



Digital Supply Chain: Literature review and a proposed framework for future research



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ABSTRACT

Suppliers, partners, companies and dealers in supply chains do use, generate and share information with others. These associations lead to a multitude of challenges and opportunities within the supply chains. A Digital Supply Chain (DSC) is a smart, value-driven, efficient process to generate new forms of revenue and business value for organizations and to leverage new approaches with novel technological and analytical methods DSC is not about whether goods and services are digital or physical, it is about the way how supply chain processes are managed with a wide variety of innovative technologies, e.g. unmanned aerial vehicles, cloud computing, and internet of things, among others. Recent literature highlights the importance of DSC and many industrial researchers discuss its applications. This article reviews the state-of-the-art of existing DSC literature in detail from both academic and industrial points of view. It identifies key limitations and prospects in DSC, summarizes prior research and identifies knowledge gaps by providing advantages, weaknesses and limitations of individual methods. The article also aims at providing a development framework as a roadmap for future research and practice.

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1. Introduction

Digital technologies have profoundly altered the way people communicate and interact with their surroundings. Technological novelties and personal gadgets, such as mobile devices, personal computers, self-driving cars, drones, advanced television units, wearable devices, smartphones and smartwatches change the way how societies access and exchange information. These emerging new technologies affect every industry. Supply chains and logistics services are no exception. Nevertheless, many operations for producing and delivering goods or services to customers are being carried out independently in current organizational structures. Conventional supply chains consist of physical facilities scattered geographically to help establish and maintain transportation links among them. Supply chains can be defined as a series of interconnected activities that involve the coordination, planning and controlling of products and services between suppliers and customers. Many of these organizational structures are no longer self-sufficient due to technological developments. Digitalization has touched almost each and every aspect of human life all over the

world, greatly affecting supply chain processes. According to market forecasts [1], 76% of global population have now access to internet with half of them actively using social media. Moreover, nine out of ten internet users make online purchases, 43% of companies make use of sophisticated big data analytics. Cloud storage is projected to hold about 37% of all generated data by 2020. In the same time horizon, 26 billion internet-connected “things” are expected to become operational. Digitalization has a disruptive transformation effect across industries, generating value and network effects. One day, people may even be able to dispatch fleets of vehicles with a simple handheld device. It may be possible to find out the contents of a cargo container with just a brief electronic glance. Before long, wearable computers on sleeves could be available. With possibilities abound, organizations become more aware of these potential developments and emphasize how DSC can add value to firms. Considering that the primary focus of organizations is to keep and strengthen their core competences in a competitive market, modern organizations should interact with their dealers through DSC processes for the production and delivery operations of their goods and services.

The DSC is in its infant steps, and the most of its potential for value creation remains unclaimed. Nonetheless, it has set supply chains and the logistics industry into a rapid change and a novel innovation path. In today's emerging digital model, data centers replace physical warehouses, bits replace the physical boxes,

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bandwidth replaces the physical trucks. There are shifts in channel management from conventional distribution centers to retailer services to broadband providers, to online, and directly to the customers. Within the DSC, there are many innovations, e.g. Augmented Reality (AR), Big Data (BD), Cloud Computing (CC), Robotics (R), Sensor Technology (ST), Omni Channel (OC), Internet of Things (IoT), Self-Driving Vehicles (SDV), Unmanned Aerial Vehicle (UAV), Nanotechnology (N) and 3D Printing (3DP), to name a few. Recent literature highlights the importance of DSC and many industrial researchers discuss its applications. Determining all potential benefits of different DSC implementations is a tedious task, as most of the benefit is not derived from the DSC itself but from the numerous solutions that arise from DSC implementations. Integration of DSC can provide various benefits to supply chains and logistics, which are addressed throughout this paper. The paper reviews the state-of-the-art within the context of DSC and introduces a framework proposition. It summarizes the past studies on the subject by critically consolidating and examining contributions of prior research. It starts with a discussion of the DSC literature to capture the conceptual and theoretical state of research to identify knowledge gaps in the literature, including the similarities and differences between the components of digitalization and their relation to the DSC. Our original contribution to DSC literature stems from our analysis of advantages, weaknesses and limitations of the published methodologies. The review also reflects the implications and inferences of DSC, challenges and success factors with a managerial perspective. The study presents a framework by synthesizing past knowledge, identifying important biases for the further development of DSC to help academics and practitioners in organizing, conceptualizing and conducting their research on DSC in the future.

The identification, realization and assessment of DSC requires a framework to build upon. Many benefits of digitalization in supply chains are still untapped, because crucial organizational transformations and their management are often neglected or postponed. Academic and industrial researchers have suggested several types of approaches to evaluate potential DSC possibilities, but little research has been conducted so far on how to construct a complete conceptual or theoretical DSC framework. In this paper, we intend to fill this research gap.

This literature review attempts to answer the question of ‘How to integrate the existing importance of digitalization into supply chain or logistics?’ The answer to this question involves the development of a framework that can be used in the identification, realization and assessment of benefits DSC can bring about. These discussions also include the similarities and distinctions of components and their relation to the problem statement, implications and inferences of DSC technologies, challenges and success factors. The section on managerial implications will separately discuss these overlapping issues and differences.

The study discusses the benefits of DSC transformation to guide researchers and industry experts in organizing, conceptualizing, and conducting their research on DSC of the future. Instead of presenting empirical results, the outcome of this extensive review aims to present a foundation for further research in this field. In this context, this study offers a development framework to capture, present and relate the digitalization in the supply chains. The main task of implementing and verifying DSC is to identify its critical stages, which is not only essential for supply chains to manage and function better (such as to fully transformed DSC), but is also functional or essential for a typical supply chain to catch the transformation path for DSC.

This article is organized as follows: the following section reviews and categorizes related publications (e.g. journal articles, theses, industrial reports, etc.) and explains the methodology adopted in this literature review. The third section discusses the

concept of DSC, its definition, features and components to build a conceptual framework that is derived from existing literature. The fourth section describes the advantages and challenges of digitalization for supply chains and logistics. A DSC framework for development is constructed in the fifth section. The sixth section presents the managerial implications to discuss the limitations as well as possible directions for DSC. The final section contains the article’s concluding remarks.

2. Review of literature on DSC

This review of journal articles and industrial reports is based on a classification methodology, which presents how the literature is approached as a basis for the conceptual and theoretical framework. First, the classification used in this literature review is explained and then the methodology of the literature review is introduced.

2.1. Method of study

Relevant publications are located with the help of a detailed online search with the objective to collect, organize, and synthesize existing DSC knowledge. Identified papers span several types of interrelated disciplines including marketing, management, operations management, management science, industrial engineering, and supply chain management. Due to the lack of precise key words defining the topic, we put substantial effort to sort academic and industrial journals by reviewing their titles, abstracts and manuscripts in the traditional and electronic library systems. Usually, this step can be carried out by targeting prominent journals and conferences. This is not the case for DSC since this recent phenomenon has emerged only a few years ago and related publication channels are still scattered. Using search queries in online databases is today the dominant method of identifying the most relevant papers. It is more practical and appropriate to focus on online databases rather than reviewing library collections for a literature review on DSC. Therefore, the following major online databases were targeted for the past six years: Elsevier’s Scopus, Thomson Reuter’s Web of Science, IEEE Xplore, ProQuest (ABI/INFORM), and ScienceDirect (Elsevier). This search indicated that the concept of DSC is still in its early years of research and development among academics, while it is widely recognized and discussed among practitioners. To include industrial reports, Google search engine is also used for a wider reach-out.

In this study, we review and classify relevant studies to gain insight on DSC. The overall review methodology for DSC papers is graphically presented in Fig. 1. Fig. 2 illustrates the significant findings by presenting a detailed summary in terms of types of DSC publication and its enablers. The literature sources are investigated in scientific databases and regular search engines which include books, peer and non-peer reviewed papers, industrial reports and white papers. The keywords were not predetermined before the search but they have gradually emerged during the extensive reading process that took place while drafting this study. The nomenclature lists the non-exhaustive keywords which is completed with the mentioned keywords and terms. Accordingly, this research captures the trends in the DSC literature by examining published academic articles and industrial reports, including DSC technologies, in order ensure that these papers are sufficiently investigated based on the year of publication, subject, objective or method. Considering the nature of DCS, however, it is quite a challenge to confine studies into specific categories. Considering this fragmented structure, the search in major databases is supported with Google Scholar search engine queries

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