

Traceability in the Supply Chain

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ABSTRACT

Traceability in firms' supply chain operations has become increasingly important today, calling for greater scrutiny and transparency. Firms have responded by increasing and improving product traceability throughout their global supply. Traceability is a significant benefit to firms. Areas affected include quality control and product safety, tracking product recalls, and reverse logistics. Research does exist on the importance and benefits of implementing traceability initiatives but in very targeted areas. In addition, missing from the literature is the important discussion of what factors predicate firms to implement traceability initiatives beyond those prescribed by law and how industries other than very specific categories, create and implement effective traceability initiatives throughout the supply chain. In turn, the purpose of this research is to investigate traceability to gain greater understanding of why firms implement traceability & what actions or initiatives lead to greater traceability effectiveness.

KEYWORDS

Contingency Theory, Supply Chain Effectiveness, Supply Chain Management, Traceability

INTRODUCTION

Global supply chain traceability has become an increasingly important issue in recent years with calls for greater scrutiny and transparency (Steven, 2015; MacCarthy et al., 2016). Government, media, industry groups, suppliers, customers, and firms themselves are all interested in a deeper understanding of how firms manage their global supply chains in terms of information exchange (Silverstro & Lustrato, 2014), quality control (Chen et al., 2014), supplier management (Handfield et al., 2015), disruption avoidance (Kleindorfer & Saad, 2005), and risk management (Grötsch et al., 2013). Recent supply chain safety and security issues in different industries, including restaurant (e.g., Chipotle), pharmaceutical (e.g., Heparin issue 2008), consumer food (e.g., e-coli in hamburger), and energy (e.g., oil rail cars), have further exacerbated demands that firms improve supply chain traceability. As a result, firms have started to increase and improve product traceability throughout their global supply chains in order to have readily available information for internal use and to satisfy stakeholder demands (Shafiq et al., 2014).

A long history of research exists pertaining to agriculture, food networks, and the food supply chain overall (Fearne, 1998; Mattevi & Jones, 2016). Targeted information systems research has

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studied the traceability abilities of software, which tends to focus on version updates (e.g. Ramesh & Jarke, 2001). In the context of these industries, traceability has been extensively studied from different perspectives, including the importance and benefits of implementing traceability initiatives (Fearne, 1998; Mattevi & Jones, 2016). Also, traceability is a significant benefit to firms in terms of managing quality control and product safety, tracking product recalls, and optimizing reverse logistics processes (Chen et al. 2014; Dai et al., 2015). Recently, there has been more research covering tools to effectively and efficiently manage traceability in the supply chain. Information technologies such as RFID have become important enablers for tracing products/services through the supply chain because they promise improved speed, transparency and security of information sharing (Jakkhupan et al., 2015; SAE, 2015; U.S. House of Representatives, 2007). Serialization is another track-and-trace system adopted by the pharmaceutical supply chain to extend the identification of drugs down to the individual level, so that each unit can be traced from its origin (Malleesh et al., 2015).

Yet, for all its purported benefits, traceability can be difficult to implement both internally and across the supply chain. Implementation is difficult because of the complex and dynamic factors that are inherent in today's global business environment. Firms often struggle to obtain critical, accurate, and up to date logistics information from supply chain partners (Mattevi & Jones, 2016). Also, the breadth of the ways companies receive and utilize information differs from firm to firm and supply chain to supply chain (Mattevi & Jones, 2016). Finally, some firms and industries feel significantly greater pressure than others to implement traceability initiatives in their supply chains because [1] they have high product and supply chain complexity and risk; or [2] they are in the sectors with regulations governing documented traceability processes (e.g. pharmaceuticals and food products). Regattieri et al. (2007) propose that a general traceability framework for food products consists of four pillars of product identification, data to trace, product routing and traceability tools. Based upon Regattieri et al.'s framework, Hu et al. (2013) analyze the implementation of a traceability system in the vegetable supply chain in China.

Practices in the food industry often require traceability be considered an integral part of logistics management including reverse flow and storage of goods, services, and related information (Bosona & Gebresenbet, 2013; Kumar et al., 2015). Yet streamlining reverse logistics process has traditionally been seen as a low priority because collection, reuse and reprocessing of returned materials require integration at various levels of a supply chain. When products are moving against the normal flow, process integration becomes a challenge across organizational boundaries. A traceability system can be an effective mechanism for reverse logistics as it [1] facilitates to establish a standard operating procedure so that a company can act quickly to handle a return with reduced costs in reverse logistics (Kumar et al., 2015); and [2] assures visibility and traceability of information and responsive communication among consumers, employees, suppliers, government agencies, and other affected participants along a supply chain. This is critical to efficiency and effectiveness of reverse logistics, and the reputation and image of a company as well (Bosona & Gebresenbet, 2013).

Although previous studies have demonstrated that traceability system implementation is a complex task, the traceability literature still lacks in important discussion of what factors predicate firms to create and implement effective traceability initiatives throughout the supply chain. This is particularly of initiatives beyond those prescribed by law and in specific industries (e.g., food/agriculture/information systems/electronics). Thus, the purpose of this research two-fold: First, to investigate why firms implement traceability, in addition to regulatory mandates, and second, to better understand which actions or initiatives lead to greater traceability effectiveness in a cross-section of firms in diverse industries. We address this dual purpose by using contingency theory to help explain traceability initiatives in firms via five dimensions of traceability: top management support (TMS), nonconforming process management (NCPM), lot traceability (LT), and internal (ITP) and external traceability processes (ETP).

The next section reviews the relevant literature on traceability and introduces the theoretical background of our research, followed by development of the research hypothesis. Then, we discuss

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