The Role of Design Management in Sustainable Building Process

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ABSTRACT

Sustainable building (SB) brings about the required building performance with minimum adverse environmental impact, while encouraging improvements in economic, social, and cultural aspects. The role of design is essential. During the design materials and construction methods are specified and the setting in which the future occupants will use the building is determined. This paper 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 keeping track that the necessary tasks are taken care of among the design team. General shared definition of a more fundamental meaning of the role is shallow. The means and mechanisms of performing the task 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. Sustainable building does not necessarily affect more tasks but it means 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.

INTRODUCTION

Sustainable development of buildings and other construction works brings about the required performance and functionality with minimum adverse environmental impact, while encouraging improvements in economic, social, and cultural aspects at local, regional and global levels (ISO 15932). Sustainable building (SB) requires the 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 help of integrated methods and information technological solutions. 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 SB, it sets high demands for the development of the construction process.

The role of design is essential in delivering a sustainable building. During the design phase materials and construction methods are specified and the setting in which the future occupants will use the building is determined. (Edwards and Hyett, 2005) (Sebastian, 2004). SB emphasizes the importance of design because it increases the requirements of the availability of information, appropriate methods and information management.

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 the chief designer is stated as a supervisor and coordinator of the design (A2, 2002)(PS01, 2001). He or she is responsible of 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 (for example a building envelope refurbishment), process designer (industrial building) or 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, i.e. the design management practices in Finnish construction projects. The study was conducted as a part of a larger research about sustainable building (Häkkinen et al. SB10). The aim of the study was to analyse the role of the chief designer from the point of view of sustainable building. The study aims at defining the new challenges that SB brings to the task and understanding of how a chief designer contributes towards sustainable building. 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 interactive, and sometimes contradictory issues and ability to create new solutions that fulfil the demanding requirements.

LITERATURE REVIEW

Sustainability in construction processes

The present construction sector is characterised by a complex supply chain, the various players of which may have competing interests. This hinders the consideration of the sustainability requirements. The public sector could have a remarkable role in initiating the transformation of the supply chain towards better cooperation and joint goals (Anon 2007). The availability of very enthusiastic and knowledgeable persons or groups influence the extent to which the environmental issues are acted upon. Environmental issues still do not include to the every-day 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), specialist (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 9 categories (Table 1).

Table 1.Barriers for sustainable building (Häkkinen and 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

The barriers of sustainable building are culminated with problems related to the lack of information and different kinds of assessment methods and information management methods and to the problems with regard to the early involvement of the design team, effective collaboration and team working (Horman et al. 2005; 2006).

Sustainable building may be hindered because of ignorance or lack of common understanding what sustainability is. The wide content of sustainability and sustainable building also makes it difficult to assess the profitability or cost impacts of sustainable building. Stenberg (2006) addresses that the plurality of meanings of green building/ sustainable building can result in widely differing problem formulations and contradictory solutions. It also makes it difficult to cooperate, which in turn hinders the creation of new knowledge and innovative solutions. Williams and Dair (2007) address the lack of knowledge as the main problem which is related to several different barriers. Rydin et al. (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 sustainable building design as a separate task hinders achieving successful results for sustainable building. Sustainability should be pursued with help of an integrated approach which is able to recognise the sustainability aspects in all selections (Sodagar and Fieldson 2008).

Sustainable building 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 sustainable building cannot be properly constructed without a much closer interaction of suppliers, professionals and users than is the case with traditional buildings. Sustainable building

requires high compatibility of architectural, structural and HVAC design, construction and user behaviour. Thus sustainable building 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 sustainable buildings, b) use of new materials and new technical solutions, c) integration of new actors (new manufacturers of new products, new servicers, 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, f) new procedures like new ways of certifying and quality control.

According to Shelbourn et al. (2006) one of the key issues in making construction projects more sustainable is overcoming the obstacles of capturing and managing the knowledge needed by project teams. Consideration of environmental aspects is hindered, if the information about environmental consequences of alternative choices is not available. According to Tucker et al. (2003), the ability to assess designs automatically to reduce environmental and economic cost 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 which 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) address the importance of cooperation in SB projects. They 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 a SB is an integrated design process, which includes all involved parties (the owner, the developer, the designers, 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 or risk controlling etc (Rounce, 1998; Chapman, 2001; Yahiaoui et al, 2006; Raveendranath and Kaka, 2006). Even mathematical models and approaches to automatic work allocation and decision making have been created (Austin et al, 2000; Browning, 2001; Turskis et al, 2009). Only a few researchers (e.g. Sebastian (2003; 2005), Prins (Volker and 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, i.e. 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 innovative new solutions, this point of view is of interest in the context of sustainability.

Sebastian (2003; 2005) has 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 it's scientific paradigm in the social science (Sebastian, 2005). Further, design is a social process. Design team communication stimulates individual understanding of the design that needs to be produced collectively (den Otter and Emmitt, 2008). Design is not only

problem solving but also 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 can be seen growing interest to the management part of design. According to literature (Gray and Hughes, 2001; Prins and Kruijne 2008; den Otter and Emmit, 2009) that is due to 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 organisations (Rydin 2008). Purely control oriented approach to management is considered outdated. Today's business environment call for more people oriented and multidimensional approach.

Design management has been understood from various point of views in the literature. Koskela et al have considered design management as 3 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 and Koskela, 1998; Koskela et al, 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, 2002).

Sebastian (2004) has made a comprehensive literature review of design management. He has categorised the so far presented management views into five categories: engineering-instrumental, design-methodological, value-performance-quality measure, systematic decision making, and organisational-protocol approach. The first mainly considers rational problem solving mechanisms. Design methodological approach believes that certain design protocols facilitate empirical and logical knowledge, and can guide design activity. The value-performance-quality approaches emphasise the end product and the process to meet the set requirements. Decision making view tries to optimise the design decision making process. The organisational-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 often said to be the most important but most problematic to assess and manage (e.g. Raveendranath and Kaka, 2006).

Tzortzopoulos-Fazenda and Cooper (2007) state that design management is 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 Middle East and India.

Emergence of new contracting and delivery models affect design management (Tzortzopoulos-Fazenda and 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 organisation to design organisations 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 and Emmit, 2009)

Only one paper was found specifically concentrating on the design manager's role in sustainable building (Mills and Glass, 2009). Mills and Glass assessed the ability of construction design managers to

integrate sustainability into building design. The study suggests that possession of the appropriate skills appears crucial in overcoming barriers and proceeding with delivery of sustainable building designs. Necessary skills for managing/leading the design of SB were summarised: Awareness, Communication, Comprehension, Experience, Lateral Thinking, Leadership, Negotiation, Passion and Technical Knowledge.

The point of view of (Mills and Glass, 2009) is to the person and skills of the design manager. Our point of view is more to the process and the design managers 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 one essential tool in leading the design team.

Most of the research seems to agree upon 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 and Kruijne, 2008) or even that management does not add value at all in building projects (Brown and Adams, 2000). This is a difficult research area, a complicated mixture of science and belief (Volker and Prins, 2005). That means that it is not clear 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 emphasises the design process and product. Sebastian (2005) 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, practicing 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 the conversation, but in 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 reflective conversations, a method of transferring experience-based knowledge in organisations (Schön, 1987; Schön 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 sustainable building 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 8 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 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 to the role.

Process modeling 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 modeling takes time, we had to concentrate to small selected pieces of the processes. Snapshots of processes were modeled 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 and Miers, 2008) was used for process modeling. It is a process modeling notation that 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 visualisation of relations and dependencies between actors, actions, information and communication flows, documents and data entities. The process modelling served for two purposes. One was to explore the link of actions and information flow. This is useful also in further development of connecting building information modeling (BIM) to the sustainable building process. The other purpose was to make visible the interrelations of 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 is essential in sustainable construction that needs total optimisation and innovative unified combinations of individual domain designs. Hence the starting point of having a statutory role of the chief architect 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 among 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, the literature review and the interviews, that is not the heart and essence of the design manager'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.

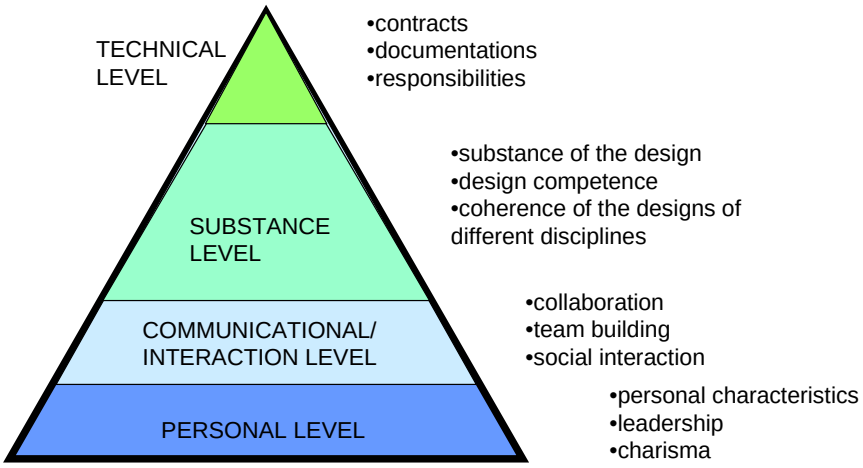

Figure 1. Constitution of the design management of four different levels.

Technical level includes schedules, agreements, documentations, i.e. 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 conception of it seems to be uniform among the interviewees. However, they felt that despite of that 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, i.e. social interaction, team spirit, charismatic leadership and influencing. For obtaining the best results out of the design team also other levels than the technical one (Figure 1) should be engaged. A lot more power and effect could be got out of design management if all the levels of leading and interaction would be consciously involved instead of only the technical part.

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 also is connected to the design tasks. At the two bottom lanes information sources and deposits (documents, drawings, building information models, etc.) are presented.

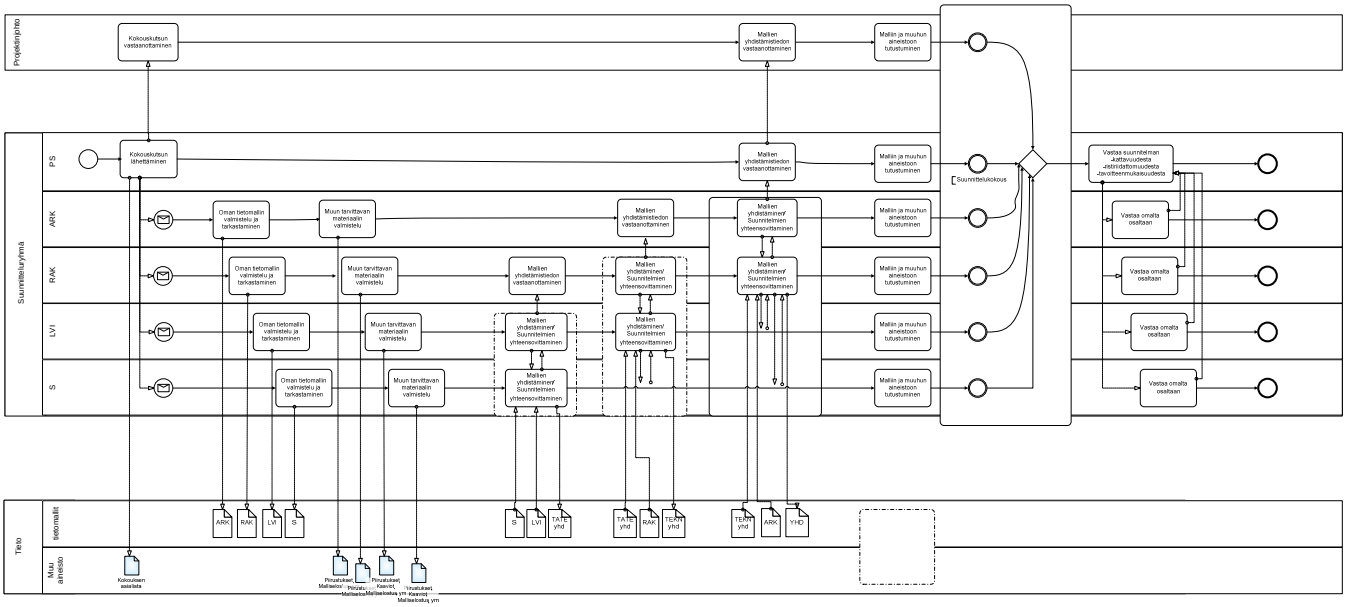

Figure 2. An example of a process model that describes design coordination among the design team.

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 influencing (making things happen) and interaction the soft management levels and skills are essential.

Another finding was that the tasks are in fact 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 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 got 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 become 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 continuous, these processes are "horizontal" and cross-secting to other design tasks. A reference can be drawn from the design organisation to a matrix organisation 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 as horisontal processes crossing all disciplines (1, 2, 3 in the figure). This is a new point of view to design project organisation. It could be utilised in the future when renewing the roles and tasks.

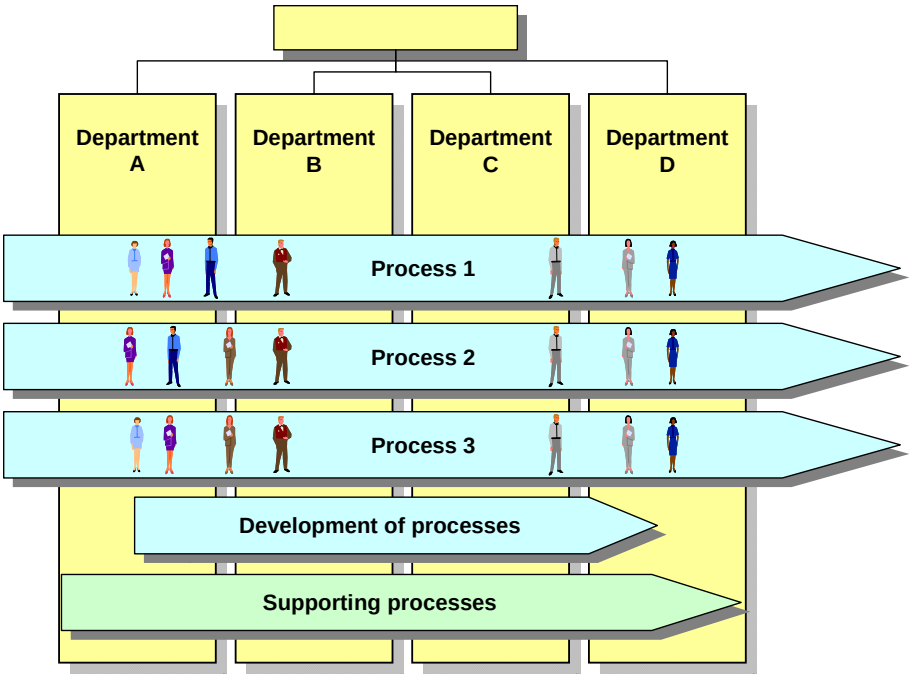

Figure 3. Design organisation can be also referred to a matrix organisation. Design disciplines correspond to departments A, B, C etc. and design management to horizontal processes 1, 2, 3…

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. That is a necessary and essential role from the point of view of sustainable building. Sustainability targets also suit well into the palette of the supervised substance matters of the chief designer. Sustainable building 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 towards sustainable building 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 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 sustainable building can not lie in 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 guidelines or references is ongoing separate sustainability specialists may be needed. Also the integration of them to the design team falls to the scope of 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 is

the one to put the chosen 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 into users attitudes and habits in using of their premises.

Management Collaboration

Also the relation of (multiple) managers in a construction project rose up in the study. Potential need for improvement was identified. Collaborative design is often mentioned today. We should also call for "collaborative management" (Ollus et al, 2009), since the (sustainability or any) target must be clear and shared with all the leaders in the project (client's project manager, chief designer, project management consultant, construction site manager, etc.) in order to be able to pull the troops into the same direction. Especially the chief designer and the project management consultant (*rakennuttajakonsultti*, 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 in Finnish construction industry is extremely essential role from the sustainability point of view. He is a key person to manage the total design process, wholeness of designs, and execution of designs in the construction phase.

There is already growing interest and effort to sustainability and collaborative design, but the means for reaching it are still mainly concentrated to the technical means of integration (BIM and other IT based assessment and communication systems) and to the control side of management, e.g. 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 role.

"Processes have to be facilitated while results have to be controlled" (Volker and Prins, 2005). This is an important observation which is not yet 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 to manage 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 to the "soft" levels of design management (interaction, communication, leadership) both in research and in industry practice.

The reference task allocation system of the Finnish construction industry (PS01 and others) facilitate the management of contracts rather than the management of design substance production. They deal 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 lead to shallow management and lacking of general shared understanding of what design management fundamentally should be and what is it's relation 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 the continuous and accumulative nature of design management. Further development is suggested for defining the actual processes and their contents. Also the matrix organisation point of view is worth considering in the further development. It may open new insights into the roles or needed new management methods.

The status of the chief designer needs strengthening in Finnish construction industry. It 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 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 from all the participants of the design and management organisations.

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