A Review of Advances in Supply Chain Intelligence

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INTRODUCTION

As the market pressures are forcing supply chain organizations to adapt to new business models, collaboration, integration and information sharing are becoming even more critical for the ultimate success. Supply chains are experiencing a major structural shift as more organizations rely on a community of partners to perform complex supply chain processes.

While supply chains are growing increasingly complex, from linear arrangements to interconnected, multi-echelon, collaborative networks of companies, there is much more information that needs to be stored and analyzed than there was just a few years ago.

Supply chains are complex systems with silos of information that is very difficult to integrate and analyze. The best way to effectively analyze these disparate systems is the use of business intelligence (BI). The ability to make, and then to process, the right decision at the right time in collaboration with the right partners is the definition of the successful use of BI (Stefanovic & Stefanovic, 2009).

During the past two decades companies have made large investments in supply chain management (SCM) information systems in order to improve their businesses. However, these systems usually provide only transaction-based functionality and mostly maintain operational view of the business. They lack sophisticated analytical capabilities required to provide an integrated view of the supply chain (Baars et al., 2014).

Supply Chain Intelligence (SCI) is relatively new initiative that provides the capability to improve supply chain performance by utilizing sophisticated analytical tools and collaborative decision making (Haydock, 2003). SCI takes broader, multidimensional view of supply chain in which, using patterns and rules, meaningful information about the data can be discovered. Supply chain intelligence reveals opportunities to reduce costs and stimulate revenue growth and it enables companies to understand the entire supply chain from the customer's perspective (Stefanovic et al. 2007).

Nevertheless, companies that implemented some kind of enterprise business intelligence systems still face many challenges related to data integration, storage and processing, as well as data velocity, volume and variety. Additional issues include lack of predictive intelligence features, mobile analytics and self-service business intelligence capabilities.

In this chapter the latest supply chain management issues, and the drivers for the implementation of the business intelligence and performance measurement systems are discussed. Review of the most important literature and research findings provides condensed view of the existing state of the art. Additionally, the latest software technologies and tools, and their impact on different supply chain areas such as collaboration, integration, and analytics are described.

Furthermore, the integrated supply chain intelligence system that enables creation of pervasive

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analytical systems for collaborative planning, monitoring and management of the supply network is described. This includes architecture, main components, technologies and tools. The SCI system is robust and cloud-based, capable to handle big data analytical tasks. Its flexible and multilayered architecture enables creation of adaptive supply chain intelligence systems by composing various analytical software components, services and tools. Finally, the main trends and advanced information technologies that will shape the future SCI systems are introduced.

BACKGROUND

Today, there are variety of business initiatives and technologies such as joint planning and execution, business intelligence, performance management (PM), data mining and alerting that can be used for more efficient supply chain management.

By applying the concepts of business intelligence to data from SCM systems, SCI technologies seek to provide strategic information to decision makers (Reddy, 2004). Information categories range from what-if scenarios for reconfiguring key functions in sourcing, manufacturing, and distribution to measuring the ability of a supply chain to produce cost-effective products. Table 1 summarizes the main differences between the SCM and SCI systems (Russom, 2010).

What truly differentiates SCI from BI is the ability to collect and aggregate data across the value chain. Data is then analyzed and the results distributed to all parties along that chain, regardless of location.

SCI technologies promise to extract and generate meaningful information for decision makers from the enormous amounts of data generated and captured by SCM systems. SCI complements supply chain planning because BI applications provide incremental benefits while a business lays the foundation for more sophisticated tools and related business process changes.

Table 1. Comparison of SCM and SCI

Supply Chain Management	Supply Chain Intelligence
Largely about managing the procurement and production links of the supply chain	Provides a broad view of an entire supply chain to reveal full product and component life cycle
Transactional	Analytical
Tactical decision making	Strategical, tactical and even operational decision making
Helps reduce costs through improved operational efficiency	Reveals opportunities for cost reduction, but also stimulates revenue growth
Usually just the SCM application's data (as a vertical stovepipe)	Integrates supplier, manufacturing and product data; possibly syndicated data, too (horizontal)
Records one state of data representing "now"	Keeps a historic record and makes predictions
Assists in material and production planning	What-if forecasting based on historic data
Quantifies cost of some materials	Enables an understanding of total cost
Shows today's yield but cannot explain influences on it, thus provides no help for improvements	Drills into yield figures to reveal what caused the performance level so it can be improved
Simple reporting	Collaborative environment with personalizable monitoring of metrics

The primary source systems for BI are the internal operational systems, while SCI integrates data from partner and supplier information systems. What truly differentiates SCI from BI is the ability to collect and aggregate data across the value chain. Data is then analyzed and the results distributed to all parties along that chain, regardless of location.

Several factors are driving the demand for BI within the SCM domain. First, organizations want more granular visibility to their SCM processes so they can manage and control them more effectively. They also want to identify negative trends in supply chain performance, and identify root causes as early as possible to take corrective action. And they need to conduct 'what-if' analyses to evaluate the service and cost trade-offs of different supply