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Evaluation of CITIS as a collaborative virtual organization for construction project management

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Abstract

The construction industry has suffered from its fragmented structure along the phases of the construction life cycle. The use of information technology (IT) has effectively promoted integration of fragmented information under the scattered construction environment. However, to date, many Internet-based systems for online project collaboration do not sufficiently provide standard formats for transmitting contractual documents and project-related information due to the data compatibility issue. As an alternative, this paper introduces a concept of virtual organization and then examines a CITIS (Contractor Integrated Technical Information Service) system for public construction projects developed in Korea from the viewpoint of a virtual organization concept. The CITIS system suggested here has been applied to local branches of the Korea MOCT (Ministry of Construction and Transportation) and is currently in use. Field evaluation has found that the Korean construction CITIS still lacks collaborative workspace despite its good results on field tests. Finally, the lessons learned from field evaluation are provided to advance the current CITIS toward fully integrated collaborative virtual organization.
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Keywords: CITIS; Virtual organization; Information technology; Fully integrated collaborative system; Electronic collaboration; Online project collaboration solutions

1. Introduction

Construction projects need coordination of many participants that have different concerns for their rewards or benefits. As a result, there is a large amount of check and control which subsequently produces the majority of paper-based documentation recorded for checks between the various participants. This is due primarily to the low levels of coordination and integration between different parties. Keeping subcontractors, contractors, designers, clients, and other parties continuously supplied with enormous amounts of information has been a challenging problem to the construction industry. To overcome this limitation, information technology (IT) has effectively promoted the integration of fragmented information in the scattered construction environment. Many Project Management Information Systems (PMIS) provide project collaboration solutions spanning all phases of the construction life cycle, which enable participants to manage, distribute, and share project-related documents and drawings – housing all information in one secure location. However, to date, they do not sufficiently provide standard formats for documents and information for a project [1], especially for transactions between public owners and contractors where more open, transparent, and equal accessibility to all qualified bidders is required and formality and security of the data transaction is more important than those of private projects. Also, it remains difficult to find a fully integrated construction system, which would be able to transfer information from one application to another, allowing the users to do true electronic collaboration.

The concept of virtual organization (VO) was introduced to enable distributed suppliers, partners and collaborators to share their works and communicate electronically by pulling

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information from a central database whenever they need it, launching shared software application from any location and responding electronically to any request [2]. Various applications using a VO concept have been developed in the manufacturing industry. This paper provides a concept of virtual organization applicable to the construction industry that enables all participants linked by an electronic network to collaborate, regardless of their location and type of local computer systems. The authors then examine the construction CITIS (Contractor Integrated Technical Information Service) system for public construction projects developed in Korea from the viewpoint of this VO concept. Originally, CITIS was developed as a global strategy in other industries to move from manual, paper-intensive system operations to an integrated, highly automated acquisition and support process so as to establish an environment where data can be created once and then used repetitively for different purposes [3]. The authors evaluated the current construction CITIS in view of how well it addresses the basic characteristics and functions of VO as a collaborative tool. Finally, lessons learned from the field evaluation are provided to advance the current construction CITIS toward a fully integrated collaborative virtual organization system.

2. Virtual organization and CITIS

2.1. Reviews of virtual organizations

Today's challenging business environment leads to increasing demand for more flexibility and faster reactivity within enterprises. Toward this end, utilization of resources must be optimized so that the geographic and temporary production demands of the market are satisfied. In conflict with this demand, enterprises usually have many functional groups which makes it difficult to transfer and share information within these groups and to make prompt decisions based on the appropriate data. However, it can be inefficient for these different functional groups to have to work at the same place and at the same time in order to communicate and collaborate. To overcome these barriers, the manufacturing industry proposed the virtual workspace concept, such as the virtual corporation, virtual factory, virtual enterprise, etc. The VO concept started from the concept of the virtual corporation in 1993 [4]. Also, Upton and McAfee [5] defined VO as; "a community of dozens, if not hundred, of factories, each focused on what it does best, all linked by an electronic network that would enable them to operate as one flexible and inexpensively operated organization – regardless of their locations". This definition requires the VO to include an integrated database system storing all data produced in the whole life cycle of a product and a fixed standard for the digitalization of information in order to exchange and share this information over a network.

Today there are several definitions of virtual organizations depending on its goals and the scope of resources combined in a virtual network. Within the area of these domains, specific research regarding virtual organization, virtual corporation, virtual company, virtual enterprise and virtual factory can be identified [6]. Despite the differences among them, all of these concepts concentrate on joint collaboration through a network, which makes it easy for companies with different systems to exchange information electronically. This paper adopts a concept of VO that includes this concentration on joint collaboration in order for information from many different organizations to be coordinated and brought together based on a

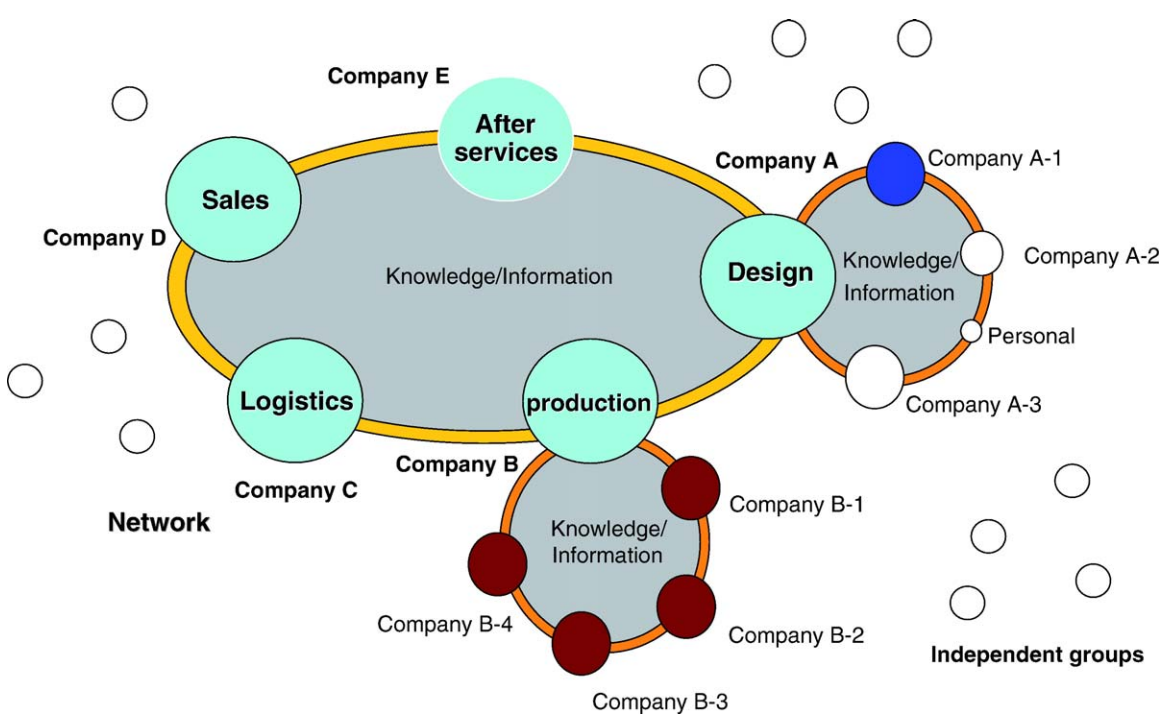

Fig. 1. The Organizational concept of VO in manufacturing industry. (Sources: revised from GNOSIS in Esprit Project [6]).

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