



Role of Business Intelligence in Supply Chain Management

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Abstract

When any firm wants to build and sell a product to other businesses, it buys raw materials and a variety of contracted services from other companies. The interrelationships with suppliers, customers, distributors, and other businesses that are needed to design, build, and sell a product make up the network of business entities, relationships, and processes that is called a supply chain. Business intelligence involves the integration of core information with meaningful business information to detect significant events and discover new business scenarios and predict business situations. It includes the ability to monitor business trends, to evolve and adapt quickly as situations change and to make intelligent business decisions on uncertain judgments and contradictory information. The paper tries to identify the role of business intelligence in supply chain management. The paper presents several examples of BI enabled Supply chain management.

Keywords: Business Intelligence, supply chain management, business performance, traditional business intelligence, real time business intelligence systems.

Introduction

The reason for many firms that are opting for supply chain management (SCM) as a top strategic objective and major e-business application development initiative is because SCM enables order processing, just-in-time inventory management, and timely order fulfillment. Fundamentally, supply chain management helps any firm get the right products to the right place at the right time, in the proper quantity and at an acceptable cost. The main objective of SCM is to manage this process efficiently by forecasting demand, controlling inventory, enhancing the network of business relationships a company has with customers, suppliers, distributors, and others and receiving feedback on the status of every link in the supply chain. To achieve this firms are today are turning to Internet technologies to Web-enabled supply chain processes, decision making, and information flows.

Firms are (Evans and Wurster, 2000; D'Aveni, 1994) experiencing environmental changes resulting from the new economics of information and the increasingly dynamic and global nature of competition. Therefore as pointed out by (Dijksterhuis et.al, 1999) organizational survival depends on the construction and integration of knowledge fostering the

adaptation to the environment, as well as stimulating environmental changes through the firm's knowledge and practices. The key drivers examined by (Deherty et.al, 2003) for underlining change are the application of information technologies and systems in any organization. Several surveys including Gartner, Forrester report that most of the firms are interested in investing in Business Intelligence systems (BI). It is to be noted that despite major investments in Enterprise Resource Planning (ERP), Supply Chain Management (SCM) and Customer Relationship Management (CRM) over the last decade businesses are struggling to achieve competitive advantage. It is due to the information captured by these systems. Any corporate would look forward for one goal called 'right access to information quickly'. Hence the firms need to support the analysis and application of information captured in order to make operational decisions. Say for marking seasonal merchandise or providing certain recommendations to customers, firms need right access to information quickly. Implementing smarter business processes is where BI influences and impacts the bottom line and returns value to any firm.

(Gangadharan and Swamy, 2004) stress on new and complex changes that are emerging which will force enterprises to operate in entirely new ways. (Gottschalk and



Emil Berg , 2007) investigated the role and effective use of information systems. As a result, (Mahoney, 2002) the investments in IT that enable differentiation are of ever-increasing importance.

To sustain in the running stream of rapidly changing, increasingly competitive global market scenario and increasingly volatile consumer and market behavior and rapidly shortening product life cycles, business enterprises today need to (Gangadharan and Swamy, 2004) necessarily analyze accurate and timely information.

The key question that arises as described by (Azvine et.al, 2007a) is how do businesses respond to changes today and, if the nature of the business and the environment is becoming more and more dynamic, what actions can businesses take to predict and prepare for change. To accomplish this, it is essential to have a system for establishing the status of a business at any moment in time in relation to its performance objectives. An important component of this investment is in Business Intelligence (BI).

This paper analyzes BI approach in supply chain management. The paper argues that Business Intelligence (BI) integrates and consolidates information in an organization and supports supply chain management. In other words, with BI firms can build their effective SCM process. To support the argument, the paper presents several examples. The rest of the paper is organized as follows: section 2 describes BI and its components. Section 3 given an understanding of real time BI. Section 4 presents BI in Supply chain Management. Section 5 describes case scenario. Section 6 concludes the paper.

The goal of SCM is to create a fast, efficient and low-cost network of business relationships, or supply chain, to get a company's products from concept to market.

Supply Chain Management Systems

Legacy supply chains are clogged with unnecessary steps and redundant stockpiles. For any product that spends so many days in factories before coming to super markets, struggling its way through processes that involves wholesalers, distributors, brokers, and consolidators, each of which has a warehouse. The main opportunity lies in the fusing of each company's internal systems to those of its suppliers, partners, and customers. This fusion forces companies to better integrate inter-enterprise supply chain processes to improve manufacturing efficiency and distribution effectiveness. SCM acts as a cross-functional system that uses information technology to help support and manage the links between some of a company's key business processes and those of its suppliers, customers, and business partners. The goal of SCM is to create a fast, efficient and low-cost network of business relationships, or supply chain, to get a company's products from concept to market.

Table 1 provides objectives and outcomes of supply chain management. The role of information technology in SCM is to support these objectives with inter-enterprise

information systems that produce many of the outcomes a business needs to manage its supply chain effectively. That's why many companies today are installing several SCM planning and execution software and developing Web-based SCM systems.

Table 1: SCM Objectives and Outcomes

SCM Objectives	SCM Outcomes
What? Establish objectives, policies, and operating footprint	> Objectives > Supply policies (service levels) > Network design
How much? Deploy resources to match Supply to demand	> Demand forecast > Production, procurement, logistics plan > Inventory targets
When? Where? Schedule, monitor, control, adjust production	> Work center scheduling > Order/inventory tracking
Do Build and transport	> Order Cycle > Material movement

Source: Adapted from Keith Oliver, anne Chung, and Nick Samanch, "Beyond Utopia: The Realist's Guide to Internet-Enabled Supply Chain Management," *Strategy and Business*, Second Quarter, 2001, p.99.

IT enabled SCM emphasizes how many companies today are reengineering their supply chain processes, aided by Internet technologies and supply chain management software. For example, the demands of today's competitive business environment are pushing manufacturers worldwide to use their IT sources like intranets, extranets, and e-commerce web portals to help them reengineer their relationships with their suppliers, distributors, and retailers. The IT enabled SCM's role is to reduce costs, increase efficiency, and improve their supply chain cycle times. This helps to improve inter-enterprise coordination among supply chain process players. The result is much more effective distribution and channel networks among business partners.

Several executives from firms admit that establishing a real-time SCM infrastructure is a complex and management challenge and sometimes ineffective supply chain planning may lead to a point of failure for several reasons. While the Companies are aware that SCM systems can provide them with key business benefits such as faster, more accurate order processing, reduce in inventory levels, quicker times to market, lower transaction and materials costs, and strategic relationships with their suppliers the planning, selection, and implementation of SCM solutions are becoming more complex as the pace of technological change accelerates and the number of a company's partners increases (O'Brien James et.al, 2010). All of these are aimed at helping a company achieve agility and responsiveness in meeting the demands of its customers and the needs of its business partners.

Table 2 provides an understanding of SCM functions and outcomes.

Table 2: SCM Functions

SCM Functions	SCM outcomes
Planning	
Supply chain design	> Optimize network of suppliers, plants, and distribution centers.
Collaborative demand and supply planning	> Develop an accurate forecast of customer by sharing demand and supply forecasts instantaneously across multiple tiers > Internet-enable collaborative scenarios, such as collaborative planning, forecasting, and replenishment (CPFR), and vendor-managed inventory
Execution	
Materials management	> Share accurate inventory and procurement order information > Ensure materials required for production are available in the right place at the right time. > Reduce raw material spending, procurement costs, safety stocks, and raw materials and finished goods inventory
Collaborative manufacturing	> Optimize plans and schedules while considering resource, material, and dependency constraints
Collaborative fulfillment	> Commit to delivery dates in real time > Fulfill orders from all channels on time with order management, transportation planning, and vehicle scheduling > Support the entire logistics process, including picking, packing, shipping, and delivery foreign countries
Supply chain event management	> Monitor every stage of the supply chain process, from price quotation to the moment the customer receives the product, and receive alerts when problems arise
Supply chain performance management	> Report key measurements in the supply chain, such as filling rates, order cycle times, and capacity utilization

Source : (O'Brien James et.al, 2010)

Business Intelligence Systems

Current Data Warehousing and Business Intelligence approaches are widely accepted as a middleware layer for state-of-the-art decision support systems Seufert Andreas and Schiefer Joesf (2005). However, they do not provide sufficient support in dealing with the upcoming challenges, such as real-time and closed loop decision making. Moss and Atre (2003) describe BI as seamless integration of operational front-office applications with operational back-office applications. Gangadharan and Swamy (2004) define BI as an enterprise architecture for an integrated collection of operational as well as decision support applications and databases, which provides the business community easy access to their business data and allows them to make

accurate business decisions. Berson et.al (2002) emphasize on emerging highly dynamic business environment and point that only the most competitive enterprises will achieve sustained market success.

Malhotra (2000) points out BI benefits that facilitate the connections in the new-form organization, bringing real-time information to centralized repositories and support analytics that can be exploited at every horizontal and vertical level within and outside the firm. Golfarelli et.al(2004) briefs on BI which includes effective data warehouse and also a reactive component capable of monitoring the time-critical operational processes to allow tactical and operational decision-makers to tune their actions according to the company strategy.

Denison (1997) examines several critical activities related to value chain. Without effective BI to target process-oriented organizations for supporting is not possible. Williams and Williams (2005) stress on achieving business value by using traditional data warehousing and business intelligence tools. Grigoria et.al (2004) mention that management information systems are targeted only for traditional reporting and not utilized for measuring the performance of business processes. Other authors (Geishecker, 2002; Moncla and Arents-Gregory,2003) explore on providing closed loop support that interlinks strategy formulation, process design and execution for business intelligence. Addressing this, real-time decision support gained great attention. Manh et.al (2005) introduced an enhanced BI architecture that covers the complete process to sense, interpret, predict, automate and respond to business environments and thereby aims to decrease the reaction time needed for business decisions. Andreas and Josef (2005) suggested an architecture for enhanced Business Intelligence that aims to increase the value of Business Intelligence by reducing action time and interlinking business processes into decision making.

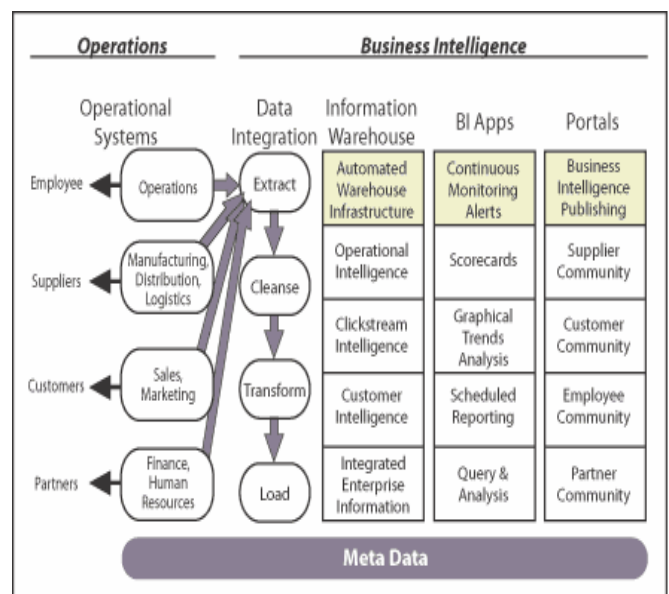


Figure 1: BI infrastructure adopted from (Mark Robinson, 2002).

The primary goal of real time BI is to meld analytics with management functions so that analytics become an integral part of how managers and employee teams perform their job (see Fig 1). Information is collected from several operation systems for data integration. Note the different applications of BI emerging from query analysis to score card management. Hence, successful implementation of real time BI needs to focus first on specific business needs (i.e., supply chain management, customer churn detection and reduction, etc.).

Robinson (2002) evaluated the completeness and adequacy of BI infrastructures based on the information available from: effective data integration process, continuous monitoring processes, Automated information delivery process, fully automated warehouse administration infrastructure, availability of information on standardized dimension such as customer, product and geography, higher end user acceptance.

Role of BI in Supply Chain Management

Developing effective SCM systems has proven to be a complex and difficult application to BI systems. Hence achieving the business value and customer value goals and objectives of supply chain management, has been a major challenge for most companies.

The customer demands raise, for high quality product and services at the right place and in timely fashion

many manufacturing firms has driven down the time and cost of the production process, leaving supply chains as the final frontier for cost reduction and competitive advantage. Supply chain management (SCM) is preferred systems for cost reduction through optimization, and real-time collaboration with trading partners. To achieve competitive advantage organizations provide cost-effective and rapid access to business information for a wide range of business users. BI provides a set of technologies and products for supplying users with the information they need to answer business questions, and make tactical and strategic business decisions. BI on SCM reduces inventory levels as BI leads to expanded data visibility. Also, it analyses customer service levels to identify niche problem areas. The concept of demand forecasting and forecasting accuracy in SCM is achieved by BI. BI helps to analyse the transport performance for reducing the cost.

Effective execution of the extended supply chain can lower costs, improve customer service performance and enhance asset productivity. Companies have used BI to develop and share vendor scorecards, and customer service metrics and have provided customers, vendors and third party service providers with visibility into the status of orders, inventory, returns, delivery performance and other key operational parameters. The Vendor Scorecard is a very effective tool to both monitor and manage suppliers.

Business intelligence systems can be used to optimize order quantities, pool suppliers and minimize materials inventory. We can determine optimal order quantities and set up in business systems to minimize costs. The application of business intelligence to cost control is justifiable. Business intelligence techniques used for inventory control include complicated cost-value equations and historical and demand forecasting. Business intelligence services can determine whether your supply chain is equipped to maintain uninterrupted supply of products and manage distribution of finished goods at the lowest cost possible.

Better and effective data management inform of consolidation and analysis leads better decisions. BI increases the return on applications of SCM as BI uses prediction to make companies understand where and how to make the right move. BI also provides shared data availability that encourages business performance. BI in SCM provides the capability to reveal opportunities to cut costs, stimulate revenue, and increase customer satisfaction by utilizing collaborative decision making.

Limited ability to raise prices, high customer expectations and low levels of loyalty have led to increased challenges in already competitive market for all retail organizations (Taylor et.al, 2004). The retailers are looking forward to

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supply chain analytics to reduce cost and improve customer service. The retail organizations can expect a better and effective supply chain analytic only by defining the analytical needs of enterprise and a well defined key metrics for organizational strategy.

The hype surrounding both ERP, SCM and CRM have led many firms to believe that these systems improve business processes and customer services and also provide enterprise reporting and analytics. But the fact is ERP and CRM systems are integrated across enterprise information infrastructure and functions on their respective modules. Both the systems do not follow the integrated business rules and definitions and function in their individual domains. The traditional transactional systems are not designed to support efficient enterprise reporting and business analytics. Hence it is well understood that SCM alone can not deliver the expected value at right time in an organization. Clearly a BI systems needs to draw information from all operational systems. Hence BI and SCM requirements need to be developed simultaneously.

Taylor et.al (2004) explores the issues on SCM and BI in an organization. Many retailers are now turning towards advanced supply chain management systems in an attempt to reduce costs and improve customer service. Further the authors describe that SCM sells on the promise of Just in Time (JIT), demand driven supply, providing the functionality to plan and monitor inventory levels, track orders and shipments and manage warehouse and distribution facilities.

There are several reasons for problems in supply chain management. A lack of proper demand planning knowledge, tools, and guidelines, inaccurate or overoptimistic demand forecasts will cause major production, inventory, and other business problems; no matter how efficient the rest of the supply chain management process is constructed.

Inaccurate production, inventory, and other business data provided by a company's other information systems are a frequent cause of SCM problems. In addition, lack of adequate collaboration among marketing, production, and inventory management departments within a company, and with suppliers, distributors, and others, will sabotage any SCM system (O'Brien James et.al, 2010).

BI in Supply chain Management provides a single view across supply chain and includes prepackaged key performance indicators (KPI), analytics. It also helps an organization on the primary drivers behind supply chain processes-planning, procurement, manufacturing, logistics, and returns. An organization therefore can analyze and act to increase the supply chain efficiency. Supply Chain analytics addresses measuring supply chain performance against goals and over time, identifies opportunities to reduce costs, improves supplier management, increases manufacturing efficiency and optimizes delivery.

Both vendors and users of supply chain have become enamored with operational BI. The real time BI can be pushed to enhance supply chains. BI analysis will be in line to a business process such as identifying unusual supplier activity that might require a change in pricing or manufacturing schedules or noting higher than expected sales activity of lower margin products that may indicate a problem in sales or distribution. Several vendors foresee BI as powerful engine that hooks into all sorts of processes and work flows to monitor anomalies and changes in trends in supply chain. BI is foreseen to automate adjustments in stead of alerting people. In other words BI can be treated as a layer that sits across all application layers. This can be interpreted as adding BI functionality to all applications that require attention to the results of the processes executed. There is no ERP report to roll up a cross process for viewing customer profitability. Applications that monitor certain processes may be immediately useful for certain managers who use these supply chain management applications but these processes also need to be monitored by BI tools that work across multiple platforms.

Examples of BI in SCM

Consider a manufacturing company that has recently adopted a web enabled system. It is a usual practice to send electronic files of new product designs by e-mail. The main objectives is to create an online extranet so that all suppliers

can study, share the new product designs. This would provide to verify and study the design errors or any enhancements or requirements so that it could be done in faster mode. The company has adopted further IT initiatives for ordering parts from suppliers and updating them by fax or phone. Its web enabled systems allowed parts suppliers to check the status of orders online. Every time an order is changed, the supplier receives an e-mail. If a supplier can't fill an order in time, it can alert the firm so that the firm can search elsewhere for the part. This system resulted in reducing the cost and managing the inventories in better way. By incorporating BI it could predict the inventory levels and demand forecasting and thus reducing the expenses on inventory.

Consider any largest suppliers of telecommunications services XYZ ltd. XYZ provides all services that include electronic data interchange. The main objective of SCM is to catch untapped market of small businesses that were not using electronic data interchange or cannot afford any standard services. XYZ offered an internet based easy EDI service for entering the transaction over that internet. This would allow smaller businesses or trading partners to directly access the services, thus reducing the timing of buying and installing special connections and dedicated work stations. XYZ consolidated these information using BI systems and could disseminate information from largest suppliers and retailers to send orders, issue invoices based on orders, send invoice summaries, track status of documents, and receive messages etc. XYZ maintained effective data management systems that used product database that lists all details of trading partners' products. Once a trading relationship has been established, each partner has encrypted access to details of its own products. Because those details remain accessible to all, the users need enter only minimal information to create links to those data, which are then plugged in as needed.

ABC is a leading drug retail chain, while XYZ is the largest U.S. distributor of pharmaceuticals health care products, and medical/surgical supplies, with annual sales in excess of \$20 billion. Better integration with XYZ strategic move for ABC, as management sees significant potential for improving sales and margins through its enhanced pricing and promotional forecasting systems. Supply chain integration helps the retailer move from pull to push promotions by allowing marketing managers to plan promotions more effectively, using item history taken from historical point-of-sale data on a store-by-store basis. The integration with XYZ substantially reduces the amount of time needed to plan and to stock inventory for individual promotions. A major objective in the ABC-XYZ chain is to improve business performance through better supply chain integration. This requires much closer cooperation between

ABC and XYZ, with ABC even taking responsibility for XYZ stock levels. ABC monitors XYZ's store-level consumption via Web extranet links and replenishes the inventory to meet the agreed-on service levels - true supply chain integration. This cooperative process between supplier and customer is achieved through seamless inter-enterprise process integration and advanced SCM applications that link XYZ directly to ABC's production department. Not every supply chain application, however, requires a hefty up-front investment. BI is incorporated in these systems. The company had been using electronic data interchange transmissions to fill its orders and was having a tough time keeping up with unscheduled changes in orders. Then a large sealant manufacturer that was one of the company's customers persuaded Modern Plastics to connect with its BI systems. This Web-based BI enabled SCM system has enabled Modern Plastics to see what its customers need on a real-time basis. Modern Plastics runs 30 to 40 different products through its presses, and BI now allows management to better plan long-production runs or prioritize specific product runs. BI helps in more accurate demand forecasting and production scheduling.

It is believed that supply chain analytics using BI in organizations will derive better operational efficiency and key performance indicators for any organization in supply chain management.

Conclusion

SCM enabled BI delivers balance scorecards, reporting systems, and data mining solutions. It provides end-users with predefined and ad-hoc reports, help them to measure and monitor progress toward organizational goals, and discover meaningful information about the data. SCM enabled BI such as analytics, reporting and dashboards monitors supply chain performance, as well as to gain new insights into all aspects of their businesses. BI allows driving performance improvement in individual functions, in business processes that span multiple functions, and supply chain through collaboration with customers, vendors and other trading partners. BI delivers significant benefits in terms of cost reduction, customer service improvements and lower inventory levels. Business transactions, customer demographics, seasonal flows, supplier data and inventory levels all have to be carefully coordinated to enable BI enabled supply chain solutions. The paper discussed role of BI in SCM. It is believed that supply chain analytics using BI in organizations will derive better operational efficiency and key performance indicators for any organization in supply chain management.

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Supply chain management (SCM) is fundamentally concerned with integration of activities both with and between organisations. IT plays a crucial role in SCM as a key enabler of supply chain integration (SCI). This chapter sets out the role of e-business concepts in the context of the supply chain challenges faced by firms. It specifically explores the role of e-procurement as an example of how e-business concepts have been applied to one key SCM activity, namely purchasing and procurement. In this context, the chapter examines the nature and evolution of e-marketplaces and goes on to identify Business intelligence tools support supply chain management by helping logistics professionals derive meaning from the data collected by logistics technology solutions. "Business intelligence is the use of computing technologies for the identification, discovery, and analysis of business data such as sales revenue, products, costs, and incomes," notes Techopedia. Regardless of its definition, many companies today are embracing business intelligence tools. And BI has become a must-have for the transportation and supply chain sector. Business intelligence/analytics is the highest-ranked functionality requested by customers, according to a recent ARC survey of leading transportation management solution (TMS) vendors. Professional people having experience in supply chain management have much influence on the success of the business. From planning, purchasing, production, transportation, storage, distribution and customer service supply chain professionals are having a major role in the process of running in any business. Professional people having experience in supply chain management have much influence on the success of the business. From planning, purchasing, production, transportation, storage, distribution and customer service supply chain professionals are having a major role in the process of running in any business. They connect all the major departments in the organization.