Major Techniques and Current Developments of Supply Chain Process Modelling

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INTRODUCTION

While there are many definitions of supply chains, a supply chain can be defined as a set of inter-linked business processes that add value from the perspective of end customers in terms of products and/or services (Christopher, 2011). Value to the customer includes good quality, a fair price and fast and accurate (i.e., correct items in full quantity on time) delivery (Russell & Taylor, 2014). This means that a supply chain can be regarded as an overarching business process which covers a full range of activities from raw material supply, manufacturing of components and finished products, to distribution of the finished products to end customers (Russell & Taylor, 2014). In other words, a supply chain is an extended process covering all activities from the point of origin to the point of consumption. Supply chain process modelling (SCPM) is essential for understanding, design or reengineering of a supply chain (Bolstorff & Rosenbaum, 2012). Meanwhile, SCPM presents many challenges due to a large number of companies involved in the supply chain and the complexity in communication and interactions between them (Brown, Recker & West, 2011).

In this chapter, we first offer some background information on supply chain processes and SCPM. Then this is followed by critical discussion of the frequently used standards/techniques for SCPM. Finally, the chapter is concluded with discussion of future trends and research directions.

BACKGROUND

Supply chain management (SCM) has received increasing attention in the literature since the early 80's (Ellram & Cooper, 2014). While there are many definitions of SCM, it can be defined as the integration of key business processes covering a wide range of activities from the original supplier to the end customer that add value to stakeholders in terms of products, services and information (Cooper, Lambert, & Pagh, 1997; Mentzer et al., 2001). Many researchers support this process view of the supply chain and argue that it helps to reduce supply chain costs and enhance customer satisfaction (Trkman, Stemberger, Jaklic, & Groznik, 2007).

There are a number of models or frameworks for a holistic understanding of supply chain processes (Ellram & Cooper, 2014). The supply chain operations reference (SCOR) model developed by the Supply Chain Council (SCC) identifies six core processes in a supply chain: plan, source, make, deliver, return and enable (SCC, 2012). Meanwhile, the Global Supply Chain Forum (GSCF) pinpoints eight key business processes in a supply chain that work at both the strategic and operational levels for the improvement of internal and external results (Croxton, Garcia-Dastugue, Lambert, & Rogers, 2001). Recently, Xu, Koh, and Parker (2009) propose a research framework that consists of seven business processes for manufacturing coordination in a complex supply network.

Though these supply chain models or frameworks have different purposes and scopes, the business processes proposed in these models or frameworks need to be analysed and implemented in practice through modelling.

Clearly, SCPM is closely related to business process modelling (BPM) as a supply chain process can be viewed an extended business process. BPM is often used as a platform for achieving a common understanding of a business process (Aguilar-Saven, 2004). It has been broadly recognised that good process models are essential for business process re-engineering (BPR) (or improvement) or for information system development. Generally, BPM can be regarded as a methodology which employs software systems to analyse, design and improve business processes so that a company's business performance in terms of productivity and profits can be improved (Bae & Seo, 2007; Trkman et al., 2007).

In the body of literature on BPM, it is a common view that depending on the purpose of modelling, one should choose an appropriate technique for a particular modelling task (Aguilar-Saven, 2004). This is because there are many tools and techniques currently available in the market from basic tools (e.g. flowcharting) to more complex techniques (e.g., Petri Nets) (Recker, Rosemann, Indulska, & Green, 2009). Generally, the techniques commonly used for BPM can be categorised into two classes: (1) descriptive (or pragmatic) approaches (e.g., the SCOR model), and (2) formal (or rigorous) approaches (e.g., simulation) (Aguilar-Saven, 2004; Ryan & Heavey, 2006). As a supply chain usually consists of a number of business processes, many techniques for BPM can be used for SCPM.

Though BPM can be regarded as the predecessor of SCPM, it poses more challenges than traditional BPM. This is because a supply chain is often a boundary-spanning process that includes at least a company's immediate suppliers and customers. Therefore, it is important to have a holistic view of the overall supply chain process, including inbound logistics, internal operations and outbound logistics (Min & Zhou, 2002). The SCOR model is best known for modelling an overall supply chain in a structured and hierarchical way (Kasi, 2005).

MAIN FOCUS

Currently there are a wide variety of standards and techniques for SCPM. Leading standards such as SCOR and unified modelling language (UML) have been well recognized and adopted by researchers, practitioners and system developers for BPM and/or SCPM. In this chapter, we focus on those techniques that have been most frequently adopted for SCPM. Specifically, we will focus on four descriptive approaches (i.e. SCOR, IDEF, UML and BPMN) and two formal approaches (i.e. Petri Nets and simulation) for SCPM.

Descriptive Approaches

Supply Chain Operations Reference Model (SCOR)

SCC released the SCOR 1.0 model in 1996 that can be used to describe supply chain operational processes for the purposes of (re)-design, (re)-engineering or improvement. The SCOR model is broadly recognised as the first cross-industry framework that can be used to measure, evaluate and improve supply chain performance. As a reference model, SCOR provides a standardized terminology and a glossary of indicators chain members can use to achieve a common understanding of supply chain processes and to evaluate their performance (Persson, 2011). By comparing the current versus the future state of a process, SCOR empowers BPR. It also allows a company to benchmark their processes against best performers' processes in the industry and to apply best practices for specific business processes. In summary, the SCOR model is built on the three important mechanisms for improving business performance: reengineering, benchmarking and best practices (Lambert, Garcia-Dastugue, & Croxton, 2005).

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