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Challenging electronic procurement in the AEC sector: A BIM-based integrated perspective

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ABSTRACT

The AEC sector has been lagging behind other sectors in the adoption of e-procurement. Building Information Modeling (BIM) is changing the way companies in the AEC sector are working, providing new processes for collaboration. This paper describes how the BIM combined with the Model-Driven Architecture, Service-Oriented Architecture, and Cloud Computing may challenge e-procurement in the AEC sector. It presents the application of the SOA4BIM Framework in the context of electronic procurement and describes an industrial research case study for validation of the proposed approach in the conception and design phases of building/construction projects.

1. Introduction

Procurement activities are quite intensive and important in the Architecture, Engineering, and Construction (AEC) sector, and occur in the different phases of any building/engineering project. Procurement can be of products or services that are highly structured, standard, or of routine nature. This type of procurement has been the main target of existing electronic platforms, namely the e-procurement systems and particularly e-marketplaces. These systems have proved to provide positive impacts in the supply chain management and the range of benefits is diverse, from simple operational cost benefits to more strategic benefits like improvement of flexibility and responsiveness. However, compared with other industries, the AEC sector is characterized by the procurement of high levels of unstructured goods and services, which makes the use of electronic systems for procurement activities more difficult, particularly when much of the information that is necessary for the contractual arrangements are not well structured and are in a "digital" processing format.

Recent developments in the use of Information and Communication Technologies in the AEC sector, namely the Building Information Modeling (BIM) approach promise to introduce major changes in visualization, coordination and planning processes of the building/engineering projects. However, a review of the literature reveals that no efforts have been directed to the application of BIM for e-procurement. Hence, this paper seeks to provide a new conceptual approach for e-procurement, through the use of the BIM and the convergence of recent technological architectures.

The paper starts by reviewing current knowledge about procurement processes and the developments in the functions and impacts of electronic procurement, in general, and also how the AEC sector in particular is embracing e-procurement. It also addresses current initiatives in public e-procurement and how these are pushing private e-procurement. Following this is a description of the Building Information Modeling approach, its functionality, the interoperability problems, and how conceptually BIM may be applied to e-procurement. The main characteristics of the Model-Driven Architecture, Service-Oriented Architecture, and Cloud Computing are described in order to provide the technical background for the SOA4BIM Framework, which will be the basis for e-procurement. Finally, the paper will describe the SOA4BIM Framework for e-procurement validation in an industrial research project context.

2. Electronic procurement in the AEC sector

2.1. The procurement process

The generic concept of "procurement" supports a delivery-relationship between buyers and sellers. Being a broader scope than "purchasing," procurement involves strategic activities such as sourcing, negotiating with suppliers, and coordination with R&D [1]. Procurement can be divided into two phases: contracting and settlement. The contracting phase consists of sourcing and availability to promise, and the settlement phase consists of transaction and delivery. Sourcing is the search for requirement information of goods/services, and availability to promise is the information flow with a supply chain, that is, the availability of goods and the shipping arrangement. This information flow usually acts as an exchange of information within the functions of quotation and negotiation. Transaction is the payment of goods/

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