Chapter 11
A Framework to Data Integration for an Internet of Things Supporting Manufacturing Supply Chain Operation

Kamalendu Pal
https://orcid.org/0000-0001-7158-6481
City, University of London, UK

ABSTRACT

With the usage of the technologies like the internet of things (IoT) and Semantic Web service spanning across the spectrum of manufacturing, production, and distribution, typical supply chain management (SCM) systems depend on a multitude of services for operation purpose. The unprecedented growth of valuable data produced by decentralised information systems along the global manufacturing supply chain has led to a persuasive appeal for a semantic approach to integrating distributed data facilities in the field of collaborating logistic services. This technology combines a set of new mechanisms with grounded knowledge representation techniques to address the needs of formal information modelling and reasoning for web-based services. This chapter describes a framework, apparel business decentralised data integration (ABDDI), which exploits knowledge representation techniques and languages (e.g., description logics – DLs) to annotate relevant business activities. Finally, a simple business case is presented to demonstrate the framework's semantic similarity assessment functionality.

INTRODUCTION

All manufacturing business today appreciates the value and consequence of building an effective supply chain as part of enterprise proliferation and profitability (Pal, 2018). There exist different types of the industry-specific supply chain (e.g., automotive, pharmaceutical, apparel, agriculture). In simple, the sup-

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ply chain is a system with organization, people, technology, activity, information, and resource involved in, to deliver a product or service from suppliers to customers. Supply chain activity transforms natural resources, raw materials, and components into final products, and delivers them to customers. The supply chain network is composed of the enterprises and enterprise departments involved in this process. The most important requirements of supply chain operation are to minimize the inventory, create seamless material and information flow, effective communication must exist among the business-partners, market, sale, purchase, manufacturing plan and control, customer delivery service, after-sales service, and so on. Therefore, a supply chain is a network of facilities and distribution options that performs the functions of material procurement, the transformation of these materials into intermediate and finished products, and delivery of these finished products to customers. This definition, or a modified version of it, has been used by several researchers (e.g. (Lee & Billington, 1993) (Swaminathan, 2001a) (Keskinocak & Tayur, 2001) (Pal, 2017)). Supply Chain Management (SCM) aims at improving the allocation, management, and control of logistical resources. In this way, manufacturing SCM is a set of synchronized activities for integrating suppliers, manufacturers, transporters, and efficient customer service so that the right product or service is delivered at the right quantities, at the right time, to the right places (Pal, 2020) (Pal & Ul-Haque, 2020).

The ultimate objective of SCM is the efficient management of the end-to-end process, which starts with the design of the product or service and ends with the time when it has been sold, consumed, and finally, discarded by the consumer. This complete process includes product design, procurement, planning and forecasting, production, distribution, fulfilment, after-sales support, and end-of-life disposal. Supply chain management issues can be classified into two broad categories: configuration (design-oriented) issues that relate to the basic infrastructure on which the supply chain executes, coordination (execution-oriented) issues that relate to the actual execution of the supply chain.

Configuration-level issues include the following topics:

1. Procurement and Supplier Decisions: Procurement generally involves making buying decisions under conditions of scarcity. At the same time, the requirements criteria for selecting suppliers and the number of suppliers need to be decided. If sound data is available, it is good practice to make use of economic analysis methods such as cost-benefit analysis or cost-utility analysis. Procurement is used to ensure the buyer receives goods, services, or works at the best possible price when aspects such as quality, quantity, time, and location are compared.
2. Production Decisions: This is a multi-criteria decision activity. It includes the decisions regarding production network design (e.g., Where, and how many manufacturing sites should be used for production purpose? How much capacity should be installed at each of these sites? What kind of products and services are going to be supported through the supply chain network?).
3. Distribution Decisions: It is mainly based on infrastructure design decisions (e.g., What kind of distribution channels should a manufacturing company have? How many and where should the distribution centres and retail outlets be situated? What types of transportation services and routes should be used? What types of environmental issues the distribution infrastructure need to be considered?).
4. Information Support Decisions: Managing a manufacturing supply chain involves numerous decisions about the flow of information, product, funds, and coordination. SCM has been instrumental in connecting and smoothing business activities as well as forming various kinds of business rela-