Chapter XIII
An Ontology-Based Competence Model for Collaborative Design

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ABSTRACT

Collaborative design in dispersed groups of engineers creates various kinds of challenges to technology, organization and social environment. This paper presents an approach to description and representation of the competences needed for a planned collaborative design project. The most important competence areas are identified starting from the nature of design work, problem solving in design teams, and working in distributed groups. The competence model is built structuring these areas according to three perspectives: general, cultural, and occupational competences. An ontological representation is proposed to implement the described model for collaborative design competence. Using an ontology language for representation of collaborative design competence models makes it possible to identify those individuals who are best suited for the collaboration by ontology matching. Furthermore, a software design team consisting of two persons was interviewed and competence profiles were created using the developed ontological representation. Modeling of the team members has confirmed that the proposed approach can be applied to modeling competences needed for collaborative design in engineering fields.
INTRODUCTION

Collaborative design in dispersed groups of engineers creates various kinds of challenges to technology, organization and social environment. Selected examples are knowledge sharing, coordination support, process adaptation or tool integration (Pawlak, Sandkuhl, Cholewa, & Indrusiak, 2007). Work presented in this paper is located in the area of formation of teams for collaborative design. The challenge addressed is how to describe and represent the competences needed for a planned collaborative design project in a way that those individuals best suited for the collaboration can be identified. The proposed approach is to apply ontology engineering to modeling competences of individuals including different competence areas like cultural, professional or occupational competences.

This paper is an extended and improved version of the paper presented in the International Journal of e-Collaboration (Tarasov & Lundqvist, 2006). The presented approach is based on earlier work in the field of competence modeling, both of enterprise competences (Henoch & Sandkuhl, 2002) and of individual competences (Tarassov, Sandkuhl, & Henoch, 2006). Furthermore, earlier work has addressed formation of networks for collaborative engineering (Blomqvist, Levashova, Øhgren, Sandkuhl, & Smirnov, 2005) or flexible supply chains (Sandkuhl, Smirnov, & Shilov), but with a focus on identifying suitable enterprises for a given task description.

The next section will present selected results from an empirical investigation in the field of information use, which confirms the importance of competence when selecting partners for collaboration activities. Section 3 will introduce the structure of competence models with focus on specific elements for collaborative design. The representation of competence models with ontologies is described in section 4. The results of modeling of a software design team are described in section 5. The conclusion presents a summary and an outlook on future work.

IMPORTANTANCE OF COMPETENCE: FINDINGS FROM AN EMPIRICAL INVESTIGATION

During March–June 2005, an empirical investigation was carried out in Sweden aimed at studying how information is used in Swedish authorities and small- and medium sized enterprises. The main objective of this investigation was to identify the connection between information use and different work related aspects rather than to focus on collaborative design or formation of teams in collaborative design. The aspects considered in the investigation were work processes, resources, and organizational structures, with the purpose of better understanding the information demands that motivate demand-driven information supply. Nevertheless, the investigation resulted in some interesting findings regarding the importance of competence in the creation of informal information exchange channels.

The investigation comprised 27 interviews with individuals from three different organizations, The Swedish Board of Agriculture, Kongsberg Automotive, and Proton Engineering, the last two being suppliers within the automotive industry. It was performed as a series of semi-structured interviews. Because the results were intended to be used in other research projects, these 27 individuals where chosen in such a way that they constitute a sample of all levels of the investigated organizations, i.e. from top-level management via middle management down to production- and administrative personnel.

To understand and analyze information demands, it is important to examine not only activities, roles and available resources but also in what situations and for what reasons individuals chose to retrieve the needed information from other individuals rather than from existing information systems (Lundqvist, 2005). Without taking into account that all work situations also have a social aspect that is not addressed by means of technology alone, information demand and