Chapter 70
Quality Assurance Issues for Big Data Applications in Supply Chain Management

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

ABSTRACT

Heterogeneous data types, widely distributed data sources, huge data volumes, and large-scale business-alliance partners describe typical global supply chain operational environments. Mobile and wireless technologies are putting an extra layer of data source in this technology-enriched supply chain operation. This environment also needs to provide access to data anywhere, anytime to its end-users. This new type of data set originating from the global retail supply chain is commonly known as big data because of its huge volume, resulting from the velocity with which it arrives in the global retail business environment. Such environments empower and necessitate decision makers to act or react quicker to all decision tasks. Academics and practitioners are researching and building the next generation of big-data-based application software systems. This new generation of software applications is based on complex data analysis algorithms (i.e., on data that does not adhere to standard relational data models). The traditional software testing methods are insufficient for big-data-based applications. Testing big-data-based applications is one of the biggest challenges faced by modern software design and development communities because of lack of knowledge on what to test and how much data to test. Big-data-based applications developers have been facing a daunting task in defining the best strategies for structured and unstructured data validation, setting up an optimal test environment, and working with non-relational databases testing approaches. This chapter focuses on big-data-based software testing and quality-assurance-related issues in the context of Hadoop, an open source framework. It includes discussion about several challenges with respect to massively parallel data generation from multiple sources, testing methods for validation of pre-Hadoop processing, software application quality factors, and some of the software testing mechanisms for this new breed of applications

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INTRODUCTION

All business today understands the value and importance of building an effective supply chain, as part of organizational growth and profitability (Pal, 2017). A supply chain is a network of suppliers, factories, warehouses, distribution centers and retailers, through which raw materials are procured, transformed into intermediate and finished products, and finally delivered the finished products to customers. In this way, a supply chain consists of all the activities associated with the flow and transformation of raw materials stage, through to the end-customers; and as well as the associated information flows. Supply Chain Management (SCM) is a set of synchronized decision and activities, utilized to effectively integrate all relevant business processes to deliver the right products, to the right locations, and at the right time, to optimize system wide costs while satisfying customer service level. Information and Communication Technology (ICT) applications have ushered enormous opportunities to retail supply chain management; and helping it to grow at faster pace. Figure 1 shows a simple diagrammatic representation of a retail supply chain, which highlights some of the main internal business activities.

In addition, retail businesses are evolving into new forms based on knowledge and networks in response to a globalized environment characterized by indistinct organizational boundaries and fast-paced change. These enterprises have understood the importance of enforcing performance tracking of the goals defined by their corporate strategy through metrics-based management (Kaplan & Norton, 1993). The strategic fit requires that a retailer's supply chain achieve the balance between responsiveness and efficiency that best support the business's competitive strategy. A supply chain's performance in terms of responsiveness and efficiency is best on interaction between the following logistical cross-functional drivers of business: demand forecasting, warehousing, scheduling, delivery, inventory planning, and distribution. The performance drivers and some of the related issues are highlighted in Figure 1. Demand forecasting helps more accurate estimation of demand by accessing data of sales, market trends, competitor analysis, and relevant local and global economic factors. Warehousing deals with real-time Big Data-based analysis within the Enterprise Resource Planning (ERP) system and identifying inventory levels, delivery miss-matches, and incoming deliveries. Scheduling plays an important role in SCM. It could help directly increasing visibility of inventory levels, demand, and manufacturing capacity; hence more accurate and distributed scheduling is necessary for global SCM.

Increased internationalization of retail business is changing the operational practices of global retail supply chains, and many retailers have adopted new models, either by outsourcing or by establishing business-alliances in other countries. Globalization has also led to changes in operational practices, where products are manufactured in one part of the world and sold in another. The retail supply chain has become more global in its geographical scope; the international market is getting more competitive and customer demand oriented. Customers are looking for more variety as well as better quality products and services.

Increased customer demand, fierce competitive market conditions, structural complexity of global operations, corporate aspiration of customer satisfying products and services, advances in technological innovation, ICT, have added extra challenges in designing and managing retail supply chains. Over the years, the concepts and practices of SCM have undergone many changes that have been reflected in its '*constantly evolving*' nature. From its initial cost efficiency focus to modern responsive and agile nature, SCM has witnessed a transformational change at the operational frontier. To survive under unpredictable business environment, it has become imperative to function with information driven strategies wherein collaborative business practice among supply chain partners is one of the crucial success factors.