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Building and evaluating ESET: A tool for assessing the support given by an enterprise system to supply chain management

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ABSTRACT

Modern organisations must effectively manage their supply chains, to exist and grow. Supply chains draw information extensively from enterprise systems (ESs) of participating businesses. Despite that supply chains frequently depend on information from ES to succeed, not much research on measuring the effectiveness of information transfers between these systems has been published. This paper describes the building and evaluation of a flexible decision support tool that evaluates the impact an ES has on supply chain management (SCM), thereby filling a gap in the SCM assessment portfolio of tools. The main purpose of the Enterprise System Evaluating Tool (ESET), is to measure the support given by ES to SCM and identify process points at which such support fails. Thus ESET empowers organisations with knowledge to improve their supply chain performance by modifying and/or enhancing the ES. A case study based approach was used to evaluate ESET to ascertain its utility by applying it in two Fortune 100 organisations within one industry. In future research, ESET will be applied across many industries, to quantitatively evaluate ESET and refine it further. Analytics on data gathered from these organisations may then enlighten researchers and practitioners on the current state of support given by ES to SCM.

1. Introduction

After many years of improving the effectiveness of internal operations, organisations are now focusing on improving processes across supply chains [2,78]. The number of organisations consciously participating in supply chains has grown dramatically in the last decade [27,83]. Successful supply chain management (SCM) often depends on the extent of support provided by organisation-wide information systems (ISs) such as enterprise systems (ESs) [2,12,22,57,59,71,81,91]. Recognising this ES–SCM interdependence, vendors strive to develop ES to better support SCM processes [2,12,22,37,83]. Delone and Mclean state that it is critical to measure IS performance in order to better understand the value and efficacy of management actions and IS investments. The practical problem that motivated this study is that, despite significant investments being made in ES and in SCM, knowledge of how well an ES supports SCM is sparse [81,91]. Support given by ES to SCM is not often measured and therefore not optimised [2,11,29,70,91]. We could not find any suitable non-intrusive, customisable and easy to use tool available that enabled comprehensive measurement of such support, whilst providing diagnostics to inform which process points in an ES must be strengthened.

ES are organisation-wide IS that are integrated across organisational functions [1,2,20]. These systems have evolved from isolated transaction processing systems, to systems that automate routine processes, share information across business functions, and generate business analytics [1,2,20]. An ES impacts performance at process, organisation and supply chain levels, benefitting the focal organisation and supply chain partners. Organisations are increasingly aware that ES are critical to achieve cost reductions and efficiencies that lead to competitive advantage [29,36,53,58,69]. They have become vastly complex systems that support many groups of people who work together with vast amounts of resources, under pressures of time, facing many challenges and across organisations. Not surprisingly, many ES implementations turn out to be less successful than originally intended [1,20,55]. However, most ESs are also considered to be cost-effective enablers of B2B (business to business), B2C (business to consumer) and B2E (business to employee) information transfers [7,9,54]. In this paper we refer to all types of enterprise-wide information systems, as ES.

A supply chain (SC) is typically defined as a group of organisations linked by flows of products, services, finances, and information from a supplier's supplier (upstream) to a customer's customer (downstream) [19,32,50]. SCM is the management of these flows from upstream production through to downstream distribution of products and/or services to reach customers, ideally just in time, to satisfy their needs [3,12,29,31,32,86]. Many types of supply chains exist [18]. The tool we developed can be applied in all types of supply chains. It focuses on measuring the

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effectiveness of information sharing between an organisation's internal and SCM processes. Many researchers consider that effective collaboration and efficient transfer of information to be critical between supply chain partners [12,22,53,91]. Indeed, this research is related to research streams such as Collaborative Planning Forecasting and Replenishment systems (CPFRS) that focus on networking organisations through their ES [35]. Although in some environments ESs of supply chain partners allow collaboration, in other situations communication between organisations happens mainly through specialised automated or semi-automated software, known as supply chain management systems (SCMSs) [3,12,22]. Currently most vendors attempt to align ES with SCM processes, particularly to reduce inventory and working capital, and to forge closer relationships with customers and suppliers [10,22]. In this paper, we refer to any collaborative software components dedicated to SCM as SCMS. SCMS can either be integrated or synchronised with existing ES [15].

1.1. Organisation of the paper

Firstly the need for organisations to evaluate the support that an ES provides their SCM is established. As we could not find any decision support system (DSS) that does this, we identified requirements for such a DSS. We next investigated techniques and models used to evaluate IS, ES and information sharing in SCM, and studied how the performance of ES support given to SCM can be improved. We discuss the design, building and evaluation of this DSS which we named, the Enterprise System Evaluating Tool (ESET). Multi-methodological [60] and design science research approaches [33] were used in this research. The lessons learnt developing a tool using an explorative IS research artefact development methodology is the contribution of the current study. Qualitative methodologies are proven as a valid methodology to evaluate IS [40,85]. We conclude this paper describing contributions made to DSS by building ESET, stating implications of this study for researchers and practitioners of ES and SCM, and explaining our goals for future research, which will include a quantitative evaluation of ESET [40,47].

2. Is effective information transfer needed from ES for efficient SCM?

The motivation of this research is the practical problem identified in our on-field observations and literature reviewed, which indicate that the support an ES provides SCM is critical to enable each supply chain partner not only to perform adequately but strive to be optimised for competitive advantage of the whole value chain [2,12,22,57,59,71,81,84,91]. Relatively little research has been conducted on the ES–SCM interdependence [2,12,91], although the performance of SCM is well researched [4,8,11,15,24,30,34,43,82,83] as is the performance of ES [1,2,5,22,25,46,57,59,64,71]. To better understand the process of information transfer between ES and SCM, we first describe the structure of an ES using Møller's conceptual framework [54], discuss a few different types of relationships observed between ES and SCM/SCMS and then investigate the need for ES to support SCM.

Møller elucidates that the conceptual framework of an ES (referred to as Enterprise Resource Planning — ERP systems) has four layers [54]. The foundation layer comprises a central data repository that allows information flows to and from various organisational functions [22]. The process layer provides integrated information with personalised visualisations to stakeholders [22,54]. The business analytics layer provides business intelligence to each stakeholder and facilitates decision support by aligning with SCMS and other software. As the need for organisations to share information by allowing integration and synchronisation of ES and SCM processes have become critical, later versions of ES have advanced capabilities to enable external information flows [7,54]. Hence, in many current ESs a portal layer is equipped with strong inter-organisational information transferring capabilities [10,22]. This outline allows us to visualise not only the basic structure of an organisation-wide IS designed to facilitate collaboration with external organisations but also the evolution of an ES with layer by layer additions over time.

The relationship between ES and SCM/SCMS varies from one supply chain micro-environment to another [12,19,22,53,91]. Initially organisations depended on organisation-wide information systems (such as MRP, MRPII, ERP) to generate and share information needed to manage supply chains. However with time, organisations have realised that collaborating with supply chain partners requires different configurations of information infrastructures. Therefore modern information systems catering to both organisational and SCM needs have ended with numerous configurations [22,52,53]. In some, ES and SCMS are highly "*integrated*", meaning systems are combined as an integral whole. This is seen in modern vendor offerings of ES, where an SCMS component is embedded as a separate module [18,22,53]. In other configurations, ES processes are totally separate from SCMS and SCM processes. In such situations systems are said to be "*synchronised*", allowing two or more systems to operate separately but share information to varying degrees harmoniously [53]. Therefore the relationships that exist between ES and SCM/SCMS to facilitate collaborative activities through business-to-business (B2B) communications are varied, needing complex information sharing solutions.

Whatever format an ES–SCM configuration takes within an organisation, these systems must effectively transfer and share needed information for the focal organisation and its participating supply chains to succeed [2,12,91]. Notwithstanding the diversity of these systems, it can be reasoned therefore that each supply chain partner will benefit by being able to measure the effectiveness of its ES in supporting SCM especially when a supply chain is first established or when the 'information-flow equilibrium' of a supply chain is disturbed. We consider a supply chain to be in information-flow equilibrium, if the information needed throughout the supply chain is obtained to a high degree of satisfaction of its partners, although the efficiency and effectiveness of this process may not be optimised. The information-flow equilibrium of a supply chain is absent or in a state of turbulence at many points of an organisation's life cycle: when a supply chain is first established or at the start of an organisation itself, when the strategic business focus of SCM changes within one or more organisations in the chain, when the membership of the supply chain changes, when new products or services are introduced along the supply chain, when upgrades or changes occur to a partner's ES (or other communicating information system), or when the activity level of the supply chain alters significantly due to natural or man-made reasons. Furthermore, when organisations merge, ES support for SCM should be strengthened to avoid a weak-link in the supply chain [18,28,32,78]. The above mentioned is not a comprehensive list of such situations. It is important to measure the impact of an ES on SCM before implementing an ES, during maintenance, and when an ES needs to tune-in with changing business or system environments. A tool used for this purpose therefore should not be intrusive and should be easy to use.

2.1. The quality of support given by an ES to SCM should be a criterion for software selection

The purchase of a suitable ES is vital not only for the success of an organisation but also for its SCM as it would impact on the whole supply chain [2,21,22,34,37,81,91]. Benefits of an ES that supports SCM well include, real-time collaborations; effective sharing of vast amounts of SCM relevant information that empower managers to implement timely, pre-emptive, and competitive business initiatives [81]; better facilitation of SCM processes such as scheduling, inventory control and transportation modal planning to increase distribution productivity [34]; and reduced cycle time, fast transactions and effective collaboration for internal and external business management [22,57,70,91]. Conversely, poorly selected, implemented, or used, ES can cause bottlenecks within supply chains [34,81,91]. To avoid such bottlenecks a systematic