Supply Chain Information Systems and Decision Support

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INTRODUCTION

Supply chains have become have become increasingly important as organisations have moved from competing on a stand-alone basis to recognizing that their success depends upon their trading partners. This includes their upstream suppliers and downstream customers. A supply chain involves a number of tiers of suppliers and customers that extends from the initial source of raw materials through to the final consumer of the finished product.

Supply chain management involves the coordination of a number of functional areas in multiple organisations. Large amounts of information can be captured describing the activities in these organisations. It is possible to use this information in order to assist in decision making at strategic, tactical, and operational levels of the supply chain. The large volume of information available and the interdependencies between the activities within these multiple organisations means that it is necessary to employ computerized decision support systems to optimize supply chain activities.

BACKGROUND

Christopher (2005, p. 4) defines logistics as

the process of strategically managing the procurement, movement and storage of materials, parts and finished inventory (and the related information flows) through the organisation and its marketing channels in such a way that current and future profitability are maximised through the cost-effective fulfillment of orders.

While logistics focuses on the movement of materials, Christopher (2005) describes supply chain management as being broader and defines supply chain management as "the management of upstream and downstream relationships with suppliers and customers to deliver superior customer value at less cost to the supply chain as a whole" (p. 5).

Porter's value chain model describes an organisation as a set of primary and support activities. The excess of the value added by the primary activities over the costs incurred by all the activities of the organisation provide the organisation's margin (Porter, 1985). The excess of value delivered to the customer over costs incurred throughout the supply chain represents the margin available to be shared among the supply chain participants. There has been a move away from traditional, transaction-oriented logistics practices which served to maximise the profitability of the individual firm. The relationship between supply chain participants has changed from being adversarial in nature to being cooperative. Organisations seek to increase the profitability of the supply chain as a whole and to share the available margin. Relationships between organisations have changed from a zero-sum game to a win-win situation.

Since the early 1990s, the process view of organisations has been mooted as a preferred alternative to the traditional functional structure. A process is a set of related activities which take place in a number of different functional units. A process-oriented organisation seeks to optimise the overall process in order to meet the needs of the end-customer of that process. This contrasts with the functional view which seeks to optimise individual functional units and which leads to suboptimal overall performance and which tends to ignore the needs of the customer.

The supply chain concept extends the process view to include multiple organisations. Processes which extend across organisational boundaries seek to satisfy the needs of the end-customer in an optimal manner. The profitability of each organisation in the supply chain depends on the success of the supply chain as a whole in serving the needs of the customer. Ultimately it is from the end-customer that funds are made available throughout the entire supply chain.

The execution of these interorganisational processes generates large amounts of data which can be shared among supply chain members. This information can be used to aid decision making to support the complex task of managing the supply chain. The major areas which require decision support are production planning, transportation, and inventory control.

SUPPLY CHAIN INFORMATION SYSTEMS AND DECISION SUPPORT

The process view of organisations as espoused by Hammer (1990) and Davenport and Short (1990) identified the interdependent nature of activities within organisations and promoted the alignment of these activities to focus on the customer. The move away from functional silos, which treated each functional unit as independent, required a sharing of information between these functional areas. The move to process-oriented organisations was hampered by the limited power of available information technologies at that time. Many organisations had computer applications which existed as islands of automation within these functional silos. These applications were not designed to share information and in many cases the applications and their data were incompatible. There emerged a business requirement for applications which were more process-oriented and which could serve to integrate multiple functional areas within the organisation. This period also saw the development of more powerful information and communication technologies. Local area networks, client-server computing, database servers, application servers, and Internet technologies were adopted by many organisations and facilitated the deployment of interfunctional information systems. Linked applications helped move away from islands of automation to provide a seamless flow of information.

Supply chains can be seen as a set of linked value chains. For example, the outbound logistics activity of one value chain links with the inbound logistics activity of its downstream partners. Cooperation can also exist in activities such as marketing and research and development. In order to meet the needs of the end-customer, the principles of integration that have been applied to internal company activities should be extended to activities that span the supply chain. The development of integrated activities requires a strategic approach. Organisations that have taken a process view of their internal activities have moved from having strategies which have an intracompany intraoperation scope which seeks to minimise local costs to having strategies with an intracompany interfunctional scope. Extending the strategy to include supply chain partners leads to an intercompany interfunctional scope (Chopra & Meindl, 2004, pp. 44-49).

Organisational structure and processes should be designed in order to support the chosen strategy. Harmon (2003) advocates the development of a process architecture to meet the goals set out in the organisation's strategy. Information technology (IT) planning should be informed by, and support, the process architecture. An intercompany interfunctional strategy requires processes that cross organisational boundaries and interorganisational information systems to support these processes. These processes should be designed to meet the needs of the end-customer and the information systems used should assist in the operation and management of these processes.

A number of generic supply chain processes have been proposed. The Supply Chain Council has proposed the Supply Chain Operations Reference (SCOR) model. This model includes five top level processes which are plan, source, make, deliver, and return. These are decomposed into a number of level 2 and level 3 subprocesses (Harmon, 2003). Lambert and Cooper (2000) propose a number of supply chain processes. These are customer relationship management, customer service management, demand management, order fulfillment, manufacturing flow management, procurement, product development and commercialization, and returns. These processes rely on the flow of information across the supply chain.

STRUCTURE OF THE SUPPLY CHAIN

The structure of the supply chain depends upon the nature of the product and the nature of demand for the product. Fisher (1997) stated that functional products require efficient supply chains whereas innovative products require responsive supply chains. Efficient supply chains are associated with the concept of leanness, which developed from the Toyota Production System and which emphasizes cost reduction. Responsive supply chains are associated with the concept of agility which developed from flexible manufacturing systems. Christopher (2000) associates lean supply systems with