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## STEERING OF SUSTAINABLE BUILDING IN PUBLIC BUILDING AND RENOVATION PROJECTS

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**Abstract** *This paper studies current public building and refurbishment processes from the point of view of a municipal client and formulates recommendations for the management of sustainable building in public building projects.*

*The paper describes a case study of procurement of design in the city of Vantaa (the third largest city in Finland). The aim of Vantaa was to develop their procurement practices inside the frame set by the directive of public procurement. The study was performed with help of a literature survey, interviews and workshops. Based on the study, the following recommendations can be given to change or develop the practices of public building owners to achieve sustainable building:*

- *The creation of an action plan for sustainable building to manifest the decision of sustainable building in the organisation and to guide the programming and target setting of all projects.*
- *Selecting suitable delivery model for the project is essential and a task that needs more emphasis and competence. Different models suit different types of projects. From the multidisciplinary collaboration point of view the models that enable all relevant actors to participate in decision making early enough should be preferred.*
- *Attaining better understanding of the use of quality based criteria in tendering processes according to the principles of public procurement.*
- *The reinforcement of the project preparation stage. Renewal of process phases and tasks, and roles of different actors will be needed.*
- *Adopting performance based target setting and formulation of a framework for continuous improvement of performance levels targeted.*
- *Better utilization of building information models. BIM offer a technology for communication and interaction of project stakeholders, and for the management of sustainable building information through the life cycle of buildings.*
- *Reinforcement of collaborative processes and owner's guidance in design.*

## 1. INTRODUCTION

Sustainable development of buildings brings about the required performance and function with the minimum adverse environmental impact [1]. Sustainable building processes can be defined as those in which the quality of the overall process enables the delivery of sustainable buildings in a way that meets the needs of all people involved [2]. Sustainability is for large part decided upon in the design phase. Current building processes need to be changed to become sustainable processes. This will require significant improvements in steering and design. Sustainability assessment is no longer used only for marketing purposes, but the definition of project objectives is increasingly guided by the sustainability content, especially in public building processes [3, 4].

This paper studies current municipal building and refurbishment processes and formulates recommendations for the management of sustainable building in public building projects. Recent research addresses the significance of the preparation phase [5] and early design phases [6, 7, 8] in sustainable building design. Clear targets for building performance and environmental impacts form the starting for the design of sustainable buildings. Important decisions regarding sustainability are done in project preparation and in early phases of design.

The activities of local authorities in building and refurbishment are influenced by the European rules for public procurement. These rules describe four different procurement methods: open tendering, limited tendering, negotiating procurement, and competitive negotiating procurement [10]. Tendering for services is remarkably more difficult than tendering for goods. Tendering for design is especially difficult, since the result of the service is not (fully) seen at the time of completion of service but only afterwards, after construction and operation. This poses challenges to the procurement criteria.

Design contracts are traditionally made in standard format in Finland (reference templates and reference terms [11]). The details of the design content is specified in Appendices. Setting the reward structure is one basic task of the procurement [12]. The rewards in design have traditionally been fixed lump sums or fixed unit price. Recently, in connection with the increasing variety of the delivery models, there has also been considerations for using incentives in design contracts.

Project delivery systems refer to the overall processes, by which a project is designed, constructed and/or maintained [13]. Traditionally, the public sector has used the design-bid-build or construction management model, both involving the separation of design and construction services, while the private sector has more favored different kinds of integrated services [13]. The delivery systems that emphasize the competition between service providers is better suitable for simple, rather formal projects where the degree of uncertainty is low. However, demanding renovation projects and many new building projects are not like this. It is possible to recognize a trend according to which the complex nature, pressures because of project schedules and uncertainty increase [14, 15]. At the same time there is a need towards better flexibility, better coordination, sharing of information and collaboration. The starting point of the research was that the project delivery system and the collaboration of different actors significantly affect the quality and success of a sustainable building project/process.

This paper utilises results of two research projects, a national case study project and EU funded research project HOLISTEEC ([www.holisteecproject.eu](http://www.holisteecproject.eu)) that is addressing design process and design methods in a wider perspective, but also considering delivery models and contractual relationships as one aspect impacting the design process.

## **2. OBJECTIVES AND METHODS**

The objective of the paper is to study current public building and refurbishment processes from the point of view of a municipal client and formulate recommendations for the management of sustainable building in public building projects. The following questions were issued: In order to achieve a successful design process that create high performing buildings that fulfil the targets given to the project

- how should a public owner act when procuring design in the project?
- how should a public owner steer the design process?

The paper describes a case study of procurement of design in the city of Vantaa (the third largest city in Finland). The aim of Vantaa was to develop their procurement practices inside the frame set by the directive of public procurement. The study was performed with help of a literature survey, interviews and workshops.

### **2.1. The research process**

The literature review aimed at getting understanding of impacts of the chosen delivery method on design process stakeholders, design team collaboration, and project requirements setting.

The case study was started by a workshop of researchers to focus the research and topics of the interviews. The participants were experts of sustainable building, design process, building information modelling, facility management, LCC and LCA, energy efficiency and HVAC systems. The aim of the researcher workshop was to identify the important requirements for management of sustainable building. The identified issues were

- support and promotion for collaboration during design process
- support and promotion of communication and trust in project team
- enforcement of the project preparation phase
- finding criteria for quality of service providers in procurement
- what kind of actions and procedures can be applied within the public procurement enacted by law.

Number of statements or propositions of actions in these themes were stated in the interviews and discussed with the interviewees. The interviewees were asked to reason how much they agree or disagree with the propositions and why. Face-to face interviews were made with 9 representatives of the owner organisation (project managers, project programming persons and others representing different roles in municipal building projects) and 2 designers they regularly use in their projects (1 architect and 1 HVAC designer).

One workshop with the owner organisation was held in the end of the process to reflect the

results of the expert workshop and interviews with the owner representatives. The findings were further discussed and recommendations developed. The workshop also served as a means to add commitment of the persons in this owner organisation towards the development of their procurement practices. Results of the case study are presented in chapter 4.

### 3. RESULTS OF THE LITERATURE STUDY

Traditionally price, timetable and quality are considered the success criteria for projects [16]. Eriksson and Westerberg [15] use environmental impact, innovations and work environment as additional criteria and claim that these are especially important in sustainable building projects. They claim on the basis of a literature study of several projects that when assessed with criteria 1) price, 2) time, 3) quality, 4) environmental impact, 5) work environment, and 6) innovation, the project succeeds the better

- the better is the integration between the client and contractor in design phase
- the more the requirement setting and the assessment of offers is based on quality criteria
- the more the payment is based on incentives related to building's performance aspects
- the more cooperative tools are made use of
- the more the assessment of the quality of the end product is done by the builder.

The literature survey in this paper studied the impact of delivery models on the following items.

- the roles and involvement of different actors in different phases of building process
- the approach used for performance management (descriptive, performance based, other)
- the need of methods and tools for design and overall performance assessment.

A review was made in following literature: [3], [9], [12-24]. The conclusions are summarized in Table 1.

The delivery models that enable or even obligate more stakeholders to be involved in the same time and interact can be recommended from the collaboration point of view. Also these models seem to favour more performance based approach for project requirements setting and managing. However, these models typically involve more preparation work and issues that are not familiar in advance to most municipal project managers. Hence they are usually seen as models for large and complex projects. One delivery model cannot be automatically recommended, but the selection of model is a specific task in each project. Different models suit different kinds of projects. However more variety of used models could be expected into public building.

	<b>Co-operation among the stakeholders</b>	<b>Typical approach for performance management</b>	<b>Need of assessment methods and tools for design and performance management</b>
<b>Design-bid-build</b>	Does not support collaborative working methods.	(Traditionally) often descriptive requirement setting. Typically not high performance targets.	Does not specifically require the use of assessment tools especially when descriptive requirements are used.
<b>Design-build</b>	Enables the close collaboration of designers with the contractor. Prevents direct steering of design by the owner.	Often performance based requirement setting	Performance assessment methods are needed to show achievement of the set targets
<b>Construction management</b>	Does not support collaborative working methods. Design managed based on trading packages (production oriented).	No typical approach	The construction manager (and the client) would benefit from the use of performance assessment methods in monitoring targets but the focus is often on time and cost.
<b>Early contractor involvement</b>	Enables close collaboration of client and contractor in the first phase.  Supports close collaboration of designers with contractor in the second phase.	Performance based target setting is more suitable when innovative solutions are targeted.	Performance assessment methods are needed to show achievement of the set targets when the requirements are performance based.
<b>Alliance contracting</b>	The collaboration of all partners is the starting point, and all partners are involved already in target setting	Performance based target setting is more suitable when innovative solutions are searched for.	The use of methods and tools for continuous performance assessment is a natural part of the decision making.
<b>PPP models</b>	Supports consideration of life cycle impacts during design and implementation and supports collaboration with the maintenance service providers	The contract is based on energy-performance or wider building performance.  Performance based target setting.	The use of assessment are important to ensure the achievement of the agreed target and avoid unprofitable outcome.

Table 1. Summary of the characteristics of different delivery models, based on [3], [9], [12-24].

## **4. RESULTS OF THE CASE STUDY**

Based on the interviews and workshops the results of the study are summarised in the following.

### **4.1. Creation of an action plan for sustainable building**

In practice, the municipal building officers can only realise projects that are in line with the strategic aims and resources available in the municipality. To gradually move towards the desired targets in energy efficiency, zero-energy building, healthy and sustainable building in general, it is recommended that the municipalities create an action plan for sustainable building. It should describe the strategic goals so clearly that it will guide the practical functions of the municipality in the project preparation process. The action plan should describe where the main efforts are concentrated and what is the desired schedule for achieving the targets.

The action plan could also include principles and target for building control authorities for steering of construction inside the municipality.

### **4.2. Project preparation stage**

The importance of project preparation stage is emphasized in parallel with the increase of the complexity of the targets. It requires careful consideration of tasks, objectives, and roles of different actors and detailed description of the process that is best applicable for the actor's own practices. The project preparation process must support putting into practice on a project level the strategic targets of the municipality for sustainable building.

The project preparation needs to be able to assess the essential options and their impacts on the strategic targets. Important aspects are especially energy efficiency, indoor air quality of buildings and cost implications from life cycle perspective. The prepared targets must be realistic and their cost and other life cycle impacts should be assessed in a holistic way.

It is essential that the project preparation process always ends up with a clear and extensive project plan, that helps first to make a clear call for tender and later is able to be fully (correctly) understood by all project partners. Project plan should be acknowledged as the main document guiding the project throughout the whole realisation, and if any deviations occur, they need to be critically assessed regarding the consequences and risks induced.

### **4.3. Performance based target setting and continuous commissioning**

Sustainable building requires performance based commissioning. The requirements should be focused on both, energy efficiency and other central performance attributes. To be able to set the requirements in a systematic and persistent way, and to be able to monitor the development of the requirement level of the municipality, a general framework for the requirements is necessary. It is recommended to e.g. utilise the indicators for sustainable building presented in the ISO standard[2], and to develop an adapted version to the practices of the organisation in question.

It is recommended to obtain continuous commissioning practices and define the procedures

that are used for verifying the realisation of the targets in design, construction, and operation. The required performance can be also qualitative, but also then it is essential that the procedures to verify the target realisation are in place. The decisions related to the achievement of the targets or the possible revising of the targets during the process need to be documented, in order them to be available for later review.

#### **4.4. Extensive utilisation of BIM**

Better utilization of building information models is recommended. BIM offer a technology for communication and interaction of project stakeholders, and for the management of sustainable building information through the life cycle of buildings. The use of BIM supports multi objective design and controlling of the design requirements. The use of BIM makes production and evaluation of several design options faster, as the information required as input by different evaluation and simulation tools is remarkably easier available.

It is recommended that if the project size allows, the requirement to use building information model based design is taken into common practise in municipal building.

#### **4.5. Tendering**

Public procurement law is still regarded as a restriction for public procurement and especially for setting higher quality requirements for the service providers. The European Parliament has recently approved the new directives for public procurement and regulations for the revision of contracts. It is recommended that the municipalities get ready for the new regulations and develop guidance for their own activities on how to contractually improve the quality of the services procured.

In general the presentation of unambiguous requirements and plans and assurance of comparability of the bids need improvement. It is recommended that systematic approach for this in municipalities.

#### **4.6. Reinforcement of collaborative processes and owner's steering in design**

To gain a common understanding and to assure the agreement on the targets among the project team, it is recommended as common practise to organise a workshop at start of the design phase. In the workshop the targets are presented and justified, and in which they can be discussed. The designers could already at this point work out the targets; what they mean from each of their own point of view and what they mean for the total project. It is anticipated that this practise will increase the understanding of and engagement to the targets. Practical work would also start building trust among the project team.

#### **4.7. Incentives in design contracts**

There is very little analysed information available on the rewarding models used design contracts. The current understanding is based on interviews in a few studies and informal discussions. Although there are arguments both for and against, it is recommended to test different incentive models, bonuses and sanctions that are tied to different design aspects, in order to find efficient incentives that affect the essential targets set by the customer.



Regarding the rewarding, it is, however, emphasized that the whole planning team should be rewarded and that the rewards (and especially sanctions) should be consistent with the general conception of fairness of the stakeholders. The justification of the rewards and the verification method for the assessed aspects should be described already in the call for tenders.

## 5. CONCLUSIONS

The conclusions are based on results from both the literature review and the case study. Regarding the case study, it is taken into account that it only represents one Finnish city, and thus may not be completely valid for all kinds of cities, municipalities and public bodies. However the building processes are similar around the world and public building projects are very similar in all municipalities and public organisations, thus recommendations on general level can be expected to be applicable widely. The results are in many points supported by other research which also confirms that the recommendations are relevant in general.

Based on the study, the following recommendations were given to change or develop the practices of public building owners to achieve sustainable building:

- The creation of an action plan for sustainable building to manifest the decision of sustainable building to all in the organisation and to guide the programming and target setting of all projects.
- Selecting the delivery model of the project is essential and a task that needs more emphasis and possibly also more competence. Different models suit different types of project. From the multidisciplinary collaboration point of view the models that enable all relevant actors to participate in decision making early enough should be preferred.
- Attaining better understanding of the use of quality based criteria in tendering processes according to the principles of public procurement.
- The reinforcement of the project preparation stage. Renewal of process phases and tasks, and roles of different actors will be needed.
- Adopting performance based target setting and formulation of a framework for continuous improvement of performance levels targeted.
- Better utilization of building information models. BIM offer a technology for communication and interaction of project stakeholders, and for the management of sustainable building information through the life cycle of buildings.
- Reinforcement of collaborative processes and owner's guidance in design.

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