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The role of design management in the sustainable building process

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Abstract

Sustainable building (SB) aims at the required building performance with minimum adverse environmental impact, while encouraging improvements in economic, social and cultural circumstances. The role of design is essential in interpreting and solving these complicated multilevel requirements. This article analyses current design management practices in Finnish construction projects. The aim was to define the challenges that SB brings to the role of the chief designer (stated in the Finnish building code) and to understand how a chief designer contributes towards SB. Study found that the role is defined and practiced mostly as a technical supervisor. The general shared definition of a more fundamental meaning of the role is shallow. The means and mechanisms of performing the task, however, rely on social interaction, influencing and leadership. A lot more power and effect could be got out of design management if these would be consciously involved. SB does not necessarily create more tasks but it affects several existing tasks by bringing new substance to be considered in the design decisions. The key impact that the chief designer can make is created through successful leadership of human creative competence.

Keywords – Design management; integrated design; sustainability management; sustainable building processes

INTRODUCTION

Sustainable construction of buildings and other construction works aims at the required performance and functionality with minimum adverse environmental impact, while encouraging improvements in economic, social and cultural circumstances at local, regional and global levels (ISO 15932, 2008). That requires careful overall management of building performance and life-cycle impacts and thus it also requires effective communication and cooperation. The models of cooperation can be partly developed with the help of integrated methods and tools provided by the information technology. However, the question is also about real team working and the participation of different actors in various process tasks and phases. Because of the comprehensive nature of sustainable building (SB), it sets high demands for changes in the construction process.

The role of design is essential in delivering a SB. During the design phase most of the materials and construction methods are specified and the setting in which the future occupants will use the building is determined (Edwards & Hyett, 2005; Sebastian, 2004). SB emphasizes the importance of design. Sustainable building design requires comprehensive understanding and command of multilevel, interconnected, and sometimes contradictory requirements and it requires ability to collaboratively create new innovative solutions that fulfil these demanding requirements.

The Finnish construction process includes a specific role of a so-called chief designer. The role and the qualifications to act in this role are set in the Finnish national building code (A2, 2002). The role of

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the chief designer is stated as a supervisor and coordinator of the design (A2, 2002; PS01, 2001). He or she is responsible for scheduling and coordinating the design between the designers in the design team. The chief designer foresees that the designs constitute a consistent overall plan. Traditionally, the role of the chief designer is assigned to one of the designers/design companies of the design team, typically to the architect. Depending on the type of the building project and emphasis of the design, it may also be a structural designer (e.g. a building envelope refurbishment), process designer (industrial building) or heating, ventilation, air conditioning (HVAC) designer (pipeline renovation). The statutory chief designer role was enacted in 2002 to assure that there is a party who takes care of the wholeness of the design in the project assuring that the requirements of the project are met and avoiding problems because of conflicting designs.

The objective of this study is to review and analyse current practices and tasks of a chief designer, that is, the design management practices in Finnish construction projects. The study was conducted as a part of a larger research about SB (Häkkinen, Belloni, Rekola, & Nykänen, 2010). The aim of the study was to analyse the role of the chief designer from the point of view of SB. The study aims at defining the new challenges that SB brings to the task and understanding of how a chief designer contributes towards SB. The premise of the work was that such a role is especially essential in SB since sustainability of a building – based on its definition – requires comprehensive understanding and management of complicated, multilevel and interrelated issues and since design is to great extent responsible for creating solutions to the demanding requirements.

LITERATURE REVIEW

SUSTAINABILITY IN CONSTRUCTION PROCESSES

The present construction sector is characterized by a complex supply chain, the various players of which may have competing interests. This hinders the consideration of the sustainability. The public sector could have a remarkable role in initiating the transformation of the supply chain towards better cooperation and joint goals (Anonymous, 2007). The availability of very enthusiastic and knowledgeable persons or groups influence the extent to which the environmental issues are acted upon. Environmental issues are still not included in the everyday concerns of companies (Stenberg, 2006). Ballard and Kim (2007) point out that the power to implement the project roadmap is distributed roughly in the following order: owner, owner agent, process manager (design and construction), specialists (design and construction) and supplier. Everybody can act but within the limits of their own power to create more value and less waste.

Barriers to SB have been analysed by many researchers. Häkkinen and Belloni (2010) have summarized them into nine categories (Table 1).

SB may be hindered because of ignorance or lack of common understanding what sustainability is. The wide content of sustainability and SB also makes it difficult to assess the profitability or cost impacts of SB. Stenberg (2006) addresses that the plurality of meanings of green/SB can result in widely differing problem formulations and contradictory solutions. Rydin, Amjad, Moore, Nye, and Withaker (2006) claim that while designers demonstrate confidence in their ability to access and use knowledge in general, this confidence falls when the specific issue of sustainable construction is addressed.

Seeing SB design as a separate task hinders achieving successful results for SB. Sustainability should be pursued with help of an integrated approach which is able to recognize the sustainability aspects in all selections (Sodagar & Fieldson, 2008).

SB requires awareness throughout the construction processes and actor networks. The researchers have pointed out different change needs and solution suggestions. Rohracher (2001) points out that SB cannot be properly constructed without a much closer interaction of suppliers, professionals and users than is the case with traditional buildings. SB requires high compatibility of architectural, structural and HVAC design, construction and user behaviour. Thus SB requires (a) introduction of new methods and tools for the assessment of buildings, whole building approach and better understanding about the interaction of components and the general performance of SBs; (b) use of new materials and new technical solutions; (c) integration of new actors

TABLE 1 Barriers for SB (Häkkinen & Belloni, 2010)

Policies and instruments of steering	Lack of effective economic incentives
	Ineffective creation of demand with help of policies
	Inadequate support for the innovation of SB technologies and services
Demand and the role of clients	Lack of information about the costs and benefits of SB
	Distant role of users in the building processes
	Ineffective mobilization of the sustainability assessment methods
	Inadequately active role the owners of state and municipal buildings in order to encourage SB
Costs, risks and market value	Lack of sustainability considerations in financing processes and lending procedures
	Lack of property databases including SB indices
	Defective linkage of SB with the corporate policies and market related issues
Tendering and procurement processes	Lack of measurable indicators for target setting
	Lack of information, methods and tools for tendering processes
Process phases and scheduling of tasks	Problems in the right timing, scheduling and commitment of all needed actors early enough may cause a barrier for SB
	Late involvement of the design team
Cooperation and networking	Ineffective communication and cooperation
	Problems in real team working and inadequate participation of different actors in various process tasks and phases
	Lack of collaborative working methods
Knowledge and common terminology	Defective common understanding and common language
Availability of integrated methods	Lack of effective methods for the information management
	Lack of appropriate methods suitable for different phases of design and building and for comparison
	Defective implementation of these methods to different process phases is a serious barrier
Innovation process	Lack of technology policy that supports innovations
	Inability of the building sector to quickly adopt innovative ways of working

(new manufacturers of new products, new services, integrative planning processes); (d) better mutual adjustment and interaction of developers, designers and construction companies; (e) new competencies and new understanding of sustainable construction by actors involved; and (f) new procedures such as new ways of certification and quality control.

Consideration of environmental aspects is hindered if the information about environmental consequences of alternative choices is not available (Shelbourn et al., 2006). According to Tucker et al. (2003), the ability to assess designs automatically to reduce environmental and economic impacts will enable building design professional to make informed decisions. The final design of buildings is a result of a long-term negotiation process between different actors. Sophisticated computer-based planning tools are not sufficient for this kind of process but those should be accompanied by rather simple assessment procedures that may be employed at various stages of the project. Moreover, there is a need to integrate sustainability criteria already into calls of tenders and into the assessment procedures of architectural competitions (Rohracher, 2001).

New delivery models have been suggested. Horman et al. (2006) suggest the use of design–build–operate–maintain (a delivery method that integrates the designers, contractors and operation and the maintenance managers under one contract

to the owner) in SB. Also Deane (2008) states that the preferred design model for delivering an SB is an integrated design process, which includes all involved parties (the owner, the developer, the designer, the builder, the tenant and the facility operator) from the beginning. A procurement method Integrated Project Delivery (IPD) (AIA, 2008) has been developed where the owner contracts the whole project under one contract from the project team.

STATE OF THE ART IN DESIGN MANAGEMENT

It is easy to find literature that deals with design management as a subset of general project management dealing with design schedules, cost/risk controlling, etc. (Chapman, 2001; Raveendranath & Kaka, 2006; Rounce, 1998; Yahiaoui, Harputlugil, & Sahraoui, 2006). Even mathematical models and approaches to automatic work allocation and decision making have been created (Austin, Baldwin, Li, & Waskett, 2000; Browning, 2001; Turskis, Kazimieras, & Peldschus, 2009). Only a few researchers (e.g. Sebastian, 2003, 2005a, 2005b; Volker & Prins, 2005; den Otter and Emmit, 2008) have been looking at design management from the point of view of design work 'guidance' or leadership and design collaboration management. This kind of management requires taking into account the nature of the design work and the interaction of the design team, that is, understanding of how the design solution is created. Thus, it requires different methods and skills than management of economical constraints. Because, according to our premise, the sustainability of a building is achieved largely in the design phase by collaboratively producing new innovative solutions, this point of view is of interest in the context of sustainability.

Sebastian (2003, 2005a, 2005b) studied collaborative design and found that total design is achieved through consensus and teamwork, rather than combining individually developed design solutions. Design conception is cognitive action that finds its scientific paradigm in the social science (Sebastian, 2005a, 2005b). Further, design is a social process. Design team communication stimulates individual understanding of the design that needs to be produced collectively (den Otter & Emmitt, 2008). Design is not only about problem solving but also about problem finding. Design management is not steering to static pre-defined goals but critical examination and reformulation of both requirements and solutions (Sebastian, 2005b).

Recently, there has been growing interest towards the management part of design. According to the literature (den Otter & Emmit, 2009; Gray & Hughes, 2001) this is due to the increasing complexity of design problems and constraints. Sustainability is one of the issues introducing new constraints and information to be managed. The real challenge of sustainable development is that it requires innovation and learning within organizations (Rydin, 2008). Purely control-oriented approach to management is considered outdated. Today's business environment calls for a more people-oriented and multidimensional approach.

Design management has been understood from various points of views in the literature. Koskela et al. have considered design management in three views: as a process of converting inputs into outputs (transformation), as a flow of information through time and space, and as a process for generating value for customers (Ballard & Koskela, 1998; Koskela, Huovila, & Leinonen, 2002). It is stated that these views are not alternative, but rather complementary. A management philosophy that fully integrates transformation, flow and value views is needed (Koskela et al., 2001).

Sebastian (2004) has made a comprehensive literature review of design management. He has categorized the so far presented management views into five categories: engineering–instrumental, design–methodological, value–performance–quality measure, systematic decision making and organizational–protocol approach. The first mainly considers rational problem-solving mechanisms. The design–methodological approach believes that certain design protocols facilitate empirical and logical knowledge, and can guide design activity. The value–performance–quality approaches emphasize the end product and the process to meet the set requirements. The decision-making view tries to optimize the design decision-making process. The organizational–protocol approach deals with design office management and administration of contractual relationships between parties (Sebastian, 2004).

Green (1994) has studied value management. The traditional approach (cost reduction) reflects the optimizing paradigm of hard systems thinking. The alternative approach is based on the learning paradigm of soft systems thinking. The purpose then is to develop a common understanding of the design problem and to identify explicitly an agreed statement of design objectives by the project stakeholders. Green suggested that this approach enables managers to exert an increased level of control over the early stages of building design (Green, 1994). The early stages are often said to be the most important but most problematic to assess and manage (e.g. Raveendranath & Kaka, 2006).

Tzortzopoulos-Fazenda and Cooper (2007) state that design management is a poorly defined profession for which the daily operating parameters are rather vague. Also Raveendranath and Kaka (2006) have found that the knowledge about management systems was in general extremely low among the building consultants in SMEs in the Middle East and in India.

Emergence of new contracting and delivery models affect design management (Tzortzopoulos-Fazenda & Cooper, 2007). den Otter and Emmit (2009) conclude that design management needs to be identified better as a professional task and role. Then it could be assigned to project management, architectural design, design specialist company or a separate consultant. However, it is important to prevent the management to become too much a checking organization to design organizations involved in projects. By improving conditions and appointments by which design is performed, a situation can be created in which all design parties automatically will optimize their contribution to the design (den Otter & Emmit, 2009).

Only one article was found specifically concentrating on the design manager's role in SB (Mills & Glass, 2009). Mills and Glass assessed the ability of construction design managers to integrate sustainability into a building design. The study suggests that possession of the appropriate skills appears crucial in overcoming barriers and proceeding with delivery of SB designs. Necessary skills for managing/leading the design of SB were summarized: awareness, communication, comprehension, experience, lateral thinking, leadership, negotiation, passion and technical knowledge.

The point of view of Mills and Glass (2009) is with regard to the person and skills of the design manager. Our point of view is more with regard to the process and the design manager's interaction with the design team (to the inside) and with the rest of the project (to the outside of the design team and design task). The results of Mills and Glass nicely complement to our study since the personality of the design manager was found to be one essential tool in leading the design team.

Most of the research seems to agree upon the fact that there is not enough knowledge and understanding about this area. There are some attempts to draw conclusions about the relations of the quality of the design process, design management and quality of the product, but so far the researchers have admitted that to be very challenging. There are results stating that the link between the management actions and results could not be found (Prins & Kruijne, 2008) or even that the management does not add value at all in building projects (Brown & Adams, 2000). This is a difficult research area, a complicated mixture of science and belief (Volker & Prins, 2005). This means that it is not clear as to what to observe or what to measure when trying to conclude about these relationships and consequences.

The state of the art in design management has not penetrated yet the core of collaborative design conception that deals with the iterative and collective idea generation (Sebastian, 2004). Existing research emphasizes on the design process and product. Sebastian (2005a, 2005b) stated referring to (Simon, 1969) and (Schön, 1991) that in certain situations a manager can be like a technician applying principles and methods to solving problems. In other situations, a manager is expected to be like a craftsman, practising the art of managing that cannot be reduced only to explicit rules.

RESEARCH METHOD

The research is a qualitative descriptive case study (Cunningham, 1997) of the Finnish design management practices. Multiple methods for

gathering data were used in order to strengthen the validity (Yin, 1994). The methods of the study were literature review, interviews, a focus group discussion and design process analysis by process descriptions and process modelling.

INTERVIEWS

Five chief designers from four companies were interviewed. Four of the designers were architects. One had a structural engineering background. The interviews were carried out in a conversational setting. The objective of the interviews was to facilitate and help the interviewees to describe their experience and knowledge about the content, tasks and practices of chief designers work. The interviews were semi-structured in order to offer topics and questions to the interviewee and focus on the conversation, but at the same time let the interviewee to provide new insights that he or she felt important and allow the interviewer to utilize these new directions (Zorn, 2005). Based on Gray (2007) the interviews could be referred to as reflective conversations, a method of transferring experience-based knowledge in organizations (Schön, 1987, 1991).

Questions or discussion topics in the interviews were set out to describe what the essential tasks of the chief designer are. How are they carried out? In which actions they get performed? How would one describe good chief design practice, and how do the targets of SB affect all this? Are there established standard practices or do the chief designers work from their own starting points?

FOCUS GROUP

After the interviews a focus group discussion (Kreuger, 1988) was held with eight persons of different construction roles: chief designer, architect (project development), cost estimation consultant, building owner, building user and construction researcher. In the focus group the discussion moderator uses questions to excite conversation from the participants (Simon, 1999). In the focus group the role of the chief designer was considered in a wider context: How the other stakeholders see the role of the chief designer, and what needs and presumptions they have in relation to the role.

PROCESS MODELLING APPROACH

To reveal the ingredients of the chief designer's tasks process maps were developed, as detailed as possible, of the tasks. As detailed process modelling takes time, we had to concentrate to small selected pieces of the processes. Snapshots of processes were modelled at the points that were considered important or representative examples based on the interviews. Process models were not primary results of the study in itself but rather tools to make observations and conclusions about the process.

The Business Process Modeling Notation (BPMN) (Object Management Group, 2009; White & Miers, 2008) was used for process modelling. It provides a graphical notation for specifying business processes. The notation supports business process management for both technical and business users by providing a notation that is intuitive to business users yet able to represent complex process semantics (Object Management Group, 2009). It enables rich visualization of relations and dependencies between actors, actions, information and communication flows, documents and data entities.

The process modelling approach had two purposes. One was to explore the link of actions and information flow. This is useful also in further development of connecting building information modelling (BIM) to the SB process. The other purpose was to make visible the interrelations of the chief designer's tasks and other stakeholders' tasks in the building process.

RESULTS OF THE STUDY

The role of the chief designer as stated in Finnish building code is essentially a role that also sustainable construction calls for. The supervision and managing of the very substance of the design and the quality and cohesion of the design are essential in sustainable construction that need total optimization and innovative unified combinations of individual domain designs. Hence, the starting point of having a statutory role of the chief designer is very good. However, the current status of the role in the industry is according to the interviews and the focus group discussion not yet at the desired level.

FROM TECHNICAL MANAGER TO HUMAN LEADER

Current task descriptions of the chief designer (PS01, 2001; Suunnittelun johtaminen, 2005) that are used in design contracts in Finland define the role mostly as a technical supervisor that keeps track that the necessary tasks have been taken care of within the design team. The juridical liability stresses these aspects of the role. By his documented actions and signatures the chief designer can show to have been taking care of his duty. However in the light of both, that is, the literature review and the interviews, it is not the heart and essence of the chief designer's role.

Based on the interviewees' descriptions of the chief designer role, four levels were distinguished from the role (Figure 1): technical level, substance level, communicational/interaction level and personal level. Technical level includes schedules, agreements, documentations, that is the actions related to visible artefacts of pulling the design forward. Substance level includes the design substance issues. Communication level includes things achieved by social interaction: team building, collaboration, positive atmosphere creation, assuring the information flow. On the personal level are things that influence and come to play in chief designer tasks, such as personal characteristics, experience, charisma and leadership.

The technical level (Figure 1) is clear and the conception of it seems to be uniform among the interviewees. However, they felt that despite this there are variations of design management practices and there are personal styles to it. Different persons emphasize different aspects or issues in their management. There are clear technical, even juridical specifications of the task on the technical level, but the means and mechanisms of performing the tasks rely on other levels, that is, social interaction, team spirit, charismatic leadership and influencing. For obtaining the best results out of the design team, levels other than the technical one (Figure 1) should also be engaged. A lot more power and effect could be achieved from design management if all the levels of leading and interaction would be consciously involved instead of only the technical part.

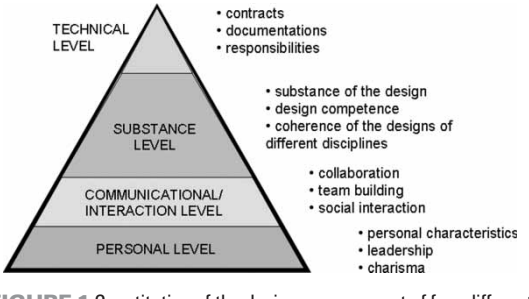

FIGURE 1 Constitution of the design management of four different levels

A significant problem affecting the motivation of the chief designer and effecting his management was identified to be the lack of actual (contractual) power to command or demand anything from other designers and consultants he is supposed to manage. Today, at worst, a chief designer could be held responsible for issues that he has not had possibilities to affect in the first place.

FROM TASKS TO PROCESSES

In Figure 2, there is an example of a process model created in the study. It describes the task 'design coordination'. The roles related to the task are presented on the lanes. In the centre lanes the design team: chief designer (second lane from the top) and the designers of different disciplines. The top lane is the project management consultant that is also connected to the design tasks. At the two bottom lanes information sources and deposits (documents, drawings, building information models, etc.) are presented.

The process models well demonstrated the fact that it is of almost no use to consider the design management tasks separately from project context. The nature of management tasks is such that the manager not so much 'gets done' himself but has to 'make things happen' among the design team. A lot of interaction takes place during the tasks. In this influence and interaction the soft management levels and skills are essential.

Another finding was that the tasks are not one-time performances. The tasks do not become completed in a single action. Instead, most of the design manager's tasks are more like processes in their nature. For example, design coordination has to

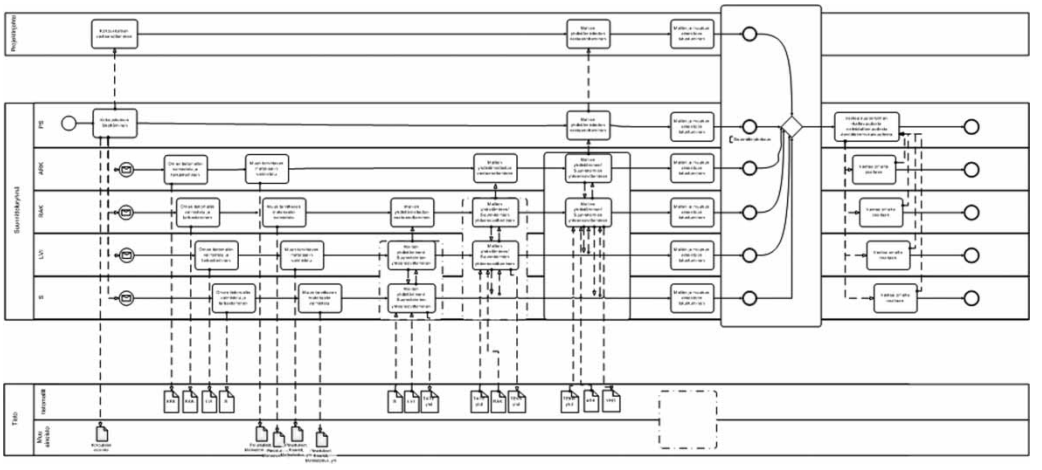

FIGURE 2 An example of a process model that describes design coordination among the design team

be done during the whole project. Responsibility of the building permit does not mean filling in and signing the permit application, but means that the compliance of the designs to the building code, city plan, etc. have to be managed from the start of the design phase, and after the permit is received it has to be controlled during the construction that the permit is fulfilled.

The current Finnish reference agreements of the chief designer's tasks (PS01) are task lists where one could get the impression that by checking the tasks from the list, the tasks are done. Understanding and presenting the tasks as a set of continuous processes would emphasize the continuous and accumulative nature of design management.

In addition to being continuous, these processes are 'horizontal' and intersecting to other design tasks. A reference can be drawn from the design organization to a matrix organization of a company (Figure 3). Different design disciplines act as departments of a company (A, B, C, D in the figure). The design management tasks are horizontal processes crossing all disciplines (1–3 in the figure). This is a new point of view to design project organization. It could be utilized in the future when renewing the roles and tasks.

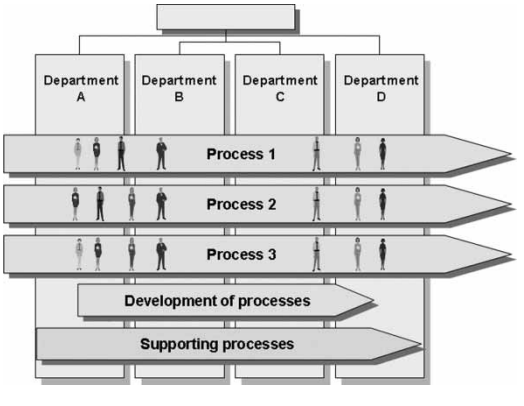

FIGURE 3 Design organization can also be referred to a matrix organization. Design disciplines correspond to departments A, B, C etc. and design management correspond to horizontal processes 1, 2, 3 . . .

DESIGN MANAGER AND SUSTAINABLE BUILDING

The chief designer as stated in the Finnish building code (A2, 2002) is responsible of consistent overall design and the compliance of the building to the client's requirements. This is a necessary and essential role from the point of view of SB. Sustainability targets also suit well into the palette of the supervized substance matters of the chief designer. SB does not necessarily affect more tasks but it means new substance to be considered in the design solution creation among the design team as well as in the decisions at the project management and execution level.

According to the interviews the practitioners felt that the chief designer can, to some extent, influence SB by bringing the issue up and encouraging the sustainable alternatives in various situations. This can be done if the designer holds enough experience and charisma. Also the success of this influencing was seen to be dependent on the possession of these. Power is granted to a convincing chief designer, and he is able to use it. However, it was acknowledged that the SB cannot lie in the hands of only individual enthusiastic persons. It must be introduced to building codes and guidelines in order to be implemented at wide front.

Challenges and tasks of designers include pursuing the information about what are the sustainable solutions and how they are created. While the learning and creation of references and guidelines is ongoing, separate sustainability specialists may be needed. Also the integration of them to the design team falls to the scope of the chief designer. The key impact and difference that the chief designer can make, however, is created through successful leadership of human creative competence.

Using and maintenance of a building are of great importance, since they constitute the major part of a building's sustainability. As buildings are getting more and more technical the users need guidance for using the systems of the building correctly. Chief designer is responsible also for coordinating the production of the maintenance manual. It was concluded that this task could be emphasized more. Besides the actual user manuals (provided typically by the solution manufacturer) a designer could provide the users with the central information considered during the design decisions. The designer could put the solutions to a context by telling why this particular heating system or window type was chosen to be built into the house. That may have an effect on the user's attitudes and habits in using their premises.

MANAGEMENT COLLABORATION

Also the relation of (multiple) managers in a construction project came up in the study. Potential need for improvement was identified. Collaborative design is often mentioned today. We should also call for 'collaborative management' (Ollus, Jansson, Karvonen, Uoti, & Riikonen, 2009), since the (sustainability or any) target must be clear and shared with all the leaders in the project in order to be able to pull the troops into the same direction. Especially the chief designer and the project management consultant (frequently used by clients in Finnish projects) were identified as a pair, the collaboration of whom could gain much power and efficiency.

CONCLUSIONS AND RECOMMENDATIONS

The chief designer role is extremely essential from the sustainability point of view. It is a key role to manage the total design process, wholeness of designs and execution of designs in the construction phase. There is already a growing interest and effort towards sustainability and collaborative design. The means for reaching it are still mainly concentrated on the technical means of integration (BIM and other IT-based assessment and communication systems) and to the control side of management, for example, in the form of restricted controlling of fulfilling design targets and using classification systems (e.g. Promise, LEED). From the point of view of creating something to be controlled the design management role is an essential one.

'Processes have to be facilitated while results have to be controlled' (Volker & Prins, 2005). This is an important observation that has not yet been noticed or appreciated enough in the industry. We argue that the management of design is rather shallow and that there is a lot of potential to be exploited in chief designer practices. The challenge is how to describe the effective ways of managing the design when the role at best is rather invisible just enabling and facilitating the design team to perform their best. The new approach includes shifting from supervision and control to coaching and supporting the design team. More emphasis should be put on the 'soft' levels of design management (interaction, communication and leadership) both in research and in industry practice.

The reference task allocation system of the Finnish construction industry (PS01 and others) facilitates the management of contracts rather than the management of design substance production. It

deals with the work scope and work cost allocation. However, as they are almost the only reference to the task, they are being used as a 'guide' to design management. This has led to shallow management and lack of general shared understanding of what design management fundamentally should be and what its relation is to other areas or levels of management in construction projects. Presenting the role, in principle correct and fine, as processes instead of task lists would emphasize on the continuous and accumulative nature of design management. Further development is suggested for defining the actual processes and their contents. Also the matrix organization point of view is worth considering in the further development. It may open new insights into the process roles or into new management methods that are needed.

The status of the chief designer needs strengthening in the Finnish construction industry. Design management should not be considered a forced juridical action, but an opportunity, an influential value adding service to the project. The imbalance between the power and responsibility should be solved. All the issues related to design should be unambiguously assigned under the power of the chief designer, and decisions about them should not be made uncontrollably, without the presence or knowledge of the chief designer. For solving these flaws perhaps also new (design) delivery models should be developed. Motivating the professionals to take a stronger position is a challenge. It requires a new kind of mindset not only from the designers themselves but also from all the participants of the design and management organizations.

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