

Chapter 52

Industry 4.0 From the Supply Chain Perspective: Case Study in the Food Sector

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ABSTRACT

Industry 4.0 proposals have an important impact not only in companies but also in the complete supply chain. The effect in the supply chain is different depending on each Industry 4.0 proposal and each supply chain configuration. This chapter deals with Industry 4.0 from the supply chain perspective. Four levels of scope on the supply chain and a classification scheme based on three blocks (technologies, features and extensions) have been defined. Finally, the case study in the food sector gives a real vision of some previously introduced concepts about Industry 4.0 from the supply chain perspective.

INTRODUCTION

Industry 4.0 promotes, among other things, autonomous decision-making, interoperability, agility, flexibility, efficiency and cost reductions. This is the reason by which many companies are aiming to implement the technologies and concepts related to “Industry 4.0” (Perez et al., 2017). Industry 4.0 holds huge potential. Smart factories allow individual customer requirements to be met and mean that even one-off items can be manufactured profitably. In Industry 4.0, dynamic business and engineering processes enable last-minute changes to production and deliver the ability to respond flexibly to disruptions and failures on behalf of suppliers, for example. End-to-end transparency is provided over the manufacturing process, facilitating optimised decision-making. Industry 4.0 will also result in new ways of creating value and novel business models (Kagermann, 2013). The importance of these advances is

DOI: 10.4018/978-1-7998-8548-1.ch052

recognized by the European Commission promoting proposals in this line such as Factories of Future (European Commission, 2013; 2016).

These technical and organizational advances in each company due to Industry 4.0 may have an impact on the Supply Chain (SC) performance. Industry 4.0 concepts have been usually treated from an intra-enterprise viewpoint. However, industries are involved in (more or less) organized supply chains, so that the success of the company depends on the success of the supply chain. The inclusion of industry 4.0 proposals in a company in the supply chain may have different repercussion on the SC depending on different factors. This chapter deals with Industry 4.0 proposals from the SC perspective analyzing the Industry 4.0 concept, studying the different supply chain configurations, defining the scope of Industry 4.0 on the SC and making a classification scheme based on technologies, features and extensions. Furthermore, a case study in the food sector is presented as an example of inter-enterprise collaboration.

INDUSTRY 4.0

Industry 4.0 and the Industrial Internet of Things (IIoT) has become one of the most talked about industrial business concepts in recent years. The IIoT has brought about a new strategy, which has arisen in industry, especially within manufacturing, and it is based on the producer focusing on what the customer actually wants rather than the product they buy. According with Gilchrist (2016) the four main characteristics of Industry 4.0 include:

- Vertical integration of smart production systems
- Horizontal integration through global value chain networks
- Through-engineering across the entire value chain
- Acceleration of manufacturing

Reviewing these main characteristics, it is easy to identify the important contribution of Industry 4.0 for the value chain or SC.

On the other hand, according to Gilchrist (2016) the nine technological trends more important in an Industrial 4.0 context are: Big Data and Analytics, Autonomous Robots, Simulation, Horizontal and Vertical System Integration, The Industrial Internet of Things, Cyber-Security, The Cloud, Additive Manufacturing and Augmented Reality.

Within these trends, IoT is possibly the most important and far-reaching technological trend. In that sense, Gubbi et al. (2013) indicates that the IoT is a radical development of today's Internet towards a network of interconnected objects that not only collects information from environment and interacts in the physical world (action/command/control), but one that also uses existing standards on the Internet to provide information transfer services, analyses, applications and communications. An important component of Industry 4.0 is the fusion of the physical and the virtual world (Kagermann, 2013). This fusion is made possible by Cyber Physical Systems (CPS). CPS are "integrations of computation and physical processes. Embedded computers and networks monitor and control the physical processes, usually with feedback loops where physical processes affect computations and vice versa." (Lee, 2008).

Furthermore, IoT protocols are fundamentals and key elements from a technical point of view. They are in constant evolution thanks to different working groups. For example, The Internet Engineering Task Force (IETF) started with three working groups (WG) (Keränen & Bormann, 2016): 6LoWPAN,

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