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Data-driven supply chain capabilities and performance: A resource-based view

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ABSTRACT

Despite the importance and relevance of data-driven supply chains, there has been very limited empirical research that investigates how big data-driven supply chains affect supply chain capabilities. Drawing on the resource-based view, this study explores the effect of data-driven supply chain capabilities on financial performance. The data for this study were gathered from China's manufacturing industry and analysed using structural equation modelling. The results indicate that a data-driven supply chain has a significant positive effect on the four dimensions of supply chain capabilities. Coordination and supply chain responsiveness are positively and significantly related to financial performance.

1. Introduction

Nowadays, firms invest heavily in information technology, e.g., enterprise resource planning, radio frequency identification, etc., to track merchandise and operations, automate transactions, and optimize inventory levels and other supply chain decisions (Chae et al., 2014; Fosso Wamba, 2012; O'dwyer and Renner, 2011; Yu, 2015). These technologies generate large amounts of data flowing in real time into every area of the global economy (The Economist, 2010). The scale of the data creation is substantial with approximately 2.5 exabytes of data generated every day in 2012, and that volume is doubling every three years (Libert, 2013; McAfee and Brynjolfsson, 2012). This data includes a burgeoning volume of transactional data associated with trading partners (Manyika et al., 2011). Properly harnessed, the scope and scale of this data have the potential to revolutionize supply chain performance, possibly through supply chain capabilities (Fosso Wamba et al., 2015; Waller and Fawcett, 2013). Supply chain managers leveraging the data coming into the system can derive useful insights toward improvements to supply chain capabilities and competitiveness (Davenport, 2006). In fact, supply chain managers are increasingly viewing such data as a critical source of value creation and competitive advantage (Tan et al., 2015) since it is the data that enables them to gain visibility into expenditures, identify trends in costs and performance, support process and planning control, capacity and inventory monitoring, and production optimization (Davenport, 2006; Hazen et al., 2014; Tan et al., 2015). While some leading manufacturing firms (such as Dell, Apple, Sony, Samsung, Volvo, and BMW) are actively employing big data to improve supply chain processes and open up new business opportunities, many firms are still in the early stage of adoption because of a lack of understanding of big data and how to manage it (Kwon et al., 2014; Manyika

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et al., 2011; Sanders, 2014). Recently, practitioner articles and consultancy white papers have reported the potential benefits from big data to generate tremendous opportunities for competitive advantage in firms (e.g., Libert, 2013; Manyika et al., 2011). Despite the importance and relevance of data-driven supply chains (DDSC), there is a dearth of research addressing the effect of DDSC on supply chain capabilities and performance (Schoenherr and Speier-Pero, 2015; Waller and Fawcett, 2013), thus calling for its theoretical development (Chae et al., 2014).

Grounded in the resource based view (RBV), the research herein investigates the relationship between DDSC and supply chain capabilities (SCC), that in turn influence financial performance; SCC referring to "the ability of an organisation to identify, utilize, and assimilate both internal and external resources to facilitate the entire supply chain activities" (Wu et al., 2006, p. 494). The RBV attributes superior business performance to the effective use of resources and organisational capabilities (Barney, 1991; Wernerfelt, 1984); capabilities being broadly defined as "complex bundles of skills and accumulated knowledge that enable firms to coordinate activities and make use of their assets" (Day, 1990, p. 38). Supply chain researchers have recognized organisational capabilities as an important source of an organisation's operational strengths and competitive performance (Huo, 2012; Peng et al., 2008; Yu et al., 2014). Supply chain management has emerged as a vital competency that depends on companies developing specific capabilities such as the ability to build strategic relationships with customers and suppliers, information sharing among supply chain partners, and flexible and quick responses to market demands (Huo, 2012; Wu et al., 2006). From an RBV perspective, this implies that DDSC are an important intangible firm resource (Hazen et al., 2014; Waller and Fawcett, 2013). DDSC and SCC are each thought to be part of an emerging competence that will transform the way in which supply chains are managed and designed (Hazen et al., 2014; Schoenherr and Speier-Pero, 2015; Waller and Fawcett, 2013).

Consistent with the RBV, effectively leveraging a resource such as big data can lead to significant profit (Libert, 2013; Manyika et al., 2011; McAfee and Brynjolfsson, 2012). It has been suggested that big data applied to supply chains will continue to reduce business costs and create competitive advantages via improved supply chain operational effectiveness and efficiency (Manyika et al., 2011; Sanders, 2014). Despite the importance of big data to business success, many managers are not taking advantage of it. For example, research from The Conference Board and Stanford University shows that only about 7 percent of boards incorporate big data into their decision making (Libert, 2013). One of the main reasons is that most companies do not manage well the information they already have. They do not know how to organize and analyse it in ways that enhance understanding of markets and then make operational and product changes in response to new the insights generated (Ross et al., 2013). Until a company learns how to use data to support its operating decisions, it will not be in a position to benefit from big data (Libert, 2013; Ross et al., 2013). Thus, a major challenge for supply chain managers is to understand the linkage between big data, SCC, and the delivery of better business performance. Unfortunately there has been a lack of practical guidance assisting managers in developing valuable insights from data to drive improvement in supply chain capabilities or business performance (Libert, 2013; Schoenherr and Speier-Pero, 2015; Tan et al., 2015; Waller and Fawcett, 2013).

This study aims to extend existing supply chain and big data research. More specifically, we develop a construct to measure DDSC. Additionally, consistent with the research of Wu et al. (2006), we conceptualise SCC as a four dimensional construct, i.e., information exchange, coordination, interfirm activity integration, and supply chain responsiveness. By disaggregating SCC into its constituent parts, this study can contribute to building a more granular understanding of the nature of the relationships between DDSC, each SCC dimension, and financial performance. After presenting the hypothesized relationships and the methodology used to test them, we present the findings from this study and offer insights to managers into how big data can be deployed to build data-driven supply chain capabilities for performance improvement.

2. Theoretical background and hypothesis development

2.1. Resource-based view (RBV)

The resource-based view of the firm (RBV) suggests that firms possessing resources that are valuable, rare, inimitable and non-substitutable can achieve sustainable competitive advantage by using them to implement strategies that are difficult for competitors to duplicate (Barney, 1991; Peteraf, 1993; Wernerfelt, 1984). The RBV considers a firm to be a bundle of resources and capabilities (Wernerfelt, 1984), and this vantage point has proven to be an influential theoretical framework for understanding how competitive advantage, and by extension financial performance, is achieved (Corbett and Claridge, 2002). In general, capabilities relate to the ability of the firm to use its resources "to affect a desired end" and are analogous to intermediate goods generated by the firm using organisational processes to provide "enhanced resource productivity" (Amit and Schoemaker, 1993). In contrast to resources, capabilities are embedded in the dynamic interactions of multiple knowledge sources and are more firm-specific and less transferable; hence they may lead to competitive advantage (Peng et al., 2008). Capabilities can be broadly categorized into those that relate to performing basic functional activities of the firm and those that guide the improvement and renewal of the existing activities (Collis, 1994). The RBV holds that firms will have different resources and varying levels of capability in regards to resource exploitation. Firm survival depends on the ability to create new resources, build upon existing capabilities, and make the capabilities more inimitable (Peteraf, 1993).