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Survey

Electronic supply chains: Status & perspective

Atiq W. Siddiqui *, Syed Arshad Raza

College of Business Administration, University of Dammam, Dammam, Saudi Arabia

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ABSTRACT

The area of e-commerce based supply chains (or *e-supply chains*) has received significant attention in the last two decades. Despite the high level of activity, the most recent reviews on this topic date back to the beginning of this century. In this paper, we analyzed the state of e-supply chain research published during January 2000–January 2015 AD, covering 165 articles from 47 ISI indexed journals. The analysis is performed using a five-dimensional framework comprising *Topic-of-Study*, *Unit-of-Analysis*, *Research Perspective*, *Industry Type*, and *Research Method*. Within these dimensions, *Topic-of-Study* plays a pivotal role, whereas the other four dimensions are analyzed around its sub-classification scheme. Our main objective is to establish a broader interdisciplinary understanding of the e-supply chain research domain, and to identify trends and gaps in contemporary e-supply chain theory and practice. The findings indicate that problems are addressed from different perspectives with varying levels of interest from researchers belonging to several academic disciplines including business, economics, engineering and social sciences. Our analysis also identified two distinct periods (2000–2006 and 2007 onwards) with different foci of research attention. The problems that received significant attention in the earlier period include innovation, adoption and barriers, and supply chain integration; while in the latter period, the focus seemed to have shifted towards supply chain integration and collaboration issues. Problems that received minimum interest across the two periods include customer relationship, economic and environmental impact.

1. Introduction

A supply chain is considered to be an integrated network of organizations and/or individuals delivering products or services to its customers. This typically involves several material, cash and information flows, the efficiencies of which drive the overall quality of service to end customers and the associated costs (Stevens, 1989). The last couple of decades have witnessed an increasingly tighter integration within supply chains through better synchronization of its activities, business realignments and improved operational flexibilities (Cattaneo, Gereffi, & Staritz, 2010). These efforts are supported by new power and leadership structures; emerging communication and information technologies; strategic distribution of resources; and increasing market uncertainty and competition (Fawcett, Magnan, & Williams, 2004; Gunasekaran, Lai, & Cheng, 2008; Moberg, Speh, & Freese, 2003; Williamson, 1989). Furthermore, events such as the emergence of ERP systems in 1990s, the technological (such as Y2K) concerns at the turn of the century, the dot-com-bust in 2002, the globalization of manufacturing in mid 2000s and the financial crisis in 2008 accelerated this change (Ivashinaa & Scharfstein, 2010; Robinson, 2015; Welch, 2008).

E-commerce, which provides an online forum for the exchange of value (Urbaczewski, Jessup, & Wheeler, 2002), has also reinforced these efforts by helping supply chains diminish their transaction costs and poor information sharing amongst partners (Johnson & Whang, 2002). In fact, it has not only supported the synchronization and integration efforts, it has fundamentally changed the way supply chains are designed, operated and maintained (Johnson & Whang, 2002). With e-commerce, new supply chain models have emerged that are either fully internet or e-commerce based (such as that of Amazon.com), or dual-channel in nature (i.e. having traditional together with internet supply/sales channels, such as that of Dell and Walmart). Despite successes, a number of failed initiatives especially in purely e-commerce based supply chains are also a reality (Welch, 2008). These failures perhaps were a result of several misconstrued diverse complexities that exist at the interface of the two fields (i.e. supply chain and e-commerce). More explicitly, electronic or e-supply chain approaches normally involve diverse, complex and interconnected issues such as new and untested business models; the corresponding e-supply chain design and the

* Corresponding author at: PO Box 1982, Dammam 31451, Saudi Arabia. Tel.: +966 13 333 2100.
E-mail addresses: awsiddiqui@uod.edu.sa (A.W. Siddiqui), saraza@uod.edu.sa (S.A. Raza).

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associated performance measurement problems; innovation adoption and other behavioral challenges; its economic and environmental impacts; along with infrastructure development and deployment tasks. It is easy to see that these interrelated issues pose challenges at different levels of scope (i.e. individual, firm or supply chain) while their nature also depends on the specific industry and the other existing organizational and social contexts.

It is worth noting that these two fields i.e. the supply chain and e-commerce are well researched areas on their own. Several literature reviews are also available covering the progress of these two fields from different perspectives. For example, Ngai and Wat (2002) analyzed research trends in early e-commerce and highlighted the diverse nature of problems faced besides identifying issues lacking attention and called for the development of technical standards for e-commerce. Kauffman and Walden (2001) reviewed studies focusing on the economic impact of internet on businesses, while Udo (2001) highlighted privacy and security concerns; and Ngai and Gunasekaran (2007) and Kourouthanassis and Giaglis (2012) discussed recent developments in mobile or m-commerce. Similarly in the supply chain area, notable studies include Kouvelis, Chambers, and Wang (2006), who presented an analysis of papers (from a single journal) mainly aiming at supply chain design, uncertainties, contracts, coordination, capacity and sourcing issues. Giunipero, Hooker, Joseph-Matthews, Yoon, and Brudvig (2008) published a similar review, though covering a broader set of journals. In contrast, Sarac, Absi, and Dauzere-Peres (2010) examined studies related to RFID technologies in supply chain management (SCM), while Tang and Nurmaya Musa (2011) covered the literature on supply chain risk management. Specific to e-supply chains, two early reviews (covering up to 2002AD) are by Johnson and Whang (2002) and Gunasekaran and Ngai (2004) who both reviewed the role of e-business and information systems within SCM – mainly focusing on e-procurement, e-collaboration and applications of Information Technology in supply chains.

It is easy to see that both e-commerce and supply chain areas have received significant attention. Despite such high activity, no recent literature review is available that provides an overarching view of the post 2000AD evolution and developments taking place in the e-supply chain area. More importantly, as e-supply chains have increasingly attracted attention from researchers from diverse backgrounds (such as business, economics, engineering and social sciences (details in Section 3)), there is a need to establish a broad interdisciplinary understanding of the overall research arena. Aiming to address these issues, we first constructed a framework – a classification scheme, which augments the frameworks presented in earlier e-commerce and supply chain survey studies (details in Section 2.1), and then analyzed the literature using this framework. This framework comprises five broad dimensions i.e. general problems being addressed (topics of study), the scope at which studies are conducted (units of analysis), their industry or application focus, their Research Perspectives and the Research Methods employed (details in Section 2.1). In this framework the first dimension plays a pivotal role as all classifications within the rest of the four dimensions are sub-categorized according to the general problem areas – this allows identifying studies specific to a problem area over any particular Research Perspective, or Research Method, or industry context. Based on this framework we then analyzed the literature where we not only discussed individual contributions, but identified overall active research areas as well as the prevailing gaps, and presented potential future research directions. Furthermore, we were also able to comment on early vs. recent research focus by dividing and comparing the literature into two periods (details in Section 3), which is across all the five dimensions.

It is worth mentioning that due to the broad nature of the field we expected a significantly large pool of literature. This fact along with our focus on high quality research limited our attention to peer reviewed journal articles only. These articles mainly belong to the 47 ISI indexed journals (details in Section 3). As expected, our results indicate a varying level of attention from multiple disciplines on different problems. For example, e-supply chain design and modeling issues received the most attention with the largest contribution from operations research and operations management; and the industrial engineering journals (11 and 7 respectively out of 47 journals). Other problems that received significant attention include innovation, adoption and barriers; and supply chain integration and collaboration issues, while issues such as customer relationship, out-sourcing, economic and environmental impacts and security and risk in purely e-supply chain context received minimal attention. These studies were mainly done at firm or supply chain levels with a very few considering issues pertaining to consumers, country or society. In terms of industry context, the studies mainly considered manufacturing or retail/wholesale, while very few considered other industries such as hospitality and tourism; healthcare; and textile.

The rest of the paper is organized as follows. Section 2 presents research methodology, followed by a detailed demographical analysis in Section 3. The literature analysis is presented in Section 4, which is divided according to the dimensions discussed above. Finally, in Section 5 we discuss the overall trends and gaps along with future directions and conclusions.

2. Methodology

In this section, we first discuss the articles collection method and then outline the framework employed to classify and analyze the collected papers. As discussed in Section 1, we remained focused on studies published in the peer reviewed ISI indexed journals only. While this selection criterion is mainly to address the problem of a very large set of literature found at the interface of the two highly active fields, we note that ISI's journal selection process aims at including and maintaining only those journals that capture the bulk of the significant (in-terms of citation frequency) contributions, while ensuring other aspects such as basic publishing standards, editorial content and diversity of authorship (Testa, 2003). We thus expect our review to be able to capture most of the significant literature in the e-supply chain area. Furthermore, we also observed that ISI based reviews are not uncommon and can be found in related fields such as business process modeling (de Oca, Snoeck, Reijers, & Rodríguez-Morffi, 2015), transportation (Ginieis, Sánchez-Rebull, & Campa-Planas, 2012), tourism and hospitality (Chang & McAleer, 2012), and business models (Ferreira, Santos, de Almeida, & Reis, 2014).

Within this scope we performed a literature search using eight premier full-text academic databases – ScienceDirect® (SD), Wiley® Online Library (WOL), EBSCO® Academic Search Complete (EA), IEEE-Xplore® Digital Library (IEEE), ACM® Digital Library (ACM), Informs Journals and Web of Science® (WOS). Note that some of these have overlaps in terms of journal coverage, whereas WOS is considered to be the premier scientific citation indexing service covering several databases including the ones above. The choice of these databases was mainly driven from their availability to the authors as well as their expected relevance to the research theme. These databases provide extensive coverage with SD offering full-text access to more than 3500 journals, WOL to nearly 1500 journals, and EA to around 4700 journals, ACM to over 44 journals related mainly to computing and information technology areas, and Informs to 14 journals mainly in operations research, management science and information systems areas. The search