Data Integration Capability Evaluation of ERP Systems: A Construction Industry Perspective

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ABSTRACT

ERP implementations within large scale construction organizations have yielded more failures than successes. As a result of this high failure rate, the integration capability of ERP systems could not be fully understood and recognized by the construction (AEC) industry. The aim of the research presented in this paper was to investigate the role of ERP systems in enabling and facilitating Data Level Integration in construction industry organizations. In parallel with this aim, an ERP Data Level Integration Capability Matrix was developed as the metric for measuring the capability of ERP systems in enabling Data Level Integration. The matrix is validated with four case studies. The development of the matrix and the results of the case studies are presented in this article.

Keywords: Construction Organizations, Data Level Integration Capability Matrix, Enterprise Resource Planning (ERP), ERP Implementations, Material Requirements Planning (MRP)

1. INTRODUCTION

In many ways, the construction industry in the 21st Century has changed very little over the last 100 years. The contracts or rules by which the industry engages have their roots firmly in Victorian processes. The traditional nature of the industry involves bringing together multi-disciplines/practitioners to deliver, in many instances, complex one-off products requiring a tremendous amount of coordination. The nature of the construction industry is very much fragmented where each discipline in the industry has evolved independently with their own unique terminology, technology and way of expressing and communicating information. In addition, high levels of competition and low levels/barriers to market entry exist in the

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industry. Over the last 30 years the evolution of ICT has led to construction organizations increasingly adopting technology in support of their complex business processes. The existence of many stakeholders with diverse backgrounds and different ICT skills together with the ad-hoc adoption of technology has caused many problems with regard to information sharing and exchange during all stages of a construction project. In response to addressing these problems, construction R&D in this field have mainly focused on enabling interoperability of applications facilitated through agreed schema standards in sharing and exchange of information throughout the life cycle of the facility. This integration approach is currently referred to as Building Information Modeling Underwood and Isikdag (2010) and facilitates the data and application level interoperability in many phases of a construction project. While research related to enabling and facilitating interoperability from a construction project perspective (project-focused interoperability) is well developed until now, research related to enabling enterprise-level information integration/interoperability (i.e. within construction organizations) is still in its infancy. In contrast to project-focused interoperability, enabling the integrated use of information within a construction enterprise needs to deal with a diverse range of issues such as, information centrality, data, application and service level integration strategies, and building up a successful enterprise integration architecture within a construction organization.

In recent years, along with the problems in information sharing and exchange, the need to gain competitive advantage in the global competition has forced organizations to work using software platforms, where operations can be executed fast and business information can be recorded and accessed efficiently. As a result of the requirements for information integration and operational efficiency, Enterprise Resource Planning (ERP) systems have emerged to achieve the capability to plan and integrate enterprise-wide resources (Yang et al., 2007). Having been influenced by the successes of the production industries, construction industry organizations have also conducted utilization trials of ERP systems to tackle enterprise-wide integration and interoperability problems. However, many of these trials have caused ERP systems to just remain automating and integrating the back office corporate functions such as financial management, human resources management, etc. and therefore ERP implementations have to date yielded more failures than successes in construction firms, which in main have been caused by the disparity and inconsistency between the process related assumptions in the standard ERP applications and complex business processes of the construction industry (Voordijk et al., 2003; Yang et al., 2007). In addition, the literature has reported that some companies in the construction industry which introduced ERP were unsuccessful or even became bankrupt eventually. These big failures occurred as a result of the level of application of IT within construction companies being comparatively low. Therefore considerable attention needs to be paid and caution in advocating ERP systems (Yang et al., 2007) in the construction industry. As a result of this failure rate and risk in the implementation of ERP systems in the industry, Integration Capability of ERP systems for construction have not been able to be fully exploited. In this context, this paper presents the results of a research study to explore the role of ERP systems in enabling and facilitating Data Level Integration within construction industry organizations. Methodology of the study is presented in the latter section.

2. ERP SYSTEMS AND THE CONSTRUCTION INDUSTRY

The key idea behind the use of ERP Systems is to plan, manage and integrate the resources of the organization. ERP systems originated from MRP (Material Requirements Planning) systems which have been mainly used in the manufacturing sector. The literature in the area (Davenport, 1998; Bingi et al., 1999; Klaus et al., 2000; Markus & Tanis, 2000; Grant, 2000;
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