Impact of Information Technology on Supply Chain Management

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Abstract: Information is said to be the glue that holds supply chains together. As a key infrastructure, Web-based technologies continue to have significant impact on supply chain strategies. On the coordination side, the Web provides a virtually free platform for enhancing transparency, eliminating information delays and distortions, and significantly reducing transaction costs. One should note, however, that, although information flow has accelerated considerably, material flow has not gained much speed. This phenomenon makes the coordination of material, information, and cash flows even more crucial for effective supply chain coordination. On the design side, current technology does not yet permit dynamic supply chain design in response to changing business environment. The adoption of Web Services represents a significant step in that direction.

6.1 Introduction

The 1986 Annual Report of the Digital Equipment Corporation (DEC) set the ambitious goal “to connect all parts of an organization – the office, the factory floor, the laboratory, the engineering department – from desktop to data center. We can connect everything within a building; we can connect a group of buildings on the same site or at remote sites; we can connect an entire organization around the world. We propose to connect a company from top to bottom with a single network that includes the shipping clerk, the secretary, the manager, the vice president, even the president” (Garvin 1997). More importantly, this goal was not based on some vaporware, but on a concrete enabling technology, a new generation of super minicomputers based on a single computer architecture, VAX. From small desktop machines to computer clusters, VAX-based machines would be fully
compatible, use a uniform operating system, and communicate across shared networks.

While DEC was working on the hardware and the infrastructure, a relatively-young German company, SAP AG, was taking on a big gamble by transitioning its mainframe-based enterprise resource planning (ERP) software, the R/2, into the client-server architecture, the R/3, making the enterprise software accessible to thousands of organizations that did not necessarily wish to invest in mainframe computers.

However, it took almost two decades during which the computing power has tremendously increased and the Internet has become ubiquitous for DEC’s 1986 vision of creating a networked organization to become a reality. Scholars of strategic management increasingly recognize that the source of value creation may lie in networks of firms (Dyer and Nobeoka 2000; Gulati et al. 2000). Amit and Zott (2001) further built on this line of thinking by postulating that value is created by the way in which transactions are enabled. Enabling such transactions requires a network of capabilities drawn from multiple stakeholders such as customers, suppliers, and complementors.

Information plays a crucial role in enabling transactions in supply chains. Creating an adequate information infrastructure to interface the members of a supply network has always been challenging. Such an infrastructure must be able to satisfy simultaneously the following requirements (Upton and McAfee 1996): First, it must be able to accommodate members with varying degrees of IT sophistication. Second, it must provide a wide range of functionality ranging from simple data transmission to access to remote applications. Finally, it must be able to accommodate a constantly changing pool of suppliers and customers within varying stages of relationships.

The Internet has emerged as an infrastructure technology that may simultaneously satisfy these three requirements. Johnson and Wang (2002) define e-business as “the marriage between the Internet and supply chain integration.” Lee and Whang (2002) divide e-business applications into three categories: e-Commerce, e-procurement, and e-collaboration, as depicted in Figure 6.1. e-Commerce enables “a network of supply chain partners to identify and quickly respond to changing customer demand captured over the Internet.” e-Procurement enables “companies to use the Internet for procuring direct or indirect materials as well as for handling value-added services.” e-Collaboration facilitates “coordination of various decisions and activities beyond transactions among the supply chain partners over the Internet.”

ERP systems have played a crucial role in e-enabling companies. In a natural experiment conducted at a U.S. high-tech manufacturer, McAfee (2002) found evidence that the implementation of an ERP system has led to significant improvements in operational performance (e.g., lead times and on-time deliveries) after an initial performance dip. In a recent survey, however, supply chain professionals highlighted four shortcomings in current ERP systems (Akkermans et al. 2003):