the lean thinking philosophy. The workshops try to respect and manage the chaotic nature of the design process, with cooperation, communication, experience and learning as a group contributing to the clarification and confirmation of project values.

From the perspective of a researcher looking at the process there would appear to be some areas for future improvement, while still retaining the simplicity of the model. For example, there is no formal management of information flow between meetings, i.e. there are no soft and hard control gates, which can be found in similar process orientated models (although this function appears to be dealt with via the workshops and controlled by the process facilitator). Some comment also has to be made on the use of the term 'lean design'. The design (and production) activities take place between the meetings; the model does not explicitly deal with the design activities and other than provide a supportive environment to discuss issues it is difficult to see how 'lean' design is encouraged. Further work is required to investigate the effectiveness of the workshop method in terms of the realisation of group goals. In particular, the role of the workshop method in promoting and delivering creative solutions would be a logical extension of this case study. So too would some reflection on lean production systems thinking in the detailed design phase.

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