

# Using Supply Chain Management for Sustainable Public Procurement

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## ABSTRACT

In recent years, interest in the cross-disciplinary area of sustainable procurement has increased in both academia and research. A main driver of this development is the rising number of policies and regulations dealing with these issues of procurement (e.g. COM (2008) 400; Directive 2014/24/EU). There are various strategies available for including sustainability aspects in the procurement of construction works.

However, the consideration of sustainability aspects in the tendering and awarding stage has only been implemented to a limited extent (insufficient criteria and weighting). In addition, a holistic approach is still missing.

This contribution presents a review of existing evaluation approaches in public tendering and awarding of construction works. This helps to provide evidence of connections between sustainability policy goals included in public procurement tenders and how public contracts are awarded (especially in Central Europe).

Furthermore, the paper focuses on supply chain management and how these processes of criteria setting, especially from the private (automotive) sector, can be considered and transferred to public procurement procedures. Therefore, not only product related aspects are examined, but also process related issues, e.g. information exchange and workflow management.

The goal is to identify and evaluate useful supply chain management criteria development methods, which could be adapted for construction and building projects in order to focus on a more holistic consideration of sustainability aspects.

Finally, a more performance-orientated approach is intended, with the aim of working towards a more cooperative procurement. Joint specification, selected tendering, performance-based bid evaluations and collaborative tools particularly influence the success of a construction project during its life cycle.

**Keywords:** *green procurement, design process, green economics*

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## 1. INTRODUCTION

Based on the latest climate initiatives, there is increasing awareness of the construction industry and their contribution to fighting climate change. In addition to the COP 21 taking place in Paris in 2015, a global alliance for building and construction has been launched to emphasize the implementation of ambitious actions towards the below 2°C pathway in the building and construction sector (cf. UN, 2015). The sector offers crucial potential for resource and energy efficiency; 30% of global CO<sub>2</sub> emissions are related to construction activities. Current developments such as rapid urbanisation, in particular in emerging economies, highlight the need to use the procurement of goods and services in the building sector to consider these sustainable development issues. This contribution targets the use of supply chain management to enable and promote sustainable public procurement.

## 2. METHODOLOGY

In order to assess the state of the art in sustainable public procurement, an extensive literature review (Wall and Hofstadler, 2016a) has been performed. In a second step, the ongoing situation has been investigated using an expert questionnaire with the aim of investigating current implementation of sustainable construction (Scherz, 2016). The questionnaire explored the perception of different parties and stakeholders involved in sustainable construction from an AEC point of view. The experts were chosen based on their experience in this field. These are people with a certain specific knowledge and expertise in a field (based on reference projects). Experts (in general) are responsible for the design and implementation as well as for checking/monitoring a certain solution and have privileged access to certain information such as decision-making processes (cf. Bogner et al., 2009).

This contribution shows the important role of supply chain management in achieving sustainable procurement. The findings stated in the following sections provide an overview focussing on the building sector. But most of these issues are relevant to the whole construction industry. There are several patterns, especially in procurement, that target the use of supply chain management.

### 3. SUSTAINABLE PUBLIC PROCUREMENT

The procurement process sets up legal boundaries, based on the conditions within which a project is developed. Several European and national initiatives proposed policies for considering additional aspects during the tendering procedure. These started with the white paper on public procurement in the EU and COM 96 (583) final as well as COM 98 (143) final, which concluded with COM (2001) 274 focusing on "Commission interpretative communication on the Community law applicable to public procurement and the possibilities for integrating environmental considerations into public procurement". They resulted in the directive 2004/18/EC, which supports the awarding of contracts based on the most economically advantageous tender and enables a more life cycle orientated perspective in tendering with the European directive 2014/24/EU.

#### 3.3 Current implementation of sustainability issues

The current procurement process within harsh and competitive markets in the construction industry is characterized by a strong focus on financial issues. The building sector has a fluctuating demand cycle, uncertain production conditions and segmented production processes with competitive relationships among the involved stakeholders. In order to focus more on life cycle oriented sustainable development, it is important to take into account a holistic approach, therefore the most economically advantageous tender could be suited best.

In the current implementation of sustainability aspects in the design and procurement of buildings, there is a strong focus on individual aspects, especially environmental issues. They may also be linked to certain energy-related performances of buildings, and building certification schemes are used to communicate these ambitions in practice. Therefore, data is required to transport this information and communicate certain aspects during the planning and construction stages of a project. For instance, in terms of environmental qualities, there are two different approaches available. One is on using normative issues, such as indications of toxic components and harmful influences, as limitation criteria in the procurement process. This information is gathered in online databases such as WECOBIS (German platform on ecological building products) and baubook (containing similar ecological information and offering services for implementing text blocks into calls for tenders).

Otherwise, a material selection process based on life cycle assessment according to EN ISO 14040 for determining the ecological performance of certain products and building components can help certain design targets to be reached. Relevant information can be communicated using environmental product declarations (EPDs) throughout the supply chain as an information tool for business-to-business clients/customers. Due to their standardized information, EPDs can be used in the procurement process to indicate the consideration of sustainably aspects and as an appropriate tool for documentation and quality management during the planning and construction stages (cf. Passer et al., 2015).

In an empirical study (cf. Scherz, 2016), different expert views from AEC industry have been assessed, not only taking into account the current implementation of sustainable construction but also future potential and action needed. The experts agreed that extensive demand planning is indispensable for the definition of specific stakeholder aims, especially for the consideration of sustainability aspects.

However, when the current situation is considered, the barriers result from reduced and limited financial and organisational capabilities of the clients. This is often combined with an insufficient understanding of integrated project deliveries and information workflows across the stakeholders. In addition to financial issues (price), current selection criteria take into account evidence of environmental policy, the supply chain network of subcontractors as well as the health and safety performance of main contractors. Furthermore, limited environmental information on products leads to look-alike criteria, which aim to consider life cycle orientated issues, but, due to their reduced weighting in the awarding procedure, are not relevant or do not contribute to a life cycle optimization.

Following the idea of holistic optimisation, it is important to target not only single normative aspects, but also an integrated project delivery.

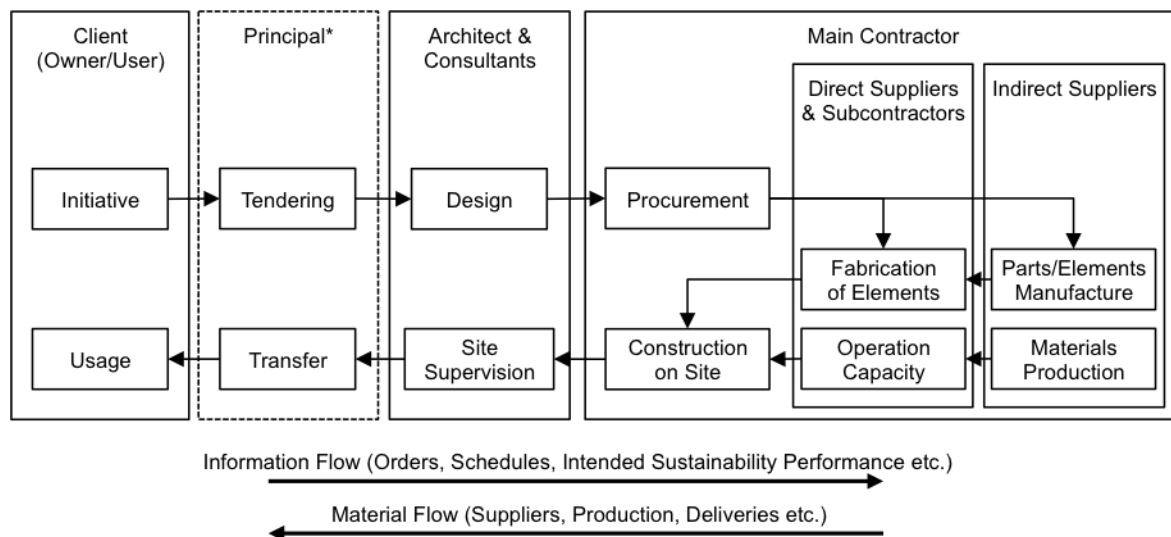
When these findings are viewed in the context of the fragmented relationships between clients, contractors, subcontractors, and the building products and components manufacturing industry, the topic of supply chain management becomes of clear relevance.

#### 4. SUPPLY CHAIN MANAGEMENT

Supply chain management (SCM) is a concept that flourished in manufacturing. It originated from Just-In-Time (JIT) production and logistics, taking into account the interdependency of supply chains (cf. Vrijhoef and Koskela, 1999). Recent developments in the field of SCM include the expansion of traditional performance measures (time, cost, and quality) including environmental and social aspects. In the automotive industry, factors affecting suppliers are identified as cost, technical capability, quality assessment, organisational profile, service levels, supplier profile as well as risk factors. Furthermore, suppliers' sustainability performance is becoming increasingly important as a key issue of tender selection criteria. Sustainable supply chain management (SSCM) has become a major issue in many industries, with the construction sector lagging behind (cf. Adetunji et al., 2008).

Green and sustainable supplier selection adds to the complexity of the decision and modeling process. The criteria are less specific and sometimes not easy to measure as they include aspects such as collaboration and project culture. Therefore, the operationalization of these criteria into meaningful and practical measurable variables presents a challenge to both suppliers and purchasers (cf. Igarashi et al 2013)

The following Figure 1 illustrates a general overview of a supply chain, with its dependencies in building construction (according to Vrijhoef and Koskela, 1999).



\* Relationship depending on the contractual framework.

Figure 22: Generic overview of a building supply chain

A major challenge is to communicate information targeting sustainable performance, not only of certain products and materials, but also of overall achievement. Problems occur due to information asymmetries and losses through the supply process, affecting the interdependencies. This causes delays in earlier stages, resulting from myopic understanding and control of single processes missing out the impact on other related processes. In many cases, the actors are not willing/prompted to consider the effects of their activities.

#### 4.1 Supplier selection methods

When procuring complex services and products, there is a need to evaluate and select qualified suppliers. The supplier selection process is often reduced to purchasing risks and maximizing the overall value of the purchase. The methodology evolved from the manufacturing industry, where selecting the right suppliers is crucial for business and represents a major opportunity for companies to reduce costs across its entire supply chain. However, emphasis changed from selection just based on price and has turned into a multi-criteria approach, with various qualitative and quantitative evaluation criteria.

There are plenty of sources introducing different approaches based on a categorical method, data envelopment and cluster analysis, such as case-based rating system decision modes for supplier selection. They follow a multi-criteria approach divided into multi-criteria decision-making tools, focusing on evaluation criteria, and sensitivity analysis (cf. Pal et al. 2013).

In this context, it is important to point out that the weighting aspect of additional criteria in supplier selection can vary depending on the specific project conditions.

#### 4.2 Classification of project parameters

An increasing awareness of environmental issues due to clients' green procurement policies has led to a focus on a more comprehensive implementation of sustainability aspects, which depends on the type of building and its usage e.g. housing, office and public service buildings (hospitals, schools). Following this diversification, there are different key issues that occur in the context of a specific project and are necessary for providing a certain type of usage. Such parameters can be divided into: project goals, resources of the client, specific importance of the project, project duration, costs and number of involved experts and professionals from different disciplines managing the planning and construction tasks. Such issues are important in the selection of a supplier in terms of adapting requirements in specific project classes.

#### 4.3 Supplier selection criteria

Despite the importance of sustainable supply chain management, there are several gaps in the research on how to implement sustainable issues into the procurement process within the frameworks of several policies (e.g. COM(2008)400) and directives (e.g. Directive 2014/24/EU). Literature reveals various criteria for supplier selection, such as cost, delivery quality, warranties, client policies and especially environmental product properties (cf. Pal et al., 2013).

The focus is often purely on product issues and material properties. Setting up selection criteria, it has to be considered that building products and the overall performance of the building are strongly influenced by the planning and building processes.

A life cycle optimized building can only be achieved using an integrated approach. This includes the consideration of issues related to process qualities, in terms of identifying criteria defining how specific works are carried out and performed, focusing on information flows and the design of reference processes to support the holistic optimization of a construction project.

#### 4.4 Performance-based supplier selection criteria

Focusing on the different stakeholders and their contribution to a successful project, their technical (problem-solving) capability is crucial for providing high quality delivery. Requirements of a more performance-orientated supplier selection target the workforce skills, organisational structures, information flows and exchange within the project team. Factors include employment relationship, staffing schedule, and a proactive and solution-orientated working approach (cf. Wall and Hofstadler, 2016b).

Therefore, environmental management systems (EMS), certifications to ISO 14001 or special in-house policies and guidelines as well as qualification of key project managers can contribute towards a more performance-orientated supplier selection. Considering the composition of teams, the European Court of Justice confirmed in Case C-601/13 Ambisig 03/26/2015 that the academic and professional background of employees and their

experience enables an evaluation of teams, especially for the performance of the contract. Hence, previous performance can help to clarify credibility and references projects, in terms of reliability.

Another crucial aspect seems to be the corporate philosophy of a project team, related to the organizational issues of the contractor in terms of their company culture and how projects are handled. This is also linked to performance and interaction with the previous client, considering how they managed to support the project workflow, keeping to the schedule and contributing towards the common project aim. When measuring such issues, the number of submitted claims could be an issue, as well as the involvement of the cooperation and project development. Performance-based tendering decisions could be conducted using expert interviews with key employees to assess their problem solving capacities as well as their qualification and applicability for project specific requirements. Furthermore, such prequalification information can be obtained from electronic platforms such as ANKÖ or PQ-VOB.

Focusing on the supplier selection process, a committee (experts from different backgrounds, technical as well as representing user and operating perspectives) could provide support from early project stages onwards, defining awarding criteria and providing consistent consideration of these issues and their weighting factors through tendering and awarding stages.

The problem of the supply selection is also based on the fact that not all decisions can be made with measurable parameters that can be indisputably economically justified. This indicates a shift from cooperative to collaborative supplier performance.

A major weakness of SCM is the difficulty of creating a shared and common strategy and vision, achieving and maintaining significant behavioural change among involved stakeholders of the AEC, which in turn leads to a common understanding of project culture. The traditional reliance on price as a major indicator of success as well as fragmented delivery structures and competitive relationships, with the knowledge of the interchangeability of involved suppliers reveals the need for further investigation and research into these relationships and how to implement a continuous information flow towards a collaborative project culture.

Cooperative relationships recognize the potential for both organisations to achieve their aims and maintain a long-term relationship. But they lack the teamwork that is needed between the buying and supplying stakeholders. In collaborative relationships, a holistic view has to be applied for the two organisations to truly realize the benefits of working together to optimize the outcomes for both organizations in terms of developing a high-quality product or service on time and under budget.

## 5. CONCLUSION AND OUTLOOK

This paper emphasized the importance of sustainable public procurement and its contribution to putting the buildings and construction sector on a below 2°C path in the fight against climate change. There are several policies available, but practical implementation seems to lag behind. It is proposed that supply chain management should be used to deal with the complex situation of supplying and purchasing in the building and construction industry, due to the various suppliers and trades involved.

The aim is to use supply chain management to enable more sustainable decision making in tendering and awarding construction works in order to consider additional criteria rather than simply focussing on the cheapest offer when making the awarding decision. Therefore, the focus is not only on the product related aspects of construction works, but also on process-orientated aspects, thus supporting a more performance-based selection of contractors.

In terms of SCM or SSCM, the existing concepts can be defined as tools for identifying problematic economic, social and environmental issues throughout the supply chain and assessing their potential impact and risks and how to handle their occurrence. Therefore, a spectrum of advanced and innovative SSCM tools and methods are suggested, such as strategic alliancing, pre-qualification assessment and third parties certification of sustainable (environmental) product properties, validation of improvements, etc., in order to target an integrated project delivery.

The implementation of sustainability into the SCM is still limited to the willingness and capability of the client to decide to implement such a process. Thus, the responsibility of involved stakeholders and, subsequently, the practical implementation of sustainable aspects should be increased.

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