THE EFFECT OF SUPPLY CHAIN MANAGEMENT PROCESSES ON COMPETITIVE ADVANTAGE AND ORGANIZATIONAL PERFORMANCE

THESIS

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Abstract

One of the most significant changes in the paradigm of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains. In this emerging competitive environment, the ultimate success of the business will depend on management's ability to integrate the company's intricate network of business relationships. Effective supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance since competition is no longer between organizations, but among supply chains. This research conceptualizes and develops three dimensions of SCM practice (supplier relationship management, manufacturing flow management, and product development and commercialization) and tests the relationships between these SCM practices, competitive advantage, and organizational performance. Data for the study was collected from prominent organizations and the relationships proposed in the framework were tested using rigorous statistical techniques. The results indicate that higher levels of SCM practice can lead to enhanced competitive advantage and improved organizational performance. These results have value to both the academic and business worlds as they provide verification of the widely held belief of the value of effective supply chain management.

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Ronald M. Salazar

Table of Contents

List of Figures

List of Tables

EFFECT OF SUPPLY CHAIN MANAGEMENT PROCESSES ON COMPETITIVE ADVANTAGE AND ORGANIZATIONAL PERFORMANCE

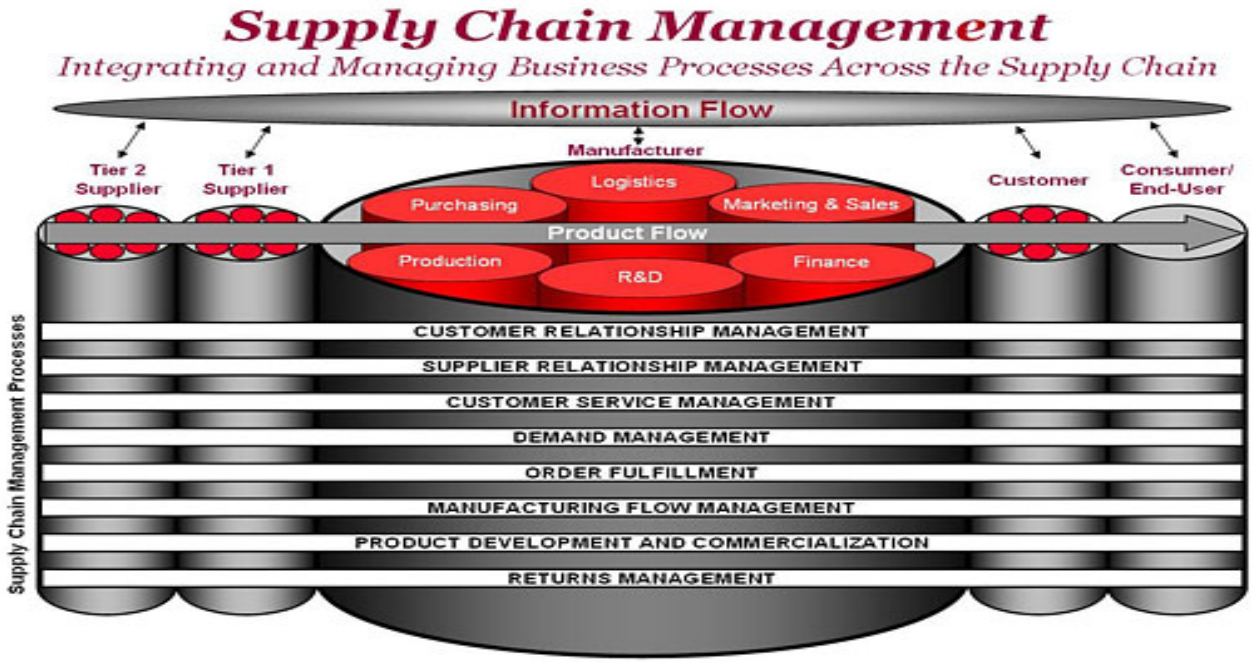
I. Introduction

The goal of Supply Chain Management (SCM) is to integrate both information and material flows seamlessly across the supply chain as an effective competitive weapon (Childhouse, 2003) The name is somewhat misleading as a supply chain is not a formal chain of businesses, but a network of businesses and relationships. In reviewing the prevailing literature available, it is clear that one common definition of SCM does not exist. The Global Supply Chain Forum consists of top executives of leading firms from a wide variety of industries, such as communications and technology, consumer packaged goods, fashion apparel, commodity merchandising, oil and petrochemicals, automotive manufacturing, athletic equipment, household plumbing and accessories, and consumer electronics. Member companies represent all possible locations across a supply chain: original suppliers, manufacturers of industrial products (business to business), manufacturers of consumer products, distributors, and retailers. Therefore, the views presented by the Global Supply Chain Forum represents combined knowledge and experiences from leading firms in the corresponding industry (Goldsby, et al, 2003).

The members of the Global Supply Chain Forum (2009) have developed the following definition which neatly encapsulates the aspects of SCM: Supply chain management is the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders. This view of SCM is illustrated in Figure 1(Drucker, 1998), which depicts a simplified supply chain network structure, the information and product

flows, and the SCM processes that integrate functions within the company as well as other firms across the supply chain. The eight supply chain management processes identified by the Global Supply Chain Forum and shown in Figure 1 are:

Figure 1. Eight supply chain management processes



(Lambert, 2008)

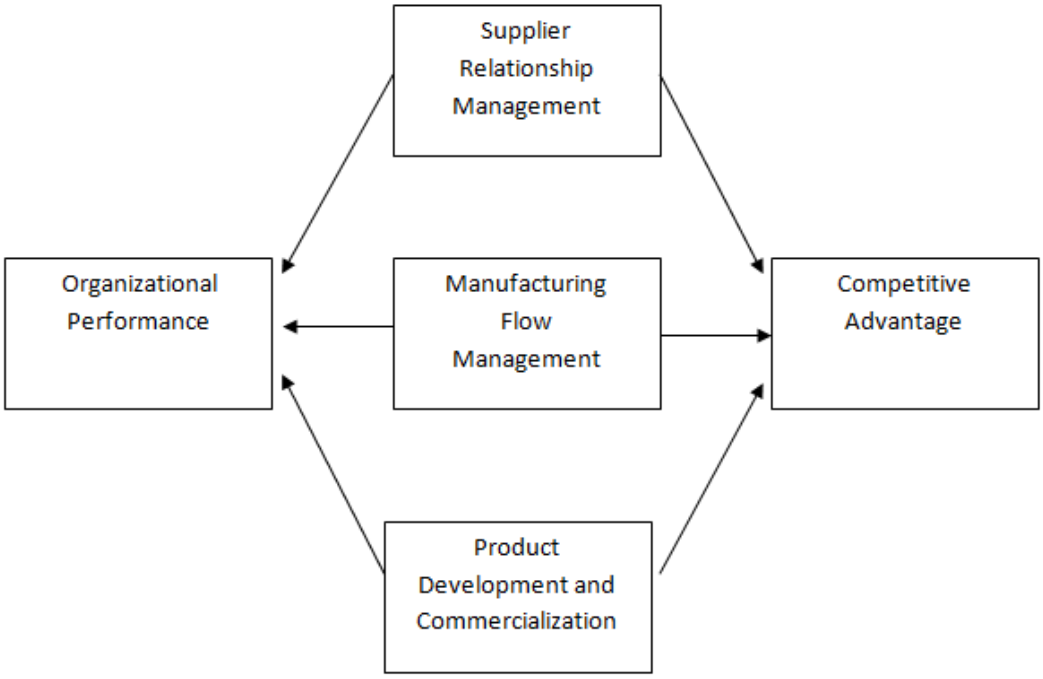
- **Customer relationship management** – provides the firm's face to the customer, including management of the PSAs, and provides a single source of customer information.
- **Supplier relationship management** – provides the structure for how relationships with suppliers are developed and maintained, including the establishment of PSAs between the firm and its suppliers.
- **Customer service management**- provides the firm's face to the customer, including management of the PSAs, and provides a single source of customer information

- **Demand management**- provides the structure for balancing the customers' requirements with the capabilities of the supply chain.
- **Order fulfillment**- includes all activities necessary to define customer requirements, design the logistics network, and fill customer orders.
- **Manufacturing flow management-** includes all activities necessary to move products through the plants and to obtain, implement, and manage manufacturing flexibility in the supply chain.
- **Product development and commercialization** – provides the structure for developing and bringing to market new products jointly with customers and suppliers.
- **Returns management-** includes all activities related to returns, reverse logistics, gatekeeping, and avoidance.

Each SCM process has both strategic and operational sub-processes. The strategic sub-processes provide the structure for how the process will be implemented and the operational sub-processes provide the detailed steps for implementation. The strategic process is a necessary step in integrating the firm with other members of the supply chain, and it is at the operational level that the day-to-day activities take place (Lambert, 2008). This survey instrument utilized in this study aims at filling the gap in the literature on the effect of supply chain processes by empirically testing the effect of the eight processes on organizational performance and competitive advantage. However, due to size limitations and time constraints, only three of the processes and their effect on organizational performance and competitive advantage are fully examined in this study: supplier relationship management, manufacturing flow management, and

product development and commercialization. Figure 2 presents the model that was developed and analyzed for this research. Two other thesis are being produced concurrently with this study, they will examine the effect of the other five supply chain processes on organizational performance and competitive advantage.

Figure 2 Research Model



CHAPTER 2

LITERATURE REVIEW

Supply chain management

Several authors have defined supply chain management. Simchi-Levi and Kaminsky (2000) define supply chain management as "the integration of key business processes among a network of interdependent suppliers, manufacturers, distribution centers, and retailers in order to improve the flow of goods, services, and information from original suppliers to final customers, with the objectives of reducing system-wide costs while maintaining required service levels". The Council of Supply Chain Management Professionals (CSCMP) (2004) defines SCM as: "SCM encompasses the planning and management of all activities involved in sourcing and procurement, conversion, and all logistics management activities, including coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers". Cooper, Lambert, and Pagh (1997) define SCM as the management and integration of the entire set of business processes that provides products, services and information that add value for customers. Other definitions of supply chain management are offered in Table 1. Though these definitions differ slightly in wording, all communicate the importance of integration, communication and coordination between functions and organizations that will create value for the customer (Gillyard, 2003).

Table 1. Supply chain management definitions

Authors	Definition
Tan et al. (1998)	SCM encompasses materials/supply management from the supply of basic raw materials to final product (and possible recycling and re-use). SCM focuses on how firms utilize their suppliers' processes, technology and capability to enhance competitive advantage. It is a management philosophy that extends traditional intra-enterprise activities by bringing trading partners together with the common goal of optimization and efficiency.
Berry et al. (1994)	SCM aims at building trust, exchanging information on market needs, developing new products, and reducing the supplier base to a particular OEM so as to release management resources for developing meaningful, long term relationships.
Jones and Riley (1985)	An integrative approach to dealing with the planning and control of the materials flow from suppliers to end-users.
Saunders (1995)	External Chain is the total chain of exchange from original source of raw material, through the various firms involved in extracting and processing raw materials, manufacturing, assembling, distributing and retailing to ultimate end customers.
Ellram (1991)	A network of firms interacting to deliver product or service to the end customer, linking flows from raw material supply to final delivery.
Christopher (1992)	Network of organizations that are involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of products and services in the hands of the ultimate consumer.
Lee and Billington (1992)	Networks of manufacturing and distribution sites that procure raw materials, transform them into intermediate and finished products, and distribute the finished products to customers.
Kopczak (1997)	The set of entities, including suppliers, logistics services providers, manufacturers, distributors and resellers, through which materials, products and information flow.
Lee and Ng (1997)	A network of entities that starts with the suppliers' supplier and ends with the customers' custom production and delivery of goods and services.

(Croom, Romano, & Giannakis, 2000)

SCM is a discipline in the early stages of evolution (Gibson, Mentzer, & Cook, 2005). SCM gives a concrete form to the so called "business ecosystem idea" and

provides a framework of processes for firms to engage in co-existence rather than competition (Bechtel & Jayaram, 1997). Consultants proposed the term and educators proposed the structure and theory for executing SCM. The term "supply chain management" first appeared in 1982 (Oliver & Webber). Around 1990, academics first described SCM from a theoretical point of view to clarify the difference from more traditional approaches and names (such as logistics), to managing material flow and the associated information flow (Cooper et al., 1997). The term supply chain management has grown in popularity over the past two decades, with much research being done on the topic (Ashish, 2007).

The concept of SCM has received increasing attention from academicians, consultants, and business manager's alike (Feldmann & Müller, 2003, Tan, Lyman & Wisner, 2002, Van Hoek, 1998). Many organizations have begun to recognize that SCM is the key to building sustainable competitive edge for their products and/or services in an increasingly crowded marketplace (Jones, 1998). The concept of SCM has been considered from different points of view in different bodies of literature (Croom et al., 2000) such as purchasing and supply management, logistics and transportation, operations management, marketing, organizational theory, and management information systems.

Tan, Kannan, Handfield & Ghosh (1999) attempted to link certain supply chain management practices with firm performance. In particular, they examined the effects of quality management, supply base management and customer relations practices on firm financial performance. They found that some aspects of quality management – use of

performance data in quality management, management commitment to quality, involvement of quality department, and social responsibility of management -- all were positively related to firm performance (Gillyard, 2003). Managing the supply base was found to have a significant impact on firm growth but not on overall performance. The significance of supply chain management highlights the need for companies to actively manage their supply chain to maximize their performance. As Mentzer et al. (2001) said, a supply chain will exist whether a firm actively manages it or not.

Boddy, Cahill, Charles, Fraser-Kraus, and Macbeth (1998) found that more than half of the respondents to their survey considered that their organizations had not been successful in implementing supply chain partnering; Spekman, Kamauff, and Myhr (1998), noted that 60% of supply chain alliances tended to fail. Deloitte Consulting survey reported that only 2% of North American manufacturers ranked their supply chains as world class although 91% of them ranked SCM as important to their firm's success (Thomas, 1999). It appears that while SCM is important to organizations; effective management of the supply chain does not yet appear to have been realized.

Supplier relationship management

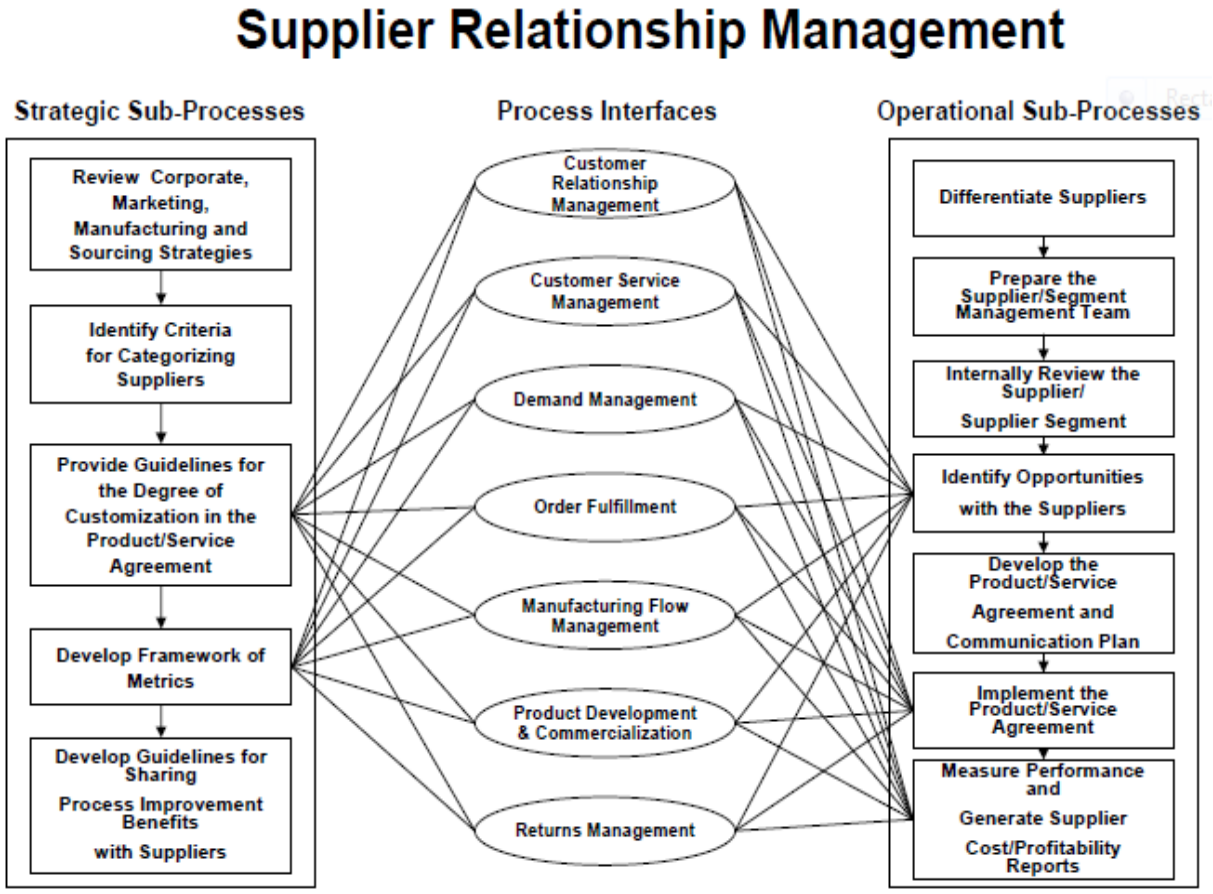
The Global Supply Chain Forum (GSCF), a group of non-competing firms and a team of academic researchers, defines supplier relationship management as "the supply chain management process that provides the structure for how relationships with suppliers are developed and maintained." The supplier relationship management process is managed by a team with members from other functions as well as representatives from other companies in the supply chain. In other words, management activities in the supplier relationship management process are coordinated with inputs from purchasing,

operations, logistics, finance, R&D, sales, and marketing functions. Through the cross-functional coordination, information from both the suppliers and customers are provided to the supplier relationship management activities (Wang, 2007).

The cost of materials as a percentage of sales has been estimated at approximately 53% for all types of manufacturing in the United States. These costs range from a low of 27% for tobacco products to a high of 83% for petroleum and coal products but most industries are in the 45 – 60% range (Stock, 2001). This amount of money spent represents a significant opportunity for companies to realize cost savings through better management of their supplier network. As part of the supplier relationship management process, close relationships are developed with a small set of key suppliers based on the value that they provide to the organization over time, and more traditional relationships are maintained with the others (Dyer, Dong & Wu, 1998). Management identifies those suppliers and supplier groups to be targeted as part of the firm's business mission. Supplier relationship management teams work with key suppliers to tailor product and service agreements (PSA) to meet the organization's needs, as well as those of the selected suppliers. Standard PSAs are crafted for segments of other suppliers. Supplier relationship management is about developing and managing the PSAs. Teams work with key suppliers to improve processes, and eliminate demand variability and non-value added activities. The goal is to develop PSAs that address the major business drivers of both the organization and the supplier. Performance reports are designed to measure the profit impact of individual suppliers as well as the firm's impact on the profitability of suppliers (Lambert, 2008).

The supplier relationship management process has both strategic and operational elements. Croxton, Lambert, Rogers, and Garcia-Dastague (2001) have divided the process into two parts, the strategic process in which the firm establishes and strategically manages the process, and the operational process which is the actualization of the process once it has been established. Figure 3 graphically represents these sub-processes.

Figure 3 Supplier relationship management

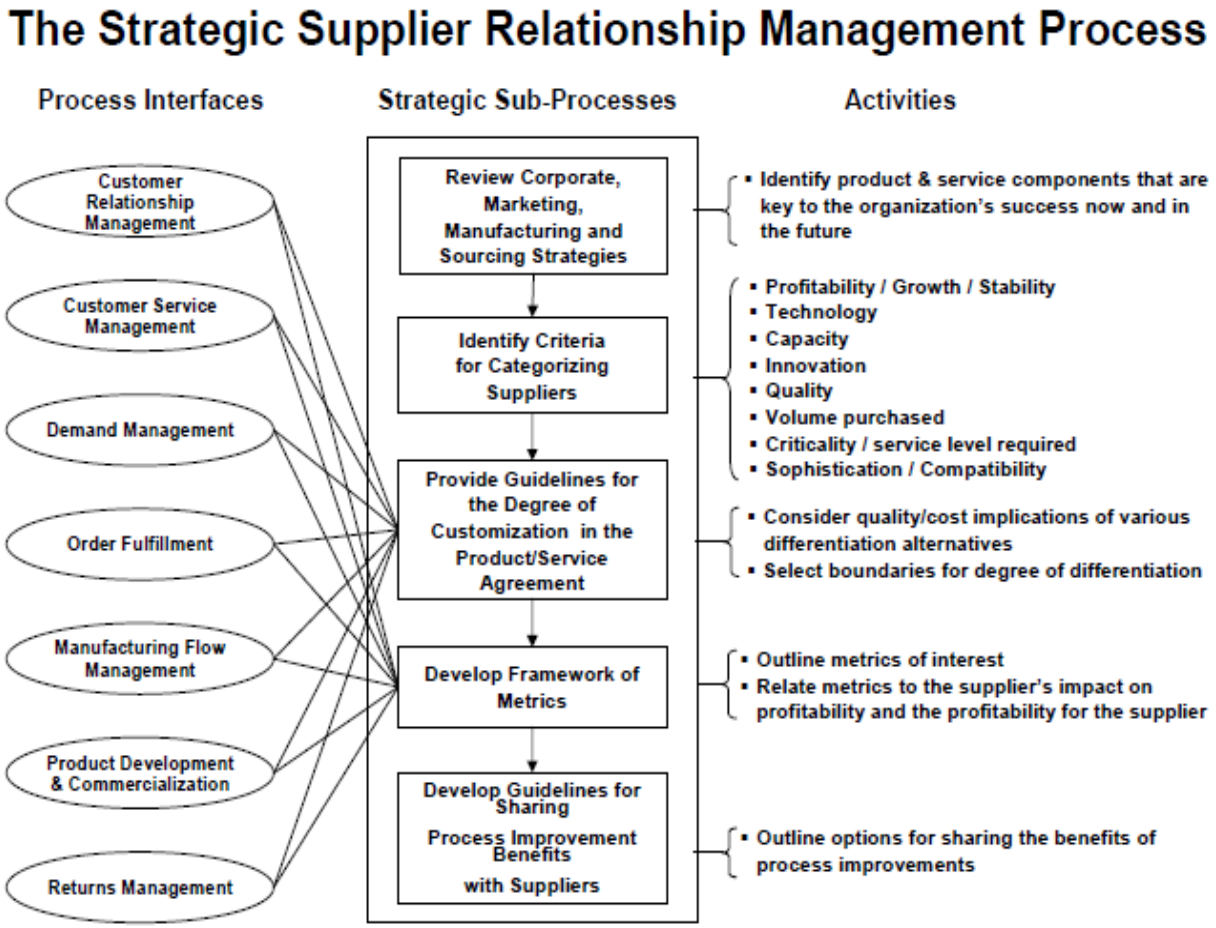


(Croxton et al, 2001)

Supplier relationship management strategic sub-processes

At the strategic level, the supplier relationship management process provides the structure for how relationships with suppliers are managed. It is comprised of five sub-processes represented in Figure 4.

Figure 4 Strategic supplier relationship management sub-processes



(Croxton et al, 2001).

The first strategic sub-process is: Review corporate, marketing, manufacturing and sourcing strategies. During this process the supplier relationship management team identifies supplier segments that are critical to the organization's success now and in the

future. By reviewing these strategies, management identifies the supplier types with whom the firm needs to develop long-term relationships (Lambert, 2008).

The second strategic sub-process is: Identify criteria for segmenting suppliers. The purpose of this segmentation is to determine which suppliers should get specifically tailored PSAs and which should be grouped together and receive standard PSAs. Potential criteria include: profitability; growth and stability; the criticality of the service level necessary; the sophistication and compatibility of the supplier's process implementation; the supplier's technology capability and compatibility; the volume purchased from the supplier; the capacity available from the supplier; and the suppliers anticipated quality levels (Burt, 2003).

The third strategic sub-process is: Provide guidelines for the degree of customization in the product and service agreements. This involves developing the differentiation alternatives and considering the revenue and cost implications of each. To do this, the team considers the quality and cost implications of various differentiation alternatives, and selects the boundaries for the degree of customization (Lambert, 2008).

The fourth strategic sub-process is: Develop framework of metrics. These metrics should reflect the supplier's impact on the firm's profitability and vice-versa. The supplier relationship team has the responsibility for assuring that the metrics used to measure supplier performance do not conflict with the metrics used in the other processes. Management needs to insure that all internal and external measures are driving consistent and appropriate behavior (Lambert, 2001).

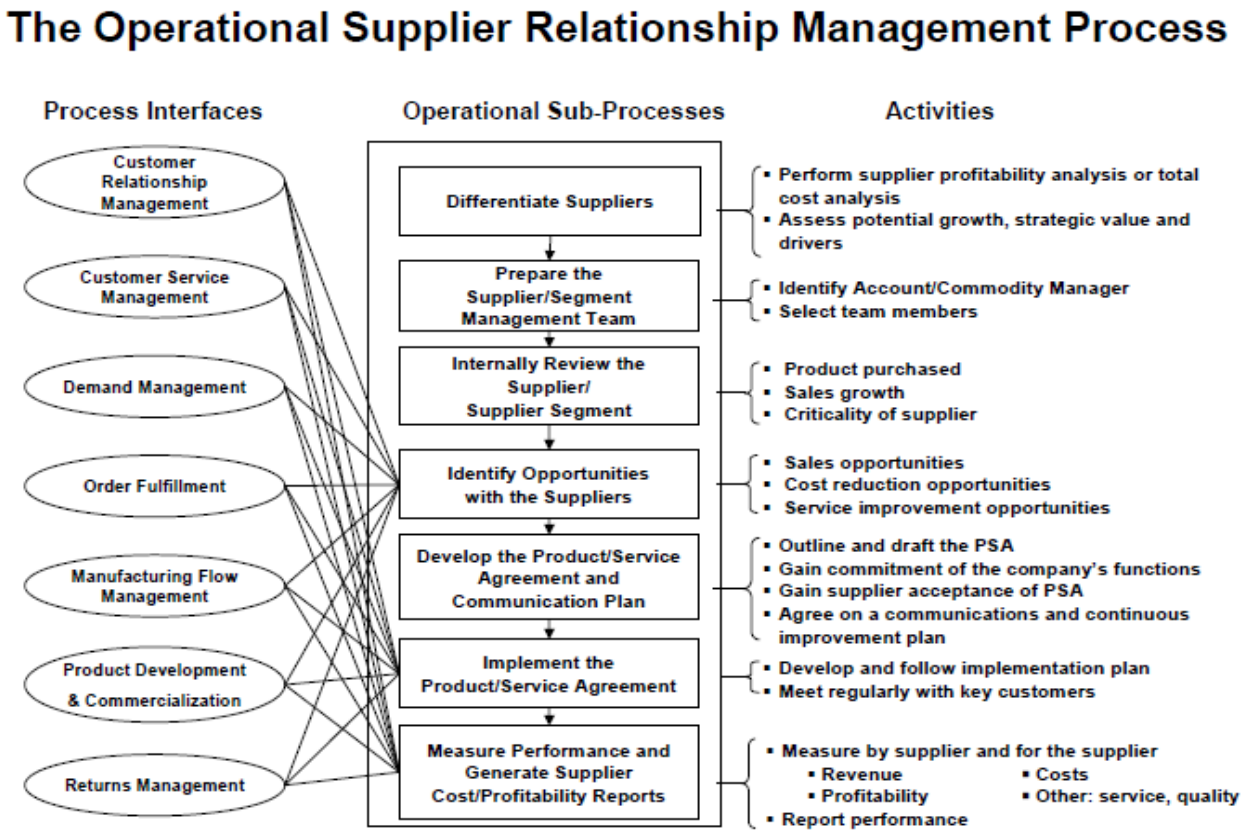
The fifth and final sub-process is: Develop guidelines for sharing process improvement benefits with suppliers. The goal is to make these process improvements

mutually beneficial for both parties involved. If the supplier does not gain from these improvements it will be next to impossible to get their full commitment to achieving these goals.

Supplier relationship management operational sub-processes

At the operational level, the supplier relationship management process deals with developing and implementing the PSAs. This is It is comprised of seven sub-processes represented in figure 5.

Figure 5 Operational supplier relationship management sub-processes



(Lambert, 2008)

The first operational sub-process is: Differentiate suppliers. These suppliers are segmented based on criteria developed in the strategic process. One of the new models

being widely adopted, that many companies have found useful in segmenting their suppliers, looks at two fundamental characteristics that practitioners believe should shape purchasers decisions. These are: Substitutability and/or availability of comparable products; and strategic importance of the supplier's product (Rackham, 2008).

The second operational sub-process is: Prepare the supplier/segment management team. The teams are cross-functional with representation from each of the functional areas. In the case of key suppliers, each team is dedicated to a specific supplier and meets regularly with a team from the supplier organization In the case of supplier segments, a team manages a group of suppliers and develops and manages the standard PSA for the segment (Lambert, 2008).

The third operational sub-process is: Internally review the supplier/ supplier segment. The teams review their suppliers or segment of suppliers to determine the role that the supplier or segment of suppliers plays in the supply chain. The teams work to identify improvement opportunities (Lambert, 2008).

The fourth operational sub-process is: Identify opportunities with the suppliers. The teams work with each supplier or segment of suppliers to develop improvement opportunities. These opportunities may arise from any of the supply chain management processes, so the supplier teams need to interface with each of the other process teams (Lambert, 2008).

The fifth operational sub-process is: Develop the product and service agreements and communication plans. Each team develops the PSA for their supplier or segment of suppliers. For key suppliers, the team negotiates a mutually beneficial PSA, and then gains commitment from the supplier's internal function (Lambert, 2008).

The sixth operational sub-process is: Implement the product and service agreements. The team implements the PSA, which includes holding regular planning sessions with key suppliers. The supplier relationship management teams provide input to each of the other supply chain management process teams that are affected by the customizations that have been made in the PSAs. The teams must work with other process teams to assure that the PSAs are being implemented as determined (Lambert, 2008).

The seventh and final operational sub-process is: Measure performance and generate supplier cost/profitability reports. The team captures and reports the process performance measures. Metrics from each of the other processes also are captured in order to generate the supplier cost/profitability reports. These reports provide information for measuring and selling the value of the relationship to each supplier and internally to upper management (Lambert, 2008).

Supplier relationship management is often referred to in the literature as strategic supplier partnership. Gunasekaran et al. (2001) assert that a strategic partnership emphasizes long-term relationship between trading partners and "promotes mutual planning and problem solving efforts". Strategic partnerships between organizations promote shared benefits and ongoing collaboration in key strategic areas like technology, products, and markets (Yoshino & Rangan, 1995). Strategic partnerships with suppliers facilitate organizations to work closely and effectively with a few suppliers rather than many suppliers that have been selected solely on the basis of cost (Ashish, 2007). Some of the advantages of including suppliers early in the product-design process are:

suppliers can offer cost effective design alternatives, assist in selecting better components and technologies, and aid in design assessment (Tan et al., 2002).

Global sourcing has forced companies to manage their supplier relationships more effectively. Mentzer (2001) suggests that the key to effective management in the global environment is to have closer relationships with suppliers. Firms are moving from the traditional approach of a one-time, cost based relationship with many suppliers to long term relationships with a few good suppliers (Kalwani & Narayandas, 2007). Firms are beginning to use supplier relationship techniques as a way to gain competitive advantage (Ballou, Gilbert & Mukherjee, 2000).

Supplier relationship management involves developing partnership relationships with key suppliers to reduce costs, innovate with new products and create value for both parties' bases on a mutual commitment to long term collaboration and shared success. For complex relationships between large companies such as Coca-Cola and Cargill, it may be necessary to coordinate multiple divisions spread across multiple geographic areas. Cargill is the largest ingredient and nutritional company in the world. It is also one of Coca Cola's main suppliers. As one can imagine the relationship between these companies is very detailed and complex. As such, cross-functional teams from each of the companies meet on a regular basis to identify products that will create joint value in areas such as new markets, new products, productivity and sustainability. This vital relationship involves the CEOs of both companies (Lambert, 2008).

Supplier relationship management has become a critical business process as a result of: competitive pressures; the need to achieve cost efficiency in order to be cost competitive; and, the need to achieve cost efficiency in order to be cost competitive; and,

the need to develop closer relationships with key suppliers who can provide the expertise necessary to develop closer relationships with key suppliers who can provide the expertise necessary to develop innovative new products and successfully bring them to market (Lambert, 2008).

Watts and Kahn (1993), surveyed members of the National Association for Purchasing Management (NAPM) representing a wide range of industry types, sizes, and purchasing departments to determine the extent of involvement in supplier relationship management programs. They found that supplier relationship programs were more prevalent than was expected and were called by different names depending on the emphasis of the program. Also, the majority of the firms had active programs of 6 months to over 4 years and had created permanent organizational units to handle supplier relationship programs (Sichinsambwe, 2011).

Watts and Kahn also found that most of the supplier development programs were initiated at the divisional or corporate levels with most functional areas of the business participating in the program with varying degrees of involvement. In particular, purchasing, quality control, and engineering were more involved in the program as compared to materials management and the production department who were less involved and marketing, research and development, and finance who were only occasionally involved. Despite the fact that many functional areas were involved in supplier development programs, the number of people involved was ten or less.

Watts and Kahn also examined differences between firms that had implemented supplier development programs and those that had not implemented supplier development programs. They found that firms with supplier development programs

tended to be larger firms in terms of annual gross sales, total employment and size of the purchasing department than firms without such programs (Sichinsambwe, 2011).

Krause (1997) surveyed purchasing executive members of NAPM representing different industries to investigate outcomes of supplier development activities and whether companies were satisfied with the outcomes. The results showed that supplier performance had improved as a result of the supplier relationship management effort. Buyers reported that supplier management efforts with a single supplier had led to significant improvement in incoming defects, percent on time delivery, order cycle times and percent orders received complete. Further, buyers were generally satisfied with the outcomes from their supplier development efforts. Specifically, supplier management efforts had yielded reduced costs for the buyer‘s final product or service. Also, the results showed that buyers perceived an improvement in the continuity of the relationship with their suppliers after the supplier relationship effort than before (Sichinsambwe, 2011).

Humphreys, Li, and Chan (2004) examined the role of supplier relationship management in the context of buyer–supplier performance from a buying firm‘s perspective using a survey of 142 electronic manufacturing companies in Hong Kong. Overall, their findings were that transaction-specific supplier development and its infrastructure factors (supplier development strategic goals, top management support of purchasing management, effective buyer-supplier communication, buyer‘s long-term commitment to the supplier, supplier evaluation, supplier strategic objectives, and trust in supplier) significantly correlated with the perceived buyer-supplier performance outcomes. Specifically, they found that transaction-specific supplier development,

supplier strategic objectives and trust significantly contributed to the prediction of supplier performance improvement. Also, the study found that transaction-specific supplier development, supplier strategic objectives and trust contributed to the prediction of buyer‘s competitive advantage improvement. Similarly, regarding the prediction of buyer-supplier relationship improvement, transaction-specific supplier development and infrastructure factors of supplier strategic objectives and trust contributed to the prediction of buyer-supplier relationship improvement.

Krause and Ellram (1997) surveyed 527 high-level purchasing executives who were members of the NAPM to determine whether buying firms’ success in their supplier relationship efforts varied, and if so, to identify factors contributing to perceived success or failure. They found that success in supplier development did indeed vary and they split the respondents into two groups representing those firms that had successfully implemented supplier development programs and those that had received less success. The successful group had experienced a superior increase in supplier performance as a result of the supplier development compared to the less successful group. Specifically, the successful group experienced significantly higher improvements in incoming defects and percentage orders received complete; however, the two groups appeared to have experienced roughly the same increases in on-time delivery and order cycle time reduction (Sichinsambwe, 2011).

Krause, Handfield, and Scannell (1998) conducted a survey to compare the supplier relationship management practices of manufacturing and service firms. The authors compared the two groups on the satisfaction derived from supplier relationship management efforts using performance goals comprising increased financial strength,

supply base reduction, increased management capability, and improved technical capability; and performance goals which included quality, cost, delivery performance, and service/ responsiveness. Both groups placed moderate levels of importance for the strategic goals but rated performance goals much higher than strategic goals. The manufacturing firms placed more emphasis on quality than did the service firms, while service firms placed more emphasis on cost, delivery performance, and service/responsiveness than manufacturing firms. The only strategic goal that differentiated the two groups was financial strength where service firms placed a higher degree of importance on improving the financial strength of suppliers than did the manufacturing firms. Based on the results of the studies presented, the first two hypotheses are:

H1. Supplier relationship management practices will be positively related to competitive advantage within an organization.

H2: *Supplier relationship management practices will be positively related to organizational performance.*

Manufacturing flow management

Firms that perform the manufacturing activities in a supply chain face several challenges, one of which is to produce products in varieties and quantities that are in synch with the marketplace. However, the production function is known for its traditional ways of performing activities. This appears to be changing given the interest in innovative management techniques such as total quality management, just-in-time operations, and continuous improvement (Goldsby & Garcia-Dastague, 2003). Properly connecting production to actual demand represents a huge money-saving opportunity for

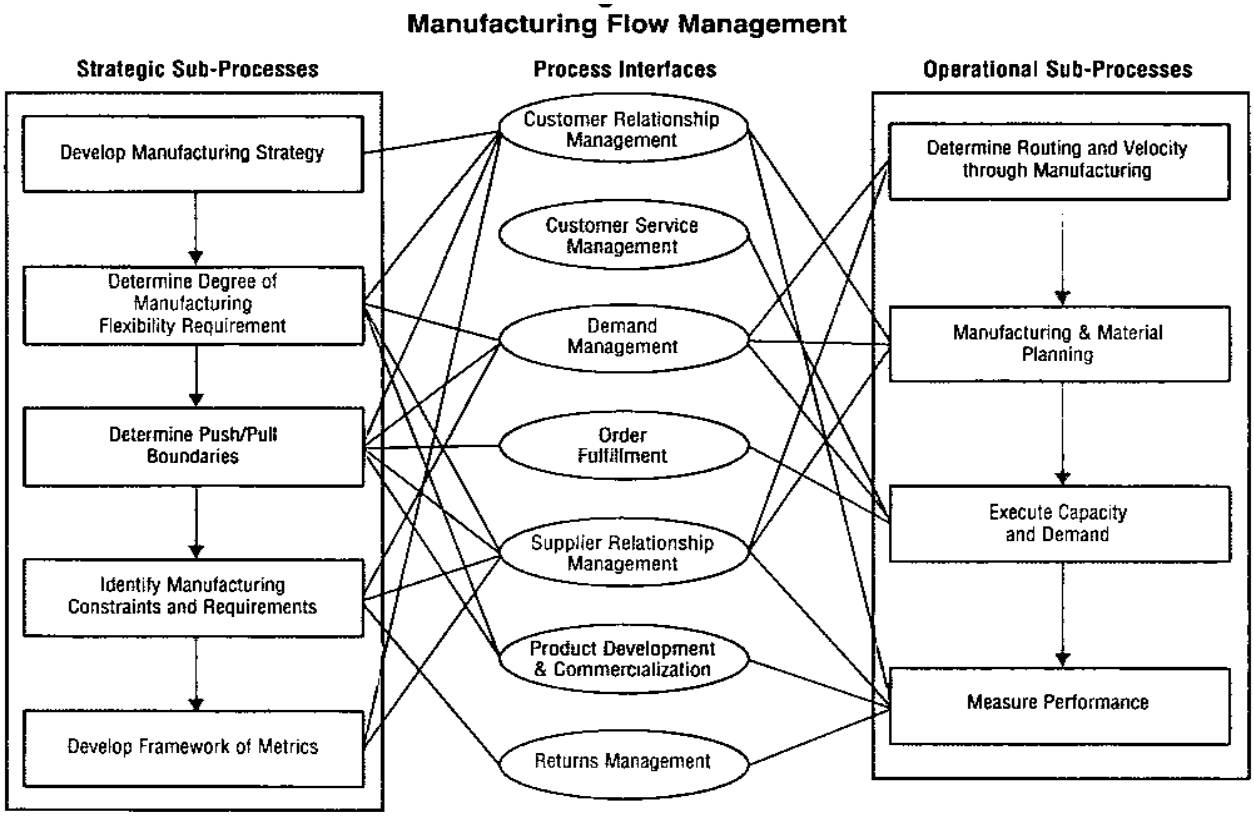
manufacturing companies and their supply chains. For example, the potential savings from Efficient Consumer Response, an effort to connect production management with the market in the food industry, have been estimated at $ 30 billion (Poirier, 1996). Firms that integrate procurement, manufacturing and logistics activities might achieve cost reductions of between three and seven percent of revenues (Hoover, Eero Eleranta & Huttunen, 2001).

Manufacturing flow management is the supply chain management process that includes all activities necessary to obtain, implement, and manage manufacturing flexibility in the supply chain and to move products through the plants (Goldsby & Garcia-Dastugue, 2003). This process deals with making the products and establishing the manufacturing flexibility needed to serve the target markets. Manufacturing flexibility reflects the ability to make a variety of products in a timely manner at the lowest possible cost and respond to changes in demand. To achieve a high level of manufacturing flexibility, planning and execution must extend beyond the individual organization towards other members of the supply chain. Manufacturing flow management should be implemented across the members of the supply chain that participate in the flow of products, as well as across those that have an effect on, or are affected by, the degree of manufacturing flexibility achieved by the supply chain as a whole (Goldsby & Garcia-Dastugue, 2003). The process involves much more that the production function within the firm and spans beyond the manufacturer in the supply chain. In fact, it is up to the entire supply chain to make the product flow as smooth as possible, as well to ensure that the desired flexibility is achieved.

The manufacturing flow management process team coordinates all activities necessary to obtain, implement, and manage manufacturing flexibility in the supply chain and to move products through the plants (Lambert, 2008). This process incorporates more than just simply production. For example, efficient product flow through a plant depends on the reliability of the inbound/receiving activity as well as the suppliers' ability to deliver complete orders on time. Therefore receiving and procurement functions should work closely with production to ensure efficient product flow during the manufacturing process. Suppliers also need to be involved in these discussions to ensure that potentially costly delays and miscommunications can be avoided.

The manufacturing flow management process has both strategic and operational elements, as shown in Figure 6. The strategic portion of manufacturing flow management provides the structure for managing the process within the firm and across key supply chain members. The operational portion of the process represents the actualization of manufacturing flow management. Developing the strategic process is a necessary first step toward integrating the firm with other members of the supply chain, and it is at the operational level that the day-to-day activities are executed (Goldsby& Garcia-Dastugue, 2003).

Figure 6 Manufacturing flow management sub-processes

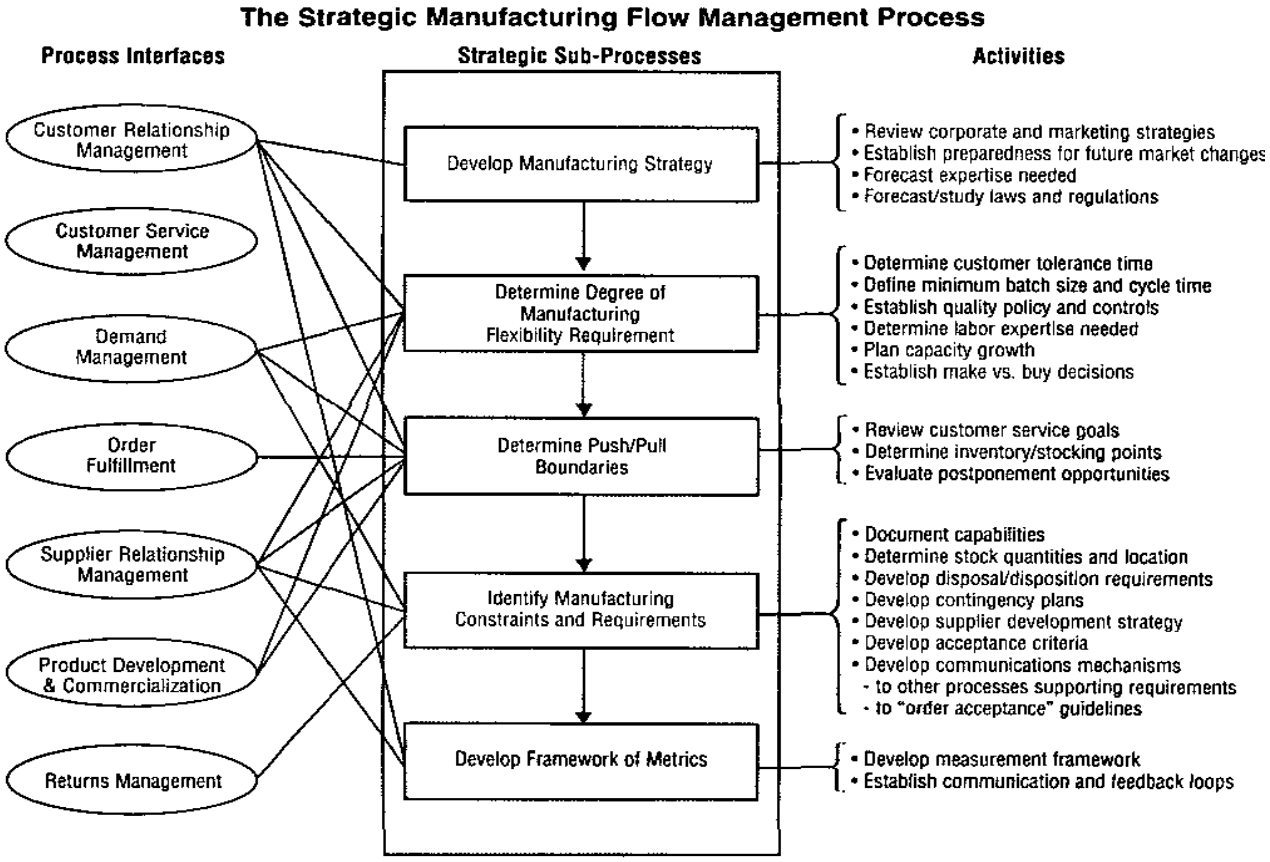


(Croxton et al., 2001)

Manufacturing flow management strategic sub-processes

The strategic portion of manufacturing flow management consists of five sub-processes that collectively represent the decision-making infrastructure for the process. This infrastructure embodies the development of the manufacturing plan, the means of execution, limits to execution, and the appropriate measures of performance. Each of the five sub-processes is addressed in order as depicted in figure 7. This figure includes the activities within each of the sub-processes as well as the interfaces between manufacturing flow management and the other supply chain management processes.

Figure 7 Strategic manufacturing flow management sub-processes



(Lambert, 2008)

The first strategic sub-process that the manufacturing flow management team develops is the manufacturing strategy. The manufacturing strategy dictates the priorities of the production function and the roles of its suppliers and supporting service providers (Demeter, 2003). In this sub-process, the strategy starts to be translated into required capabilities and deliverables. Typically, the team will review corporate and marketing strategies to determine the manufacturing strategy that best accommodates customer demand. This marks an important shift in mentality from "We sell what we make" to "We make what we sell" (Goldsby & Garcia-Dastague, 2003). This is an important

distinction that must be understood as it leads to the production of products that satisfy the needs of an increasingly diverse marketplace.

The second strategic sub-process that the manufacturing flow management team develops is determining the degree of manufacturing flexibility required. Manufacturing flexibility ensures the company's ability to manage resources and uncertainty to meet various customer requests (Lambert, 2008).

As a general rule more flexibility is preferred over less. However, as with any other advantage in business there is a cost associated with developing manufacturing flexibility. Therefore, the targeted type and degree of flexibility should fit the overall business strategy (Gaimon & Singhal, 1992). Key customers may receive a higher degree of flexibility in order to keep that customer satisfied. However, managers must be confident that the firm will be rewarded by these customers for providing greatened amounts of manufacturing flexibility. If this flexibility is determined to be of little or no value to the customer than the managers may reduce this flexibility in or to contain costs. The customer relationship management team is vital in determining the amount of flexibility required in order to satisfy the customer. By evaluating their input, management should be able to determine the desired degree of manufacturing flexibility that is desired.

The third strategic sub-process that the manufacturing flow management team develops is determining push/pull boundaries. Push/pull boundaries refer to the positioning of a decoupling point in the supply chain – up to which supply is pushed forward as make-to-stock but beyond which demand drives make-to-order execution (Graves & Williams, 2000). This of course is a conceptual simplification, it is doubtful

that a single decoupling point is evident in a diverse supply chain. It is more likely that more than one decoupling point is needed in a modern supply chain. The key to determining a push/pull boundary is recognizing the stage of value-added processing in which differentiation from a standard configuration takes place (Goldsby et al., 2003). In a buy-to-order arrangement, manufacturing flexibility is at a premium and the primary decoupling point is upstream from the manufacturer given that raw materials are unique to the individual finished good. At the other extreme, ship-to-stock strategies generate a standardized product, allowing the decoupling point inventories to reside in the manufacturer's distribution channel (Naylor, Naim & Berry 1999).

The fourth strategic sub-process that the manufacturing flow management team develops is identifying manufacturing constraints and determining capabilities. During this sub-process management must address the roles and responsibilities of the supply chain members to identify manufacturing constraints and requirements for desired performance. Recognizing bottlenecks in the manufacturing process is critical in achieving this objective (Lambert, 2008). Among the more common constraints are labor and equipment resources. Ensuring that existing resources meet current and future demand ranks among the greatest difficulties for manufacturers (Goldsby et al., 2003).

Manufacturing constraints and requirements will lead to the development of in the inventory policy for each facility in the supply chain network structure. The inventory policy will include how much inventory is to be held in the form of raw materials, subcomponents, work-in-progress, and finished goods, and how often inventory will be replenished. Finally, the inventory policy will determine the appropriate actions in the event of a stockout, which will be coordinated with demand management and, eventually,

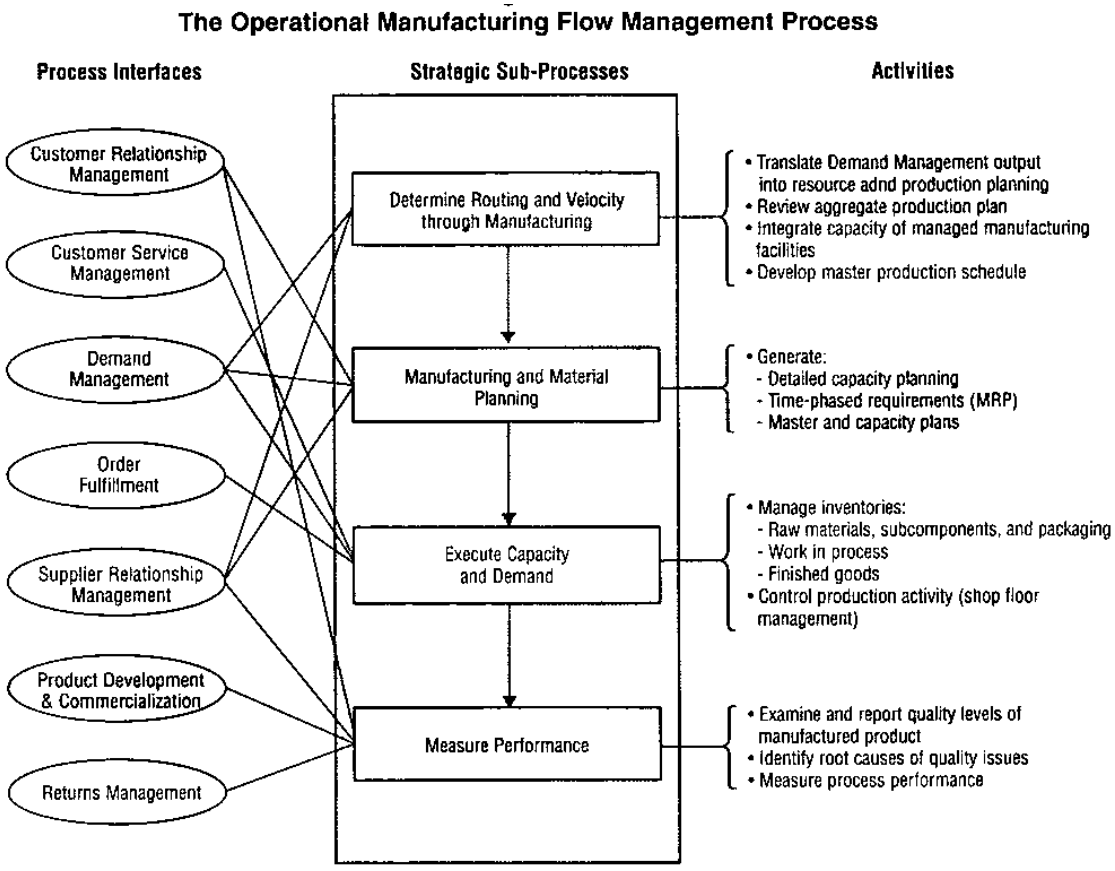
incorporated with contingency plans (Croxton, Lambert, Rogers & Garcia-Dastague, 2002).

The fifth and final strategic sub-process that the manufacturing flow management team develops is developing the framework of metrics. These metrics should be used to measure and improve the performance of the process. A uniform approach should be used throughout the firm to develop these metrics (Lambert& Pohlen, 2001). The team should start by understanding how the manufacturing flow management process can directly affect the firm's financial performance, as measured by economic value added (EVA) (Bennett, 1999). The ultimate test of the process worth is found in the value it creates.

Manufacturing flow management operational sub-processes

The operational portion of manufacturing flow management is the realization of the process developed at the strategic level (Lambert, 2008). Goldsby (2011) refers to operational sub-processes as the "just do it side" of the manufacturing flow management process. Despite the apparent similarities between the operational sub-processes and the planning and scheduling activities of the production function internal to most manufacturers, key differences exist. These differences include the guidance provided by the infrastructure developed at the strategic level and the interfaces that link the operational sub-processes in a structured way to the other seven supply chain management processes (Goldsby & Garcia-Dastugue, 2003). Four sub-processes represent this operational flow. Each process is depicted in figure 8 and described in succeeding paragraphs.

Figure 8 Operational manufacturing flow management sub-processes



(Goldsby & Garcia-Dastugue, 2003)

Determining the routing and velocity of materials and goods through manufacturing is the first operational sub-process. During this process the execution of the plan set forth in the strategic portion is implemented. This plan is bases on historical demand, marketing and sales strategies, and general market intelligence and is developed at the product family or group level (Lambert, 2008). After reviewing the production plan, management assesses manufacturing capacity and allocates production volume to each plant. Each plant then develops its own master production schedule (MPS) that specifies what to produce and in what quantities. This MPS reflects the manufacturing priorities set forth at the strategic level. Factors such as capacity limitations,

manufacturing constraints, production setup time and costs, and inventory carrying costs are considered when developing the MPS (Krajewski, 2004). Communication with the supplier base is vital to ensure accommodation of these manufacturing priorities.

The second operational sub-process is: Plan manufacturing and material flow. In this process attention shifts to the detailed planning of capacity and inbound materials necessary to "feed" the production schedule (Goldsby & Garcia-Dastugue, 2003). This material requirements plan (MRP) identifies the quantities and timing of all subassemblies, components, and raw materials needed to support production of the end-items (Krajewski, 2004). Along with the MPS, product-specific bills of materials and on-hand inventories drive the MRP explosion that yields the desired quantities of input materials required at any given time to support product flow (Lambert, 2008).

The third operational sub-process is: Execute capacity and demand plans. This sub-process involves frequent interface with the demand management and order fulfillment process teams to maintain efficient flow of materials, work-in-process, and finished goods (Goldsby & Garcia-Dastugue, 2003). Synchronizing available capacity and demand is a continuous process that strives to ensure adequate, timely supply with minimal inventory, delivering a high quality product. Success in these plans depends on flexible, well developed plans. Quality programs such as Six Sigma can be used to ensure high quality products with little product variance. To the extent that processing time can be lessened and the variance minimized, the manufacturer can better meet customers' changing needs with less disruption and lower costs (George, 2002).

The final operational sub-process is: Measuring performance. The manufacturing flow management process, like all of the other supply chain management processes,

spans beyond the four walls of the company. The manufacturing flow management team must therefore not only measure performance within the firm's manufacturing plants but must also relate this performance to the broader supply chain (Lambert, 2008). Metrics tracked in this process must be shared with the customer relationship management and supplier relationship management teams. By utilizing these available metrics the customer and supplier relationship teams can generate cost and profitability reports. These reports are valuable when negotiating services with key material and service providers, and when determining rewards for customers and suppliers who have positively influenced the performance of the manufacturing flow management process (Lambert & Pohlen, 2001).

Manufacturers have become increasingly reliant on outsourced production activities. Contract manufacturing services provided about 10 percent of all global output in the electronics industry in 1998, totaling approximately $60 billion. It is forecasted by the year 2018, the figure will reach $1.3 trillion – a 2,167% increase (Meeks, 2004). In large part, outsourced manufacturing is growing as a result of the need for manufacturing flexibility (Panchuk, 1998). In reviewing the prevailing literature it is apparent that the term "manufacturing flow management" is not commonly used. However, the term "manufacturing flexibility" is used quite often. According to Goldsby (2011), "manufacturing flexibility" is a nearly interchangeable term for "manufacturing flow management" in current literature.

In manufacturing literature, there are many definitions of what constitutes manufacturing flexibility. Sehti and Sehti (1990) point out that there are no fewer than 50 combined flexibility types and dimensions described in the literature, and that the

definitions " are not always precise and are, at times even for identical terms, not in agreement with one another. In 1998, Shewchuk and Moodie found a combined 80 flexible types and dimension in their literature review. Beech (2000) sums up this lack of a universal definition from a "system level": "Without an agreement on issues as what the constituent elements of manufacturing flexibility are, the effects of interrelationships which exist between then and the extent of the role of the enablers of flexibility, when viewed at the system level, is likely to continue to appear inconsistent and confusing". It appears there is only endless debate concerning the definition of manufacturing flexibility. For the purposes of this paper Goldsby's popular (often cited) definition will be utilized: Manufacturing flexibility reflects the ability to make a variety of products in a timely manner at the lowest possible cost and respond to changes in demand (Goldsby & Garcia-Dastugue, 2003).

Beyond the definition of manufacturing flexibility there are many different types of manufacturing flexibility. However, there appears to be general consensus that there are two major types of manufacturing flexibility: organizational and production. For the purposes of this paper, Duclos, Vokurka, and Lummus neatly summarize the major types of manufacturing flexibility and provide the definition for each in Table 2.

Table 2 Types of flexibility

Type of Flexibility	Definition
Organizational Flexibility	
Manufacturing or Operations	The ability of the organization to manage production resources and uncertainty to meet various customer requirements
Market	The ability to mass-customize and build close relationships with customers, including designing new products and modifying existing ones
Supply	The ability to reconfigure the supply chain (geographically) as sources of supply and customers change
Information Systems	The ability to align information systems with changing customer demands
Production Flexibility	
Mix	The ability to change over to a different product quickly and economically without changes in capacity
Volume	The ability to operate at various batch sizes and/or at different production volumes economically and effectively
Expansion	Modular building and expanding capacity
Material Handling	The ability to effectively transport different work pieces between various processing centers over multiple paths
Process (routing)	The ability to process a given set of part types using multiple routes effectively
Machine	The ability of a machine to perform different operations economically and efficiently
Work-center (labor)	The ability of the workforce to perform a broad range of tasks economically and effectively

(Duclos, Vokurka, & Lummus, 2003)

Although there are several factors that drive the need for manufacturing flexibility, demand is most assuredly the most important factor. Demand volume, variation, and predictability of the variation are at the top of the list of considerations (Lambert, 2008). Also important to consider is the customer's tolerance for waiting and reaction to an out-of-stock situation by either switching to a substitute product, back-ordering, delaying the purchase, or getting the item from an alternative supplier/store (Zinn & Liu, 2001). Characteristics associated with the product itself include the variety

(i.e., the level of standardization or differentiation), stage and expected duration of the product life cycle, complexity of the product, and profit margin of the product (Goldsby & Garcia-Dastugue, 2003).

Manufacturing flexibility enables greater responsiveness to changes in customers' preferences and quantities demanded (Christopher & Towill, 2002). Determining the right degree of flexibility is important to virtually any company involved in the supply, production, distribution or sales of goods, and is at the center of the manufacturing flow management process (Goldsby& Garcia-Dastugue, 2003). Although the manufacturing process may be outsourced, the commitment to quality of the product must be returned by the contracting firm.

Manufacturing flow management should be implemented across the members of the supply chain that participate in the flow of products, as well as across those that have an effect on, or are affected by, the supply chain as a whole. Through the manufacturing flow management process, management coordinates all activities necessary to move products through the plants, and to obtain, implement, and manage manufacturing flexibility in the supply chain (Goldsby & Garcia-Dastugue, 2003). However, it is the responsibility of each and every member of the supply chain to make the product flow as efficient as possible while allowing for the desired amount of manufacturing flexibility

Extensive reviews of the literature on manufacturing flexibility are provided by Hyun and Ahn (1992), Sethi (1990), and Suarez, Cusumano, and Fine (1991). They all seem to have come to one general conclusion: the achievement of flexibility in manufacturing is a critical source of competitive advantage for manufacturing firms.

CEOs know this, managers know it, and shop floor operators know it (Upton, 1994). Based on the results of the studies presented, the next two hypotheses are:

H3. Manufacturing flow management practices will be positively related to competitive advantage within an organization.

H4: *Manufacturing flow management practices will be positively related to organizational performance.*

Product development and commercialization

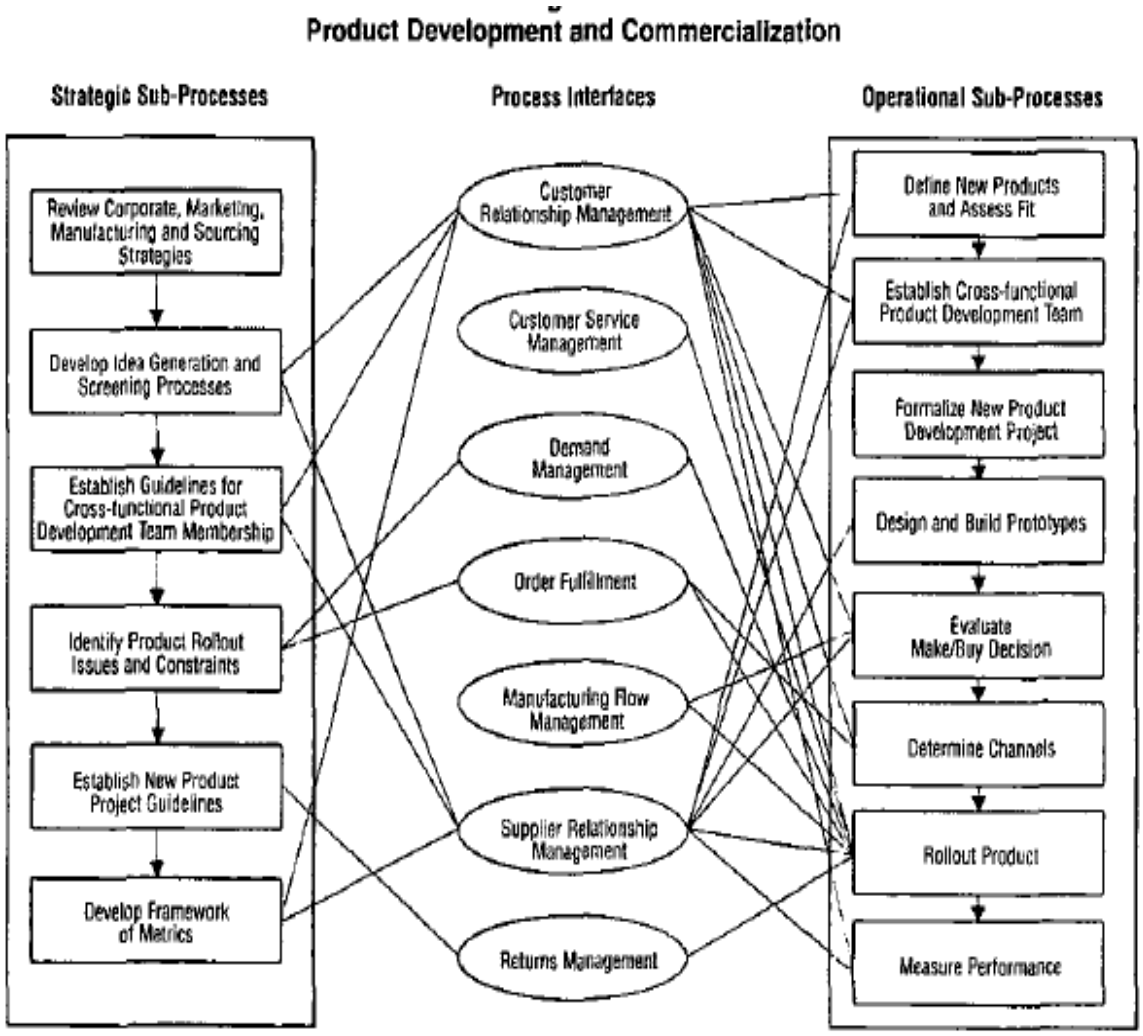
Successful new products and services are critical for many organizations, since product development is one important way that firms can implement strategic intentions into real business operations (Brown & Eisenhardt, 1995). Developing products rapidly and moving them into the marketplace efficiently is important for long-term corporate success (Cooper & Kleinschmidt, 1987). In many markets, 40 percent or more of revenues come from products introduced in the prior year (Handfield & Nichols, 2002). While the creation of successful products is a multidisciplinary process (Olson, 2001), product development and commercialization from a supply chain management perspective integrates both customers (Karkkainen & Piippo, 2001) and suppliers (Schilling & Hill, 1998) into the process in order to reduce time to market (Rogers, 2004). The ability to reduce time to market is key to innovation success and profitability (Droge, Jayaram & Vickery, 2000) as well as the most critical objective of the process (Schilling & Hill, 1998).

Product development and commercialization is the supply chain management process that provides structure for developing and bringing to market new products jointly with customers and suppliers (Rogers, Lambert, & Knemeyer, 2004). Effective

implementation of the process not only enables management to coordinate the efficient flow of new products across the supply chain, but also assists supply chain members with the ramp-up of manufacturing, logistics, marketing and other related activities to support the commercialization of the product (Lambert, 2008). This process requires effective planning and execution throughout the supply chain, and if managed correctly should provide a competitive advantage. In many markets, 40 percent or more of revenues come from products introduced in the prior year (Handfield & Nichols, 2002). The creation of successful products from a SCM perspective must integrate both customers and suppliers into the process in order to reduce time to market. This ability to reduce time to market is key to innovation success and profitability as well as the most critical objective of the process (Schilling et al., 1998).

The product development and commercialization process has both strategic and operational elements, as shown in Figure 9. The strategic portion of the product development and commercialization process establishes a structure for developing a product and moving it to market. . The operational portion is the realization of the process that has been established at the strategic level. Developing the strategic process is a necessary first step toward integrating the firm with other members of the supply chain, and it is at the operational level that the day-to-day activities are executed (Rogers et al., 2004).

Figure 9 Product development and commercialization sub-processes

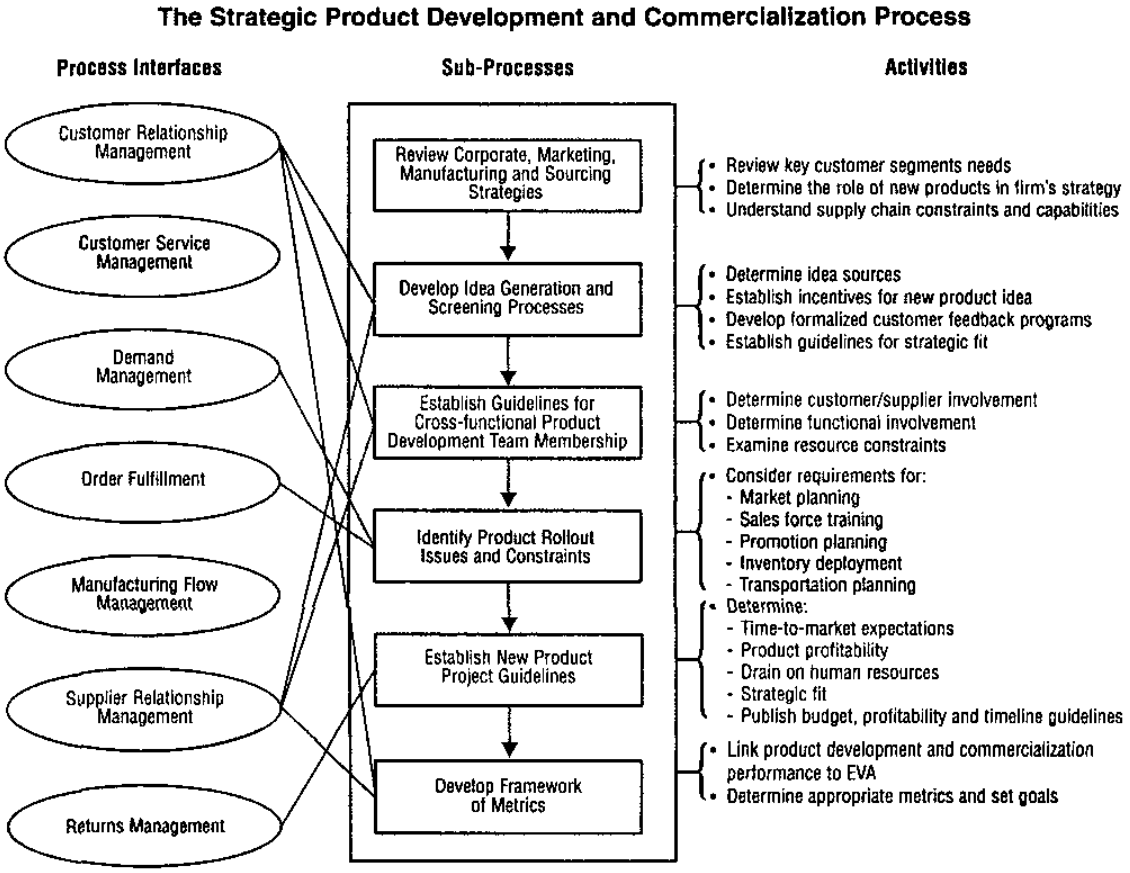


(Croxton et al., 2001)

Product development and commercialization strategic sub-processes

The objective of the strategic portion of the product development and commercialization process is to construct a formalized structure through which management executes the operational process (Lambert, 2008). This process provides a guide for implementation and is composed of six sub-processes, as shown in figure 10.

Figure 10 Strategic product development and commercialization sub-processes



(Croxton et al., 2001)

The first strategic sub- process is to review the corporate, marketing, manufacturing and sourcing strategies to determine their impact on products sold. The product development and commercialization team reviews the sourcing, manufacturing and marketing strategies in order to assess the fit of the objectives with current capabilities. The team then provides feedback of future development requirements to the sourcing, manufacturing and marketing functional areas.

The second strategic sub-process is: Develop idea generation and screening processes. The outputs of the first sub-process are objectives that will drive the idea generation and screening procedures. This can include determining sources for ideas,

considering incentives for developing products for: the focal firm, suppliers, and customers. In addition, this sub-process will begin to develop formalized customer feedback programs (Rodgers et al., 2004).

The third strategic sub-process is: Establish guidelines for cross-functional product development team membership. It is critical to include the right people from internal functions as well as key customers and suppliers. Partnerships might be formed with customers and suppliers to complement internal knowledge as well as to learn about new markets and technologies, and reduce overall risk (McDermott, 1999).

The fourth strategic sub-process is: Identify product rollout issues and constraints. This process includes considerations of transportation and capacity planning, deployment planning, inventory, sales force training and promotion planning (Lambert, 2008). It is critical to discover potential problems at this stage before they become major problems down the road.

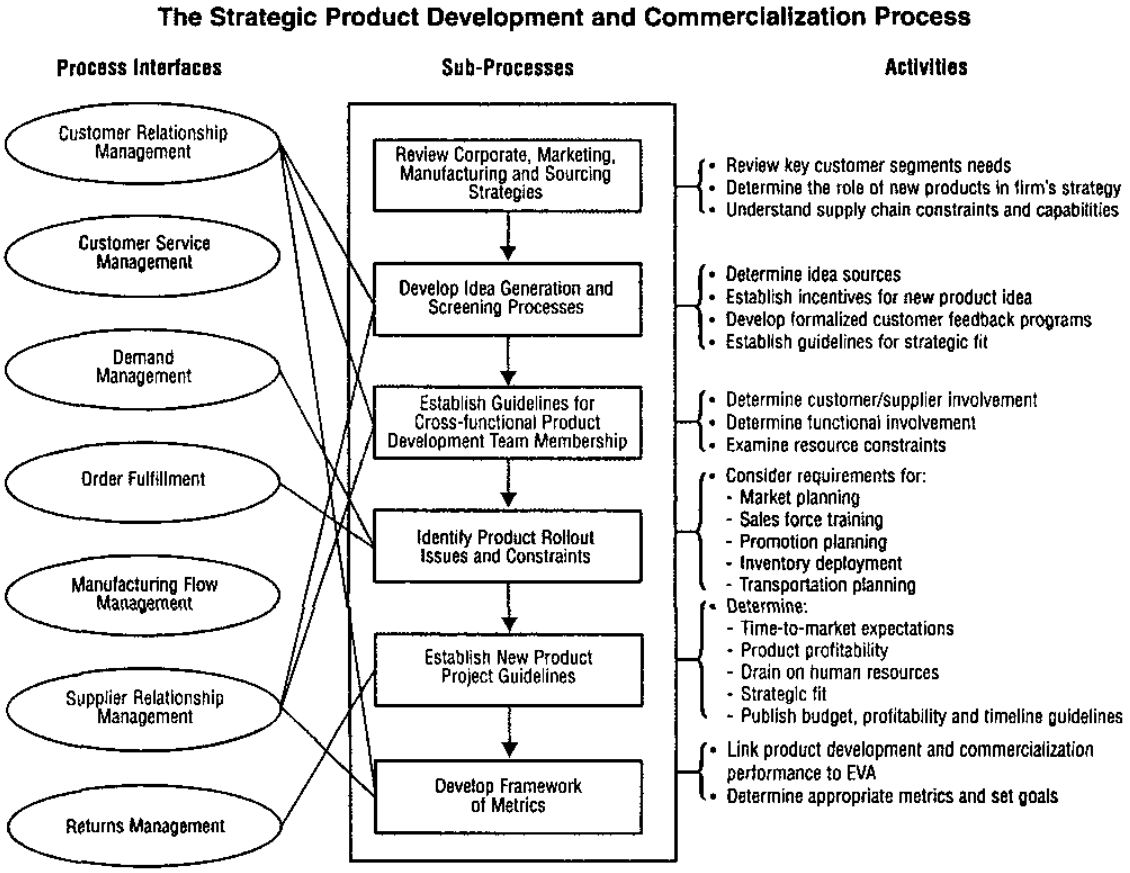
The fifth strategic sub-process is: Establish new product project guidelines. During this process product profitability scenarios are developed and the implications for human resources resulting from new product projects are determined. The guidelines for evaluating the strategic fit of new products are established (Rogers et al., 2004).

The sixth and final strategic sub-process is: Develop framework of metrics. Typical process metrics might include cycle time, time to market, and projected sales and profitability (Griffin, 1993).These metrics must be coordinated with other process teams in order to assure they do not conflict with other company metrics.

Product development and commercialization operational sub-processes

The operational portion of the product and commercialization process is the implementation of the structure developed at the strategic level. It serves as a guide for the implementation of the product and commercialization activities and consists of eight sub-processes, as shown in figure 11.

Figure 11 Operational product development and commercialization sub-processes



(Croxton et al., 2001)

The first operational sub-process is: Define new products and assess fit. In this process new product ideas are generated and screened. A market assessment is completed, key customers and suppliers are consulted, and the fit with existing channels, manufacturing and logistics are determined. This sub-process involves interfaces with

customer and supplier relationship management processes, as well as with the business function of the firm (Lambert, 2008).

The second operational sub-process is: Establish cross functional product development team. These teams are formed using the guidelines developed at the strategic level. External parties whose input is valuable should be included as early in the project as feasible. This requires a culture permeating each organization that encourages and values collaboration (McIvor & Humphries, 2004). These teams are responsible for finalizing plans for new product.

The third operational sub-process is: Formalize new product development project. The cross functional product development teams examine the strategic fit of the new product within the organization's current product portfolio. The team works with key suppliers to formalize time to market expectations, product profitability goals, and budget requirements (Lambert, 2008). The formation of budget and resource needs is particularly relevant given that 75 percent of new product development programs fail commercially (Griffin & Page, 1996).

The fourth operational sub-process is: Design, build and test prototypes. In this phase, teams work with suppliers and perform a value analysis to determine what portions of the product design and rollout process truly add value. Then, they source prototype materials and manufacturing product samples. The final step of this sub-process is to test the product (Rogers et al., 2004).

The fifth operational sub-process is: Evaluate make/buy decision. Team members must determine how much of the product should be made in-house and how much by their supply chain partners in the supply base. In many firms, management has a short-

term perspective. These decisions might have strategic implications for the firm and should be formulated from a strategic perspective with senior management involvement (Humphries et al., 2002).

The sixth operational sub-process is: Determine channels. Team members determine the marketing and distribution channels for the new product. The customer relationship management and order fulfillment teams provide input at this stage. Then, the market plan for the product is developed, and initial inventory planning is performed (Lambert, 2008).

The seventh operational sub-process is: Rollout product. In this process materials need to be source, inbound materials positioned, and products manufactured and/or assembled. The market plan is implemented, the sales force is trained on the new product offering, and the promotion plan is executed. It is important that all of the other processes are involved in planning and executing the product rollout (Rogers et al., 2004).

The eighth and final sub-process is: Measure performance. Performance is measured using the metrics developed at the strategic level, and communicated to the appropriate individuals both within the organization and across the supply chain. Communications with other members of the supply chain are coordinated through the customer relationship management and supplier relationship management processes (Lambert, 2008).

There is, accordingly, a large and growing literature on product development at the level of both specific projects (e.g. Cooper, 1996) and the firm as a whole (e.g. Wheelwright & Clark, 1992). Researchers have identified various characteristics that

relate to new product success, such as market orientation (Day, 1990) or innovative product features (Van de Veen, 1986) among others. There is significant disagreement in the literature concerning the stages of the product development and commercialization process. In addition to the process presented in this paper, Ulrich & Eppinger (1995), separate the product development process into five stages that describe product development from the initial idea to production. These stages consist of: Concept development, system-level design· detail design, testing and refinement & production ramp-up. Booz, Allen and Hamilton (1982) present the basic stages of product development as: identifying new product strategy, exploration, screening, business analysis, development, testing, and commercialization.

Table 3 perspectives in the product development research community

	Marketing	Organizations	Engineering Design	Operations Management
Perspective on Product	A product is a bundle of attributes	A product is an artifact resulting from an organizational process	A product is a complex assembly of interacting components	A product is a sequence of development and/or production process steps
Typical Performance Metrics	"Fit with market" Market Share Consumer utility (Sometimes profits)	"Project success"	"Form and function" Technical performance Innovativeness (Sometimes direct cost)	"Efficiency" Total cost Service level Lead time Capacity utilization
Dominant Representational Paradigm	Customer utility as a function of product attributes.	No dominant paradigm. Organizational network sometimes used.	Geometric models. Parametric models of technical performance.	Process flow diagram Parametric models of process performance.
Example Decision Variables	Product attribute levels, price	Product development team structure, incentives	Product size, shape, configuration, function, dimensions	Development process sequence and schedule Point of differentiation in production process
Critical Success Factors	Product positioning and pricing Collecting and meeting customer needs	Organizational alignment Team characteristics	Creative concept and configuration Performance optimization	Supplier and material selection Design of production sequence Project Management

(Krishnan & Ulrich, 2001)

There are at least four common perspectives in the product development research community: marketing, organizations, engineering design, and operations management as illustrated in table 3. In addition to the dimensions highlighted in this table, these perspectives often differ in the level of abstraction at which they study product development. For instance, the organizational perspective is focused at a relatively aggregate level on the determinants of project success. On the other hand, much of the engineering and marketing literature is at a more detailed level of abstraction, with the focus being the individual product engineer or market researcher and the issues confronting them. Finger and Dixon (1989) provide an excellent review of the engineering design literature; while a number of survey papers have been published reviewing the marketing perspective (Green & Srinivasan, 1990, Mahajan & Winn, 1992, Shocker & Srinivasan, 1979). Several articles have been published in recent years reflecting the operations perspective, and some of them even serve to bridge two or more perspectives (Krishnan & Ulrich, 2001).

Some of the earliest work of product development that emphasized the importance of market issues over purely technical ones was written by Myers et al. (1969). They studied 567 successful products in over 100 firms and 5 industries. They concluded that market pull, i.e. identifying and understanding customer needs, was substantially more important to new product success than technology push. In addition, they identified cross functional integration as the key factor for product development success (Blum, 2003).

Issues in new product development practices were investigated in the aggregate by Booz et al. (1968). The effort was repeated in 1982. The 1968 report, based on

knowledge accrued from over 800 client assignments and data obtained from just over 49 firms, reported that almost a third of all product development projects commercialized by firms were failures, with this rate essentially independent of industry. Most of the commercialization failures occurred because the idea or its timing was wrong. This report presented the product development mortality curve, which showed that, on average, 58 ideas were considered for every successful new product commercialized (Griffin, 1997).

Subsequent research sharpened the emergent emphases on product advantages, market attractiveness, and product development organization. Particularly important were several studies of Cooper and Kleinschmidt (1979, 1987). The 1979 study, called NewProd, examined 102 successful and 93 failed products within 103 industrial firms in Canada. The 1987 study investigated 203 products in 125 manufacturing firms, including 123 successes and 80 failures. Project organization was also found to be important. Particularly important was pre-development planning. This included a well-defined target market, product specifications, clear product concept, and extensive preliminary market and technical assessments.

More recently, Cooper and Kleinschmidt (1995) conducted another study of product development efforts by 161 business units in the chemical industry. The authors replicated some of their earlier findings. Most notably, this time they highlighted that product development organization was most strongly associated with new product success. They recommended a “high quality product development process” as a major determinant of new product success. Contrary to their earlier studies, the authors found in this study that market competitiveness had no relationship with new product success (Blum, 2003).

Other studies focused not on sole projects or products but on sequences of products. Little (2001), for example, noted that many organizations still have difficulty with sustained product development success, or managing a number of product development efforts over time. Sustained new product success has been found particularly difficult for organizations with long histories of stable operations (Blum, 2003). A thorough review of all these studies indicates that product development and commercialization is a vital component to organizational success. Based on the results of the studies presented, the final two hypotheses are:

H5. Product development and commercialization practices will be positively related to competitive advantage within an organization.

H6: *Product development and commercialization practices will be positively related to organizational performance.*

Competitive advantage

Competitive advantage is defined as the "capability of an organization to create a defensible position over its competitors" (Li, Ragu-Nathan, Ragu-Nathan, & Rao, 2006). Tracey, Vonderembse, and Lim (1999) argue that competitive advantage comprises distinctive competencies that set an organization apart from competitors, thus giving them an edge in the marketplace. They further add that it is an outcome of critical management decisions.

Competition is now considered a "war of movement" that depends on anticipating and quickly responding to changing market needs (Stalk, Evans & Schulman, 1992). Competitive advantage emerges from the creation of superior competencies that are leveraged to create customer value and achieve cost and/or differentiation advantages,

resulting in market share and profitability performance (Barney, 1991; Day & Wensley, 1988). Sustaining competitive advantage requires that firms set up barriers that make imitation difficult through continual investment to improve the advantage, making this a long-run cyclical process (Day & Wensley, 1988). Porter's approach to competitive advantage centers on a firm's ability to be a low cost producer in its industry, or to be unique in its industry in some aspects that are popularly valued by customers (Porter, 1991).

Most managers agree that cost and quality will continue to remain the competitive advantage dimensions of a firm (D' Souza, 2002). Wheelwright (1978) suggests cost, quality, dependability and speed of delivery as some of the critical competitive priorities for manufacturing. There is widespread acceptance of time to market as a source of competitive advantage (Holweg, 2005). Price/cost, quality, delivery dependability, and time to market have been consistently identified as important competitive capabilities (Fawcett & Smith, 1995; Vokurka, Zank & Lund 2002; Tracey, Vonderembse & Lim 1999). 'Time' has been argued to be a dimension of competitive advantage in other research contributions (Stalk, 1988; Vesey, 1991; Handfield & Pannesi; 1995). In a research framework, Koufteros, Vonderembse and Doll (1997) describe the following five dimensions of competitive capabilities: competitive pricing, premium pricing, value-to-customer quality, dependable delivery, and product innovation. These dimensions were further described and utilized in other contributions as well (Koufteros Vonderembse & Doll, 2002, Li et al. 2006; Safizadeh, Ritzman, Sharma & Wood 1996; Vickery, Calantone & Droge, 1999). Based on these studies, the five dimensions of competitive advantage most applicable to this study are:

1. Price/Cost - “The ability of an organization to compete against major competitors based on low price” (Li et al., 2006).

2. Quality- “The ability of an organization to offer product quality and performance that creates higher value for customers” (Koufteros, 1995).

3. Delivery Dependability- “The ability of an organization to provide on time, the type and volume of product required by customer(s)” (Li et al., 2006).

4. Product Innovation. “The ability of an organization to introduce new products and features in the market place” (Koufteros, 1995).

5. Time to Market. “The ability of an organization to introduce new products faster than major competitors” (Li et al., 2006).

Organizational performance

Organizational performance refers to the financial aspect of organizational performance as a final economic goal of firms (Venkatraman & Ramanujam, 1986). The potential indicators of organizational performance include profits, return on investment, return on assets, return on equity, and stock-market performance (Garcia, 2005; Tharenou, Saks & Moore, 2007). Regarding the classification of organizational performance, several researchers (Davis & Pett, 2002; Hubbard, 2009; Ostroff & Schmidt, 1993) have suggested their perspectives on the classification of organizational performance, but there is little consensus about this issue.

The short-term objectives of SCM are primarily to increase productivity and reduce inventory and cycle time, while long-term objectives are to increase market share and profits for all members of the supply chain (Tan, 1998). Financial metrics have served as a tool for comparing organizations and evaluating an organization’s behavior

over time (Holmberg, 2000). Li et al. (2006) propose that any organizational initiative, including supply chain management, should ultimately lead to enhanced organizational performance.

Hubbard (2009) proposed the Sustainable Balanced Scorecard (SBSC) conceptual framework as an appropriate measure of organizational performance. SBSC includes social and environmental issues in the existing Balanced Scorecard (BSC) by integrating the Triple Bottom Line. In the SBSC framework, the Triple Bottom Line refers to a broader perspective of the stakeholders, and the BSC performance measurement incorporates financial, customer/market, short-term efficiency, and long term learning and development factors as internal processes of the performance measurement. Additionally, Ford and Schellenberg (1982) addressed that the assessment of organizational performance could be classified into behavioral consequences (e.g., turnover, satisfaction) or non-behavioral consequences (e.g., profit) or intended consequences (e.g., product quality) or unintended consequences (e.g., turnover) (Park, 2009).

Several researchers (Davis & Pett, 2002; Ford & Schellenberg, 1982; Ostroff & Schmitt, 1993) have advocated dimensions of both efficiency and effectiveness for measuring organizational performance. Ford and Schellenberg (1982) asserted that organizations can acquire higher return when concepts of efficiency and effectiveness are concentrated. Furthermore, Davis and Pett, (2002) proposed a typology of performance consisting of organizational efficiency and effectiveness and provided indicators of both dimensions. The measures of organizational efficiency include after-tax return on total

sales and return on total assets. As for organizational effectiveness, the firm's total sales growth and total employment growth are considered.

Another perspective on measuring organizational performance is financial performance versus non-financial performance. Regarding this viewpoint, the conceptual framework presented by Venkatraman and Ramanujam (1986) sheds light on the dimensions of performance in an organization. Venkatraman and Ramanujam (1986) argued that business performance consisted of financial performance and business performance, including both financial performance and non-financial performance. They included both financial performance and business performance in a broader domain of organizational effectiveness. In their conceptualization of organizational performance, they indicated financial performance as a narrower concept relative to business performance. Financial performance highlights the use of outcome-based financial indicators, so that it assumes that organization's ultimate goal is to achieve economic benefits. Typical indicators for financial performance are sales growth, profitability (ratios such as return on investment, return on sales, and return on equity), earnings per share, and so on (Venkatraman & Ramanujam, 1986).

Based on the above discussion, business performance is regarded as the broadest concept of organizational performance because business performance includes both financial performance and non-financial performance as operational performance (Park, 2009). Indicators of organizational efficiency such as after-tax return on total sales, return on total assets, and organizational effectiveness such as sales growth are also included in the domain of financial performance (Venkatraman & Ramanujam, 1986). However, due to the limited scope of the survey used in this study, organizational

performance measures will be limited to widely accepted financial measures such as: return on investment, market share, and profit margin.

To sum up, this chapter discussed the theoretical foundation of various constructs used in this research: supplier relationship management, manufacturing flow management, product development and commercialization, competitive advantage, and organizational performance. In the next chapter, we present the research framework that describes the relationships between these constructs along with the development of research hypotheses.

Chapter 3

Methodology

This study was developed to determine the relationship between three supply chain management business processes, as defined by the GSCF, and competitive advantage and advantage organizational performance. Internet based surveys were developed and distributed to 800 business executives. Due to an insufficient response rate, data simulation techniques were employed to generate data. Nonparametric and bivariate correlation analysis tools were then used to analyze this data. The five measures used in this study are: supplier relationship management (SRM), manufacturing flow management (MFM), product development and commercialization (PD&C), organizational performance, and competitive advantage.

Procedures

Data for this study was collected using a 163-item internet based survey that was delivered to 800 top management executives in a wide range of industries. This survey was developed for use by two additional thesis studies being produced concurrently with this study. A total of 78 of the 163items are analyzed in this study. All 800 executives contacted by email were members of the Council of Supply Chain Management Professionals. Internet based surveys have surged in popularity in the past decade (Wright, 2005). Advantages of internet based surveys include: ease of delivery, significant cost savings, access to diverse populations, and simplified data collection. Disadvantages include: survey solicitations being viewed as unwanted “junk mail”,

respondent anonymity concerns, technical glitches, and increased possibility of sampling error (Wright, 2005). In addition, there is a real possibility of respondents deleting the email if they do not recognize the sender (Fink, 2009).

The survey utilized in this study was open to respondents from December 2011 thru February 2012. The invitation to take the online survey was sent to 800 email addresses provided by the Council of Supply Chain Management Professionals. The invitation consisted of a cover page (see Appendix A), and a link to take the survey. Participation in this survey was strictly voluntary and several safeguards were developed to protect the anonymity of all respondents. Respondents were informed that all research findings would be made available to them upon request. In addition, researcher contact information was provided in case respondents had any questions/comments.

The survey was developed using supply chain assessment tools developed by Lambert (2008). An extensive review of available literature found no other use of this assessment tool for any type of survey. The initial survey was reviewed and approved for use by a group of academicians at the Air Force Institute of Technology.

Participants

The 800 individuals invited to take the survey consisted of executives from a diverse range of businesses. All of these executives were members of the Council of Supply Chain Management Professionals. Out of the 800 invitations, only 10 surveys were submitted. Two of those surveys had serious problems and were deemed insufficient for survey purposes. One of the surveys was missing a large amount of data, while the other displayed central tendency error in which the respondent chose "Neutral" for each item. The eight remaining surveys constitute a low 1% response rate.

Demographic information concerning the respondent was collected in the survey. Respondent's job titles included: Vice President (VP) Distribution & Fulfillment, Transportation Manager, Logistics Development Manager, Global Supply Chain Manager, VP of Supply Chain Management, Production Manager, Director of Supply Chain Initiatives, and VP of Global Manufacturing Alliances. Logistics/Transportation /Distribution (75%), Production/Operations Management (37.5%), and Supply/ Purchasing/Procurement (25%) were identified as the area that describes the respondents' current job responsibility. Participants were allowed to choose more than one description of their current job responsibility. Three respondents had less than 2 years of experience in their current position (37.5%), three respondents had between 2 and 5 years of experience (37.5%), and two respondents had between 6 and 10 years of experience (25%). One respondent had been with their current organization for less than 2 years (12.5%), three respondents had been with their current organization between 6 and 10 years (37.5%), and four respondents had been with their current organization over 10 years (50%).

Company profile information was also collected in this survey. Of the eight useable responses, one respondent worked at an organization with between 251 and 500 employees (12.5%), one respondent worked at an organization with between 501 and 1000 employees (12.5%), and six respondents worked at organizations with over 1,000 employees (75%). Logistics/Transportation/Distribution (75%), Production/Operations Management (37.5%), and Supply/Purchasing/Procurement (25%) were identified as the area that describes the respondents' current job responsibility. One respondent's organization had an annual sales volume of between $10 and $25 million (12.5%), one

respondent's organization had an annual volume of sales between $50 and $100 million (12.5%), and six respondent's organizations had an annual volume of sales greater than $500 million (75%). Four respondents worked for organizations from the manufacturing industry (50%), one respondent worked in the wholesale trade (12.5%), the retail trade (12.5%), and the transportation and warehousing (12.5%) industries, and one respondent chose the category "Other" to represent their organization (12.5%).

In order to determine if there is a difference in the company profile data, the researcher used the nonparametric (distribution-free) statistical procedures available in Statistical Package for the Social Sciences (SPSS) software. Given the small sample size (n=8), it was determined that the Wilcoxon Rank-Sum Test (WRST) test is an appropriate choice for this analysis. The WRST test enables the user to compare two independent groups when the t-test cannot be used because of the small sample size (Fink, 2009). Assumptions of the WRST are: (1) the observations from both groups are independent of each other, (2) the responses are ordinal (i.e. one can at least say, of any two observations, which is the greater), (3) μ_1 and μ_2 are the only differences between the distributions from which the samples are drawn (Hollander, 1999). Each variable (SRM, MFM, PDAC, competitive advantage, and organizational performance) was compared to the organization's number of full time employees, organization's annual volume of sales, and industry classification. Each company profile item was categorized into two categories as seen in Table 4.

Table 4. Company Profile

Company Profile (WRST Categories)				
Company Profile Item	Category 1		Category 2	
# of Employees	> 1000	n = 6	≤ 1000	n = 2
Annual Volume of Sales	> 500	n = 6	≤ 500	n = 2
Industry Classification	Manufacturing	n = 4	Other	n = 4

The null hypothesis of the WRST is that distributions of both groups are equal: (H_0: $\mu_1 - \mu_2 = 0$). There didn't appear to be a statistical difference in the means for the SRM, MFM, PDAC, CA, and OP variables with respect to the organization's number of employees, annual volume of sales, and industry classification ($p > .05$). Results from the WRST for the organization's number of employees, annual volume of sales, and industry classification are listed in Table 5 to 7 respectively.

Table 5 Number of Employees

Test Statistics[b]

	SRM	MFM	PDAC	CA	OP
Wilcoxon W	22.000	22.000	1.000	1.000	3.500
Z	-1.009	-1.048	-1.464	-1.514	-.252
Asymp. Sig. (2-tailed)	.313	.295	.143	.130	.801

b. Grouping Variable: Num of employees

Table 6 Annual Volume of Sales

Test Statistics[b]

	SRM	MFM	PDAC	CA	OP
Wilcoxon W	2.500	3.000	1.000	2.500	1.000
Z	-.764	-.509	-1.464	-.764	-1.500
Asymp. Sig. (2-tailed)	.445	.611	.143	.445	.134

b. Grouping Variable: Annual vol of sales

Table 7 Industry Classification

Test Statistics[b]

	SRM	MFM	PDAC	CA	OP
Wilcoxon W	2.500	15.000	17.000	15.000	15.000
Z	-.603	-1.485	-.293	-1.485	-1.464
Asymp. Sig. (2-tailed)	.546	.137	.770	.137	.143

b. Grouping Variable: Industry Classification

Due to the low 1% response rate, the researcher determined data should be simulated based on the collected response data (n=8). Bivariate correlation analysis was utilized to test the proposed hypotheses. In order to obtain 95% confidence interval and a ± .05 precision level of the total number of executives invited to participate in the survey (N = 800), a representative sample of 260 respondents was deemed minimally sufficient (Ross et al., 2002). In order to sufficiently meet this requirement, a sample of 400 data points for each item was generated utilizing the random number generator and the normal distribution function in Microsoft Excel. The mean and standard deviation of each item in the actual data was entered into Excel to generate the simulated data. The small amount of simulated data (less than 3%) that fell out of the usable range (1-5) was replaced with the mean of all simulated data in that category. The simulated data was deemed representative of the actual data and sufficient for analysis. The normal distribution appeared to provide adequate variation in the data such that further statistical analysis appeared appropriate.

Measures

The survey was designed to measure five dimensions as well as individual and organizational characteristics. The five dimensions are: SRM, MFM, PDAC, competitive

advantage, and organizational performance. The items used in each measure are listed in Tables 8 & 9.

Table 8 Variable Descriptive Statistics (Response Data Sample)

Variable Descriptive Statistics (Response Data)				
	Cronbach's α	Mean	Std. Deviation	n
Supplier Relationship Management	.81	3.33	.56	8
Manufacturing Flow Management	.91	4.17	1.38	8
Product Development & Commercialization	.74	3.56	4.00	8
Competitive Advantage	.38	3.83	0.20	8
Organizational Performance	.28	3.80	0.22	8

Table 9 Variable Descriptive Statistics (Generated Data Sample)

Variable Descriptive Statistics (Response Data)				
	Cronbach's α	Mean	Std. Deviation	n
Supplier Relationship Management	.97	3.66	.78	400
Manufacturing Flow Management	.98	3.94	.82	400
Product Development & Commercialization	.97	3.90	.72	400
Competitive Advantage	.96	3.65	.61	400
Organizational Performance	.96	4.25	.54	400

For any research study to be valid there must be inherent validity built-in to the research process (Wright, 2005). Content validity represents the extent to which a content domain (or construct) is captured by a defined set of items (DeVellis, 2003). Content validity was addressed through rigorous review by a group of academics to ensure the items reflected the intended variables. Construct validity is concerned with the theoretical relationship a variable appears to have with another variables as indicated by their respective measures (DeVellis, 2003). Construct validity was addressed by

examining the relationships demonstrated between the variables with the assistance of confirmatory factor analysis (CFA).

CFA was not able to be utilized on the small (n=8) actual data set. This is due to the fact that factor analysis is relatively sensitive to sample size and when the sample size is insufficient the factor analysis process may be compromised (DeVellis, 2003). CFA was able to be conducted on the generated data (n=400). In order to address the expectation that the variables may be somewhat correlated with each other (DeVellis, 2003), an oblique rotation was utilized in the factor analysis. An alpha score of higher than 0.70 is generally considered to be acceptable, while an alpha score of higher than 0.80 is considered a good measure of reliability (Nunnally, 1978). The results do not conclusively suggest that the items captured the intended construct. The items primarily loaded on one factor when forced to extract three components as seen in Table 10. The instability of the CFA is likely due to the fact that the items are so highly correlated.

Table 10. CFA Component Matrix

Component Matrix[a]

	Component				
	1	2	3	4	5
Q1_SRM	.798	.415			
Q2_SRM	.893				
Q3_SRM	.700	.559			
Q4_SRM	.857				
Q5_SRM	.885				
Q6_SRM	.904				
Q7_SRM	.659	.549			
Q8_SRM	.844				
Q9_SRM	.716		.357	.377	
Q10_SRM	.819		.307		
Q11_SRM	.842		.335		
Q12_SRM	.903				
Q13_SRM	.792	.461			
Q14_SRM	.792	.461			
Q1_MFM	.733	-.539			
Q2_MFM	.861	-.418			
Q3_MFM	.861	-.418			
Q4_MFM	.742		-.501		
Q5_MFM	.714	-.503			
Q6_MFM	.638		-.556		
Q7_MFM	.798	-.473			
Q8_MFM	.838	-.315			
Q9_MFM	.820	-.488			
Q10_MFM	.820	-.488			
Q11_MFM	.785		-.454		
Q12_MFM	.808		-.355		
Q13_MFM	.777	-.522			
Q14_MFM	.777	-.522			
Q15_MFM	.777	-.522			
Q16_MFM	.820	-.488			
Q17_MFM	.841	-.313			
Q18_MFM	.843	-.401			
Q1_PDAC	.883				

Q2_PDAC	.789	.428			
Q3_PDAC	.775	.303	.383		
Q4_PDAC	.871				
Q5_PDAC	.880				
Q6_PDAC	.713	.446			
Q7_PDAC	.884				
Q8_PDAC	.816	.373			
Q9_PDAC	.625	-.510	.308		.356
Q10_PDAC	.695	.602			
Q11_PDAC	.635	.494	.481		
Q12_PDAC	.869	-.357			
Q13_PDAC	.896				
Q14_PDAC	.904				
Q15_PDAC	.842		.335		
Q16_PDAC	.838		-.368		
Q17_PDAC	.838	.301			
Q18_PDAC	.703		.455		

Extraction Method: Principal Component Analysis.

a. 5 components extracted.

Supplier Relationship Management. The SRM measure was used to determine the extent to which an organization developed a business process that provides the structure for how relationships with customers of that organization will be developed and managed. This measure was adopted from Lambert's (2008) assessment tool for the SRM process. This measure was assessed using 14 items. These 14 items were answered on a 5-point Likert-type response scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, 6 = not applicable) to assess the extent to which an organization strategically developed their SRM process. The reported Cronbach's alpha for this measure was .81. The scale response ranged from 3.11 to 4.05 with a mean of 3.33 (*SD* = .56; *n* = 8).

Manufacturing Flow Management. The MFM measure was used to determine the extent to which an organization developed a business process that includes the activities necessary to define customer requirements, design the logistics network, and fill customer orders. This measure was adopted from Lambert's (2008) assessment tool for the MFM process. This measure was assessed using 18 items. These 18 items were answered on a 5-point Likert-type response scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, 6 = not applicable) to assess the extent to which an organization strategically developed their OF process. The reported Cronbach's alpha for this measure was .91. The scale response ranged from 3.25 to 4.80 with a mean of 4.17 (*SD* = 1.38; *n* = 8).

Product Development and Commercialization. The PDAC measure was used to determine the extent to which an organization developed a business process that provides a formalized structure that includes all activities related to returns, reverse logistics, gatekeeping, and avoidance. This measure was adopted from Lambert's (2008) assessment tool for the PDAC process. This measure was assessed using 18 items. These 18 items were answered on a 5-point Likert-type response scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, 6 = not applicable) to assess the extent to which an organization strategically developed their RM process. The reported Cronbach's alpha for this measure was .74. The scale response ranged from 1.30 to 4.88 with a mean of 3.56 (*SD* = 4.00; *n* = 8).

Competitive Advantage. This measure was used to determine "the extent to which an organization is able to create a defensible position over its competitors" (Li et al., 2006: 111). The competitive advantage measure was adopted from Li et al. (2006). This

measure was assessed using 14 items. The 14 items assesses five sub-scales of competitive advantage. These five sub-scales were (a) price (items 1 and 2), (b) quality (items 3, 4, 5, 6), (c) delivery dependability (items 7 and 8), (d) product innovation (items 9, 10, 11), (e) time to market (items 12, 13, 14). Questions within each of the five sub-scales included (a) we offer competitive prices, (b) we offer products/services that are highly reliable, (c) we provide dependable delivery, (d) we provide customized products/services, and (e) we have fast product development. The five sub-scales were combined to create an overall measure of competitive advantage. These 14 items were answered on a 5-point Likert-type response scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, 6 = not applicable) to assess the extent to which an organization was able create a defensible position over its competitors. The reported Cronbach's alpha for this measure was .38. The scale response ranged from 3.57 to 4.21 with a mean of 3.83 (*SD* = .20; *n* = 8).

Organizational Performance. This measure was used to determine "how well an organization achieves its market-oriented goals as well as its financial goals" (Li et al., 2006: 121). The organizational performance measure was adopted from Li et al. (2006). This measure was assessed using 7 items. These 7 items were answered on a 5-point Likert-type response scale (1 = significantly lower, 2 = lower, 3 = average, 4 = higher, 5 = significantly higher, 6 = not applicable) with respect to the industry average to assess the extent to which an organization achieved its market-oriented and financial goals. The reported Cronbach's alpha for this measure was .28. The scale response ranged from 3.43 to 4.00 with a mean of 3.80 (*SD* = .22; *n* = 8).

Demographics. The demographics information included two sections: individual profile and company profile. The individual profile section included four items. The items were: (1) what is your current job title; (2) how many years have you been in your current position; (3) how many years have you been in your current organization; and (4) in your current job, what function(s) best describe your responsibilities. The company profile section included three items. The items included: (1) how many full time employees are in your organization; (2) what is your organization's annual volume of sales measured in millions of dollars; (3) please select the industry classification code which best describes your firm.

Summary

This chapter described the study participants and the research design and methodology used to determine whether the key business processes (SRM, MFM, and PDAC) were positively related to competitive advantage and organizational performance. The measures were discussed and their reliabilities were presented. The subsequent chapter discusses the procedures used to analyze the generated data and the results of that analysis.

Chapter 4

Results and Analysis

The goal of this research project was to determine if three dimensions of SC practices (supplier relationship management (SRM), manufacturing flow management (MFM), and product development and Commercialization (PDAC)) are related to competitive advantage and organizational performance. This chapter summarizes the findings of a survey sent out to 800 executive members of the Global Supply Chain Forum. The six hypothesis presented earlier in this research project are evaluated using bivariate correlation analysis.

Data

800 surveys were distributed and 10 surveys were returned and of those 10 surveys 8 were deemed usable (n = 8) for a 1% response rate. Parameters (mean and standard deviation) for each variable (SRM, MFM, PDAC, competitive advantage, and organizational performance) were estimated using the response data sample (n = 8). This data was then utilized to generate a larger data sample (n = 400) utilizing the random number generator and normal distribution inverse function in Microsoft Excel. All generated data was analyzed using the SPSS software package. Both the response sample data (n = 8) and the generated data set (n = 400) were analyzed in evaluating the hypotheses.

In order to measure relationships between each of the three SC practices to competitive advantage and organizational performance, a Pearson correlation coefficient was calculated. Pearson correlation is a measure of the correlation (linear dependence) between two variables X and Y, giving a value between +1 and −1 inclusive (Nunnally,

1978). The larger the absolute value of the correlation coefficient, the stronger the relationship.

Hypothesis One

The first hypothesis *is*: supplier relationship management practices will be positively related to competitive advantage within an organization. The SRM measure was comprised of 14 items and utilized a 5-point Likert type response scale and the CA measure was comprised of 14 items and utilized a 5-point Likert type response scale adopted from Li et al. (2006). The resulting Pearson correlation coefficient for the response data sample (n = 8) was .08 (p >.05), which failed to support hypothesis 1. The resulting Pearson correlation coefficient for the generated data set (n = 400) was .95 (p < .01), which supported hypothesis 1. In sum, hypothesis 1 was not supported when utilizing the response data sample (n = 8), but was supported when utilizing the generated data set (n = 400).

Hypothesis Two

The second hypothesis is: supplier relationship management practices will be positively related to organizational performance. The organizational performance measure was comprised of 7 items and utilized a 5-point Likert type response scale adopted from Li et al. (2006). The resulting Pearson correlation coefficient for the response data sample (n = 8) was .05 (p > .05), which failed to support hypothesis 2. The resulting Pearson correlation coefficient for the generated data set (n = 400) was .90 (p < .01), which supported hypothesis 2. In sum, hypothesis 2 was not supported when utilizing the response data sample (n = 8), but was supported when utilizing the generated data set (n = 400).

Hypothesis Three

The third hypothesis is: manufacturing flow management practices will be positively related to competitive advantage within an organization. The MFM measure was comprised of 18 items and utilized a 5-point Likert type response scale. The resulting Pearson correlation coefficient for the response data sample ($n = 8$) was .40 ($p > .05$), which failed to support hypothesis 3. The resulting Pearson correlation coefficient for the generated data set ($n = 400$) was .69 ($p < .01$) which supported hypothesis 3. In sum, hypothesis 3 was not supported when utilizing the response data sample ($n = 8$), but was supported when utilizing the generated data set ($n = 400$).

Hypothesis Four

The fourth hypothesis is: manufacturing flow management practices will be positively related to organizational performance within an organization. The resulting Pearson correlation coefficient for the response data sample ($n = 8$) was .78 ($p < .05$), which supported hypothesis 4. The resulting Pearson correlation coefficient for the generated data set ($n = 400$) was .44 ($p < .01$), which supported hypothesis 4. In sum, hypothesis 4 was supported when utilizing both the response data sample ($n = 8$) and the generated data set ($n = 400$).

Hypothesis Five

The fifth hypothesis is: Product development and commercialization practices will be positively related to competitive advantage within an organization. The PDAC measure was comprised of 18 items and utilized a 5-point Likert type response scale. The resulting Pearson correlation coefficient for the response data sample ($n = 8$) was .54 ($p > .05$), which failed to support hypothesis 5. The resulting Pearson correlation

coefficient for the generated data set (n = 400) was .94 (p < .01), which supported hypothesis 5. In sum, hypothesis 5 was not supported when utilizing the response data sample (n = 8), but was supported when utilizing the generated data set (n = 400).

Hypothesis Six

The sixth hypothesis is: product development and commercialization practices will be positively related to organizational performance within an organization. The resulting Pearson correlation coefficient for the response data sample (n = 8) was .27 (p > .05), which failed to support hypothesis 6. The resulting Pearson correlation coefficient for the generated data set (n = 400) was .86 (p < .01), which supported hypothesis 6. In sum, hypothesis 6 was not supported when utilizing the response data sample (n = 8), but was supported when utilizing the generated data set (n = 400).

Summary

In summary, hypothesis 4 was the only hypothesis that was supported when utilizing the response data sample (n = 8). The remaining Pearson correlation coefficients calculated were not statistically significant (p > .05) and failed to support the hypotheses when utilizing the response data sample. All hypotheses were supported when utilizing the generated data (n = 400) to calculate the correlation coefficient specific to the evaluation of each relationship. The resulting correlation coefficient suggests highly positive relationships that are statistically significant (p < .01). A correlation coefficient summary using the original data (n=8) is listed in table 11, while a summary using the generated data (n=8) is listed in table 12.

Table 11 Pearson Correlation Coefficient Summary (Original Data, n = 8)

Correlations

		SRM	MFM	PDAC	CA	OP
SRM	Pearson Correlation	1	-.055	.700	.079	.047
	Sig. (2-tailed)		.889	.053	.839	.905
	N	8	8	8	8	8
MFM	Pearson Correlation	-.055	1	-.139	.399	.780*
	Sig. (2-tailed)	.889		.743	.287	.013
	N	8	8	8	8	8
PDAC	Pearson Correlation	.700	-.139	1	.516	.272
	Sig. (2-tailed)	.053	.743		.191	.514
	N	8	8	8	8	8
CA	Pearson Correlation	.079	.399	.516	1	.795*
	Sig. (2-tailed)	.839	.287	.191		.010
	N	8	8	8	8	8
OP	Pearson Correlation	.047	.780*	.272	.795*	1
	Sig. (2-tailed)	.905	.013	.514	.010	
	N	8	8	8	8	8

*. Correlation is significant at the 0.05 level (2-tailed).

Table 12 Pearson Correlation Coefficient Summary (Generated Data, n = 400)

Correlations[a]

		SRM	MFM	PDAC	CA	OP
SRM_Variable	Pearson Correlation	1	.709**	.966**	.946**	.896**
	Sig. (2-tailed)		.000	.000	.000	.000
MFM_Variable	Pearson Correlation	.709**	1	.802**	.692**	.443**
	Sig. (2-tailed)	.000		.000	.000	.000
PDAC_Variable	Pearson Correlation	.966**	.802**	1	.944**	.864**
	Sig. (2-tailed)	.000	.000		.000	.000
CA_Variable	Pearson Correlation	.946**	.692**	.944**	1	.916**
	Sig. (2-tailed)	.000	.000	.000		.000
OP_Variable	Pearson Correlation	.896**	.443**	.864**	.916**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

**. Correlation is significant at the 0.01 level (2-tailed).

a. Listwise N=400

Chapter 5

Discussion

This final chapter presents the conclusions from this research study. Limitations to the findings of this study and the influences to this research are presented. Future research possibilities are suggested based on the findings and limitations experienced in this research effort. A thorough review of prevalent SCM literature indicates that improving competitive advantage and organizational performance is one of the main objectives of SCM (Croxton et al., 2001, Cooper et al., 1997, Lambert, 2001, Li et al, 2005, Simchi-Levi, 2000). This study evaluated whether three dimensions of SCM practice (supplier relationship management, manufacturing flow management, and product development and commercialization) have an effect on competitive advantage and organizational performance. A survey instrument based on Lambert's (2008) supply chain assessment tool was developed and send distributed to leading executives throughout industry. The results of this study support the hypotheses that SRM, MFM, and PDAC have a positive effect on competitive advantage and organizational performance.

The primary findings of this study based on generated data suggest that (SRM, MFM, and PDAC) have a positive effect on competitive advantage and organizational performance. The findings of this research are consistent with a similar study conducted by Thatte (2007) at the University of Toledo. In that study, every SCM dimension studied appeared to have a positive effect on competitive advantage. These findings are also consistent the relationship's strongly suggested throughout prevalent SCM literature (Tan et al., 1999; Mentzer et al., 2001, Lambert, 2008). These findings highly suggest that

organizations should embrace and actively promote high levels of these SCM practices. In a survey conducted by Davis et al. (2002) 36% of the respondents indicated that their firm has not embarked upon a program aimed specially at implementing supply chain management. Of the remaining 64% of the respondents, 55% indicated that their firm has embarked on a supply chain management program for just three years or less. The findings of this research should assure industry that SCM is an effective way of competing, and the implementation of SCM practices does have a positive impact on competitive advantage and organizational performance.

Limitations

As is the case with any research effort, this study is not without limitations. First, this study relied on self-report measures. Although self-reports are used prominently in organizational and management research, there are problems associated with their use (Podsakoff & Organ, 1986). Social desirability and response acquiescence are two tendencies that influence self-report responses (Schwab, 2005). These phenomena may prompt responses that will present the person or organization in a favorable light. This could skew the effectiveness of any self-response survey. In order to negate these tendencies as much as possible, the importance of this research was emphasized in the cover letter that was sent to all survey participants. Participants were also ensured of survey confidentiality in order to decrease the instances of social desirability.

Secondly, common methods variance may affect this study. Common methods variance is the impact of collecting data from one source at one time (Podsakoff & Organ, 1986). The only data collection method used was surveys. Respondents answering the questions on the survey may have negative or positive opinions of surveys that result in

overly positive or negative responses to the survey questions. The data was collected only once and at one point in time. Respondents taking the survey may have encountered an event on the day of taking the survey that caused them to respond overly positive or negative to the questions asked on the survey. Separation of measurements within the survey was used to decrease the impacts of common method variance. Scale re-ordering was also used to decrease the impacts of common method variance. Using different scaling and reverse scoring kept respondents from falling into to a constant answer without regard to their true feelings and opinions about the questions asked.

Third, due to size and time restraints, this research analyzed the effect of only three of the eight supply chain management processes identified by the Global Supply Chain Forum. Although the other five processes were analyzed in other theses, a comprehensive research product would have resulted in a more unified final product.

Perhaps the most serious limitation of this research is the use of simulated data. Due to the poor response rate of 1% (n=8), a sample data set (n=400) based on those responses was generated. The parameters of this simulation were based on the response data sample, and the normal distribution was found to be the most representative distribution to be used in the data generation. All generated data was assumed to be fairly representative of the target population of this research study. However, due to the small sample size on which it is based, there is a very real possibility that the generated data may not be reflective of the population it was intended to represent.

Future Research

Results from this research appear to support the prevailing belief in literature that SRM, MFM, and PDAC are positively related to competitive advantage and

organizational performance. However, research was limited by the small data sample utilized. Future research should attempt to sample from a larger sample population size in order to obtain statistically defensible results without having to rely on simulated data. Perhaps future researchers could work in conjunction with a professional society such as the Global Supply Chain Forum to promote a better survey response rate. A larger sample size would allow for the use of more precise statistical analysis techniques in order to generate more significant findings.

As noted in the limitations section this research analyzed the effect of only three of the eight supply chain management processes. Multiple linear regression analysis on a sufficient sample size taken across the spectrum of all eight processes would generate results that would be of real value to academics and practitioners alike. It is highly recommended that a comprehensive research effort be undertaken.

Conclusion

The results of this study seem to indicate that SRM, MFM, and PDAC processes have a positive impact on competitive advantage and organizational performance. Therefore, business organizations should take an active role in managing all facets of their supply chain. In today's increasingly competitive global markets, organizations that do not practice sound supply chain management techniques may find themselves unable to compete with their business competitors.

Appendix A

4 Dec 2011

FROM: SMSgt Ronald M. Salazar
2950 Hobson Way
Wright-Patterson AFB OH 45433-7765

SUBJECT: Leading Edge Study Survey

TO: Business Leader

1. This study is being conducted by SMSgt Ronald M. Salazar of the Department of Operational Science at the Air Force Institute of Technology to further understand, develop, and test the framework of supply chain management as defined by The Global Supply Chain Forum. Current literature suggests that the implementation of the supply chain management key business processes will have a positive impact on the firm's financial performance. The objective of this study is to determine the degree to which leading edge organizations are strategically developing key business processes and measure the relationship between these processes and financial performance across a wide variety of industries. Results from this study will be used to better understand how business processes impact financial performance and to advance the current level of knowledge regarding supply chain management. I plan to publish results of this study based on the data provided by survey respondents.

2. I would greatly appreciate you completing the web-based survey at your earliest convenience. Since the validity of the results depend on obtaining a high response rate, your participation is crucial to the success of this study. Your submission of the completed survey indicates your consent to participate in this study. Please be assured that your responses will be confidential and safeguarded as appropriate. All surveys will be stored electronically through the duration of the study and destroyed upon completion of the study. If the results of this study were to be written for publication, no identifying information will be used.

3. The potential benefits to you from participating in this study include better defining which and how key business processes impact financial performance. These results will enable you and your organization to make better management decisions. In today's competitive environment where there is less focus on firm versus firm and more emphasis on supply chain versus supply chain possessing the knowledge and having an understanding of leading edge supply chain management techniques will put you and your organization a full head of steam on the path to success.

4. I would appreciate your prompt cooperation with this study and thank you for your valuable time. If you have any questions and/or concerns regarding this study please contact SMSgt Ronald Salazar (associate investigator) – Phone 937-255-3636, ext. 4319; E-mail – Ronald.salazar@afit.edu.

Dr. William Cunningham
Principal Investigator

Appendix B

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Survey meets criteria for exclusion for a SCN under 32 CFR 219, DoDD 3216.2, and AFI 40-40

Privacy Notice

The following information is provided as required by the Privacy Act of 1974:

Purpose:
Dear **Anthonelli White**
The Global Supply Chain Forum (GSCF) defines supply chain management (SCM) as "the integration of key business processes from end-user through original suppliers that provides products, services, and information that add value for customers and other stakeholders". The purpose of this survey is to measure the perceived benefits of implementing the eight SCM processes identified by the GSCF framework as they pertain to competitive advantage and organizational performance. Results from this survey will be reported to all interested participants and used to shed light on the leading edge supply chain management practices currently being implemented throughout industry.

This survey will take approximately **25-30** minutes based on your answers.

Participation: We would greatly appreciate your participation in our data collection effort. Your participation is **COMPLETELY VOLUNTARY**. Your decision not to participate or to withdraw from participation will not jeopardize your relationship with the Air Force Institute of Technology, the U.S. Air Force, or the Department of Defense.

Confidentiality: We ask for some demographic information at the end of this survey in order to interpret results more accurately. No one other than the research team will see your completed questionnaire. Findings will be reported at the group level only.

Instructions

This survey consists of various statements which will measure the degree to which your firm has implemented certain supply chain management processes. For each section, please indicate the degree to which you agree or disagree with the associated statetments. If you are uncertain how to answer a particular question, or if the process does not apply to your firm, please choose the **"not applicable"** response. Also, please answer all questions in the context of your firm which is defined as the business unit at which you are currently employed.

- Base your answers on your own thoughts & experiences
- Please make your answers clear and concise when asked to answer in a response or when providing comments
- Be sure to select the correct option button when asked

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Section I: Customer Relationship Management (CRM)

The CRM process provides the structure for how the relationships with customers will be developed and maintained by segmenting customers based on their value over time.

Product and service agreement (PSA): Formal or informal contract or agreement (that may be referred to by different names from company to company) between two organizations with the purpose of specifying the level of performance that will be provided to meet the needs of both parties.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, **5** = Strongly Agree, **6** = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has developed a CRM process team.	○	○	○	○	○	○
2	Our firm utilizes cross-functional input within the CRM process.	○	○	○	○	○	○
3	Our firm ensures our CRM process is aligned with our corporate strategy.	○	○	○	○	○	○
4	Our firm identifies target segments that are critical to our organization's success.	○	○	○	○	○	○
5	Our firm develops guidelines for the degree of differentiation in PSAs.	○	○	○	○	○	○
6	Our firm documents our business relationships with customers through formal PSAs.	○	○	○	○	○	○
7	Our firm develops PSAs that do not enhance the profitability of the firm.	○	○	○	○	○	○
8	Our firm provides customized PSAs for key customers.	○	○	○	○	○	○
9	Our firm provides standard PSAs for customer segments.	○	○	○	○	○	○
10	Our firm develops PSAs that do not enhance the profitability of our customers.	○	○	○	○	○	○
11	Our firm develops metrics that are related to the customer's impact on our firm's profitability.	○	○	○	○	○	○
12	Our firm develops metrics that are related to our firm's impact on the customer's profitability.	○	○	○	○	○	○
13	Our firm's CRM metrics are tied back to our firm's financial performance.	○	○	○	○	○	○
14	Our firm does not measure customer profitability over time.	○	○	○	○	○	○
15	Our firm's CRM metrics are aligned with other metrics used throughout the firm.	○	○	○	○	○	○
16	Our firm's people understand how their decisions/actions affect the CRM process.	○	○	○	○	○	○
17	Our firm's key suppliers do not understand how their decisions/actions affect the CRM process.	○	○	○	○	○	○
18	Our firm's customers understand how their decisions/actions affect the CRM process.	○	○	○	○	○	○
19	Our firm uses guidelines for sharing process improvement benefits with customers.	○	○	○	○	○	○

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Section II: Order Fulfillment (OF)

The OF process includes all activities necessary to design a network and enable a firm to meet customer requests while minimizing the total delivered cost.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has developed an OF process team.	○	○	○	○	○	○
2	Our firm utilizes cross-functional input within the OF process.	○	○	○	○	○	○
3	Our firm understands how our OF process is tied to our customer service strategy.	○	○	○	○	○	○
4	Our firm does not understand how our OF process is tied to our marketing strategy.	○	○	○	○	○	○
5	Our firm's OF process is designed around the customer.	○	○	○	○	○	○
6	Our firm has not identified our core competencies within order fulfillment.	○	○	○	○	○	○
7	Our firm does not adhere to our order fulfillment budget.	○	○	○	○	○	○
8	Our firm works with customers to understand their order fulfillment requirements.	○	○	○	○	○	○
9	Our firm regularly improves the structure of our logistics network.	○	○	○	○	○	○
10	Our firm differentiates order fulfillment terms/policies for each customer segment based on profitability.	○	○	○	○	○	○
11	Our firm establishes rules for how product is allocated between customers/customer segments.	○	○	○	○	○	○
12	Our firm utilizes technology to support our order fulfillment activities.	○	○	○	○	○	○
13	Our firm has not established ordering rules that minimize demand variability (e.g. payment terms, minimum order sizes, etc).	○	○	○	○	○	○
14	Our firm has order fulfillment metrics that are tied back to financial performance.	○	○	○	○	○	○
15	Our firm does not have performance goals that are related to order fulfillment.	○	○	○	○	○	○
16	Our firm has order fulfillment goals that are understood throughout the firm.	○	○	○	○	○	○
17	Our firm's order fulfillment metrics are not aligned with other metrics used throughout the firm.	○	○	○	○	○	○
18	Our firm's people understand how their decisions/actions affect the order fulfillment process.	○	○	○	○	○	○
19	Key suppliers do not understand how their decisions/actions affect the OF process.	○	○	○	○	○	○
20	Our firm's customers do not understand how their decisions/actions affect the OF process.	○	○	○	○	○	○

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Section III: Returns Management (RM)

The **RM process** includes all activities associated with returns, reverse logistics, gatekeeping, and avoidance that are managed within the firm and across key members of the supply chain.

Reverse Logistics: the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption to the point of origin for the purpose of recapturing value or proper disposal.

Avoidance: finding ways to minimize the number of return requests.

Gatekeeping: making decisions to limit the number of items that are allowed into the reverse flow.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has formally developed a RM process team.	○	○	○	○	○	○
2	Our firm uses cross-functional input to frame the role of returns management within the corporate strategy.	○	○	○	○	○	○
3	Our firm evaluates the best alternatives to recapture value from returns.	○	○	○	○	○	○
4	Our firm regularly assesses our organization's level of preparedness to comply with potential environmental/legal requirements that may affect returns management.	○	○	○	○	○	○
5	Our firm does not consider internal constraints/capabilities when determining goals/strategy for returns management.	○	○	○	○	○	○
6	Our firm has not identified types of returns.	○	○	○	○	○	○
7	Our firm has procedures for identifying avoidance opportunities.	○	○	○	○	○	○
8	Our firm has not developed refund policies.	○	○	○	○	○	○
9	Our firm has not developed gatekeeping policies.	○	○	○	○	○	○
10	Our firm has developed disposition guidelines.	○	○	○	○	○	○
11	Our firm has designed a reverse logistics network that minimizes the supply chain's reverse logistics costs.	○	○	○	○	○	○
12	Our firm has not developed plans for dealing with product recalls.	○	○	○	○	○	○
13	Our firm has developed a method of valuing returned product.	○	○	○	○	○	○
14	Our firm's supply chain partners understand our credit authorization procedures.	○	○	○	○	○	○
15	Our firm's credit policies were developed with input from our supply chain partners.	○	○	○	○	○	○
16	Our firm has developed rules about using secondary markets.	○	○	○	○	○	○
17	Our firm has not developed remanufacturing/refurbishing strategies.	○	○	○	○	○	○
18	Our firm has returns management metrics that are related to financial performance.	○	○	○	○	○	○
19	Our firm's people do not understand how their decisions/actions affect the RM process.	○	○	○	○	○	○
20	Our firm's supply chain partners understand how their decisions/actions affect the RM process.	○	○	○	○	○	○

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Section IV: Customer Service Management (CSM)

The **CSM process** deals with the administration of product and service agreements (PSAs) developed by customer teams as part of the customer relationship management process. Customer service managers monitor the PSAs and proactively intervene on the customer's behalf if there is going to be a problem delivering on promises that have been made.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our customer service strategy is executed well throughout the firm.	○	○	○	○	○	○
2	Our firm uses cross-functional input within the CSM process.	○	○	○	○	○	○
3	Our customer service representatives respond to customer service issues with formally-developed response procedures.	○	○	○	○	○	○
4	Our firm does not understand the internal coordination required to respond to customer service events.	○	○	○	○	○	○
5	Our firm has mechanisms in place for responding to customer service issues prior to the customer being impacted.	○	○	○	○	○	○
6	Our firm understands the external coordination required to respond to various customer service events.	○	○	○	○	○	○
7	Our firm responds to customer service issues before the customer is impacted.	○	○	○	○	○	○
8	Our firm uses information systems to aid with the information flow related to CSM.	○	○	○	○	○	○
9	Our firm has developed formal CSM metrics.	○	○	○	○	○	○
10	Our firm understands how CSM metrics impact financial performance.	○	○	○	○	○	○
11	Our firm does not have formal performance goals relating to CSM.	○	○	○	○	○	○
12	Our firm's key suppliers understand how their decisions/actions affect the CSM process.	○	○	○	○	○	○
13	Our firm's key customers understand how their decisions/actions affect the CSM process.	○	○	○	○	○	○

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Section V: Demand Management Process (DM)

The **DM process** balances the customers' requirements with the capabilities of the supply chain. The process includes forecasting and other efforts to increase flexibility through synchronizing supply and demand and reducing variability. The process also includes efforts to coordinate marketing requirements and production plans on an enterprise-wide basis or efforts made towards synchronizing production rates to manage inventories globally.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm's demand management strategy is executed well throughout the firm.	○	○	○	○	○	○
2	Our firm uses cross-functional input within the DM process.	○	○	○	○	○	○
3	Our firm has not identified the bottlenecks in our supply chain.	○	○	○	○	○	○
4	Our firm's forecasts are coordinated with key suppliers.	○	○	○	○	○	○
5	Our firm's forecasts are coordinated within the firm such that everyone's planning is based on the same numbers.	○	○	○	○	○	○
6	Our firm's forecasts are coordinated with key customers.	○	○	○	○	○	○
7	Our firm does not have formal synchronization procedures in place to match supply with demand.	○	○	○	○	○	○
8	Our firm understands the production/inventory capacity available at key points in the supply chain.	○	○	○	○	○	○
9	Our firm has mechanisms to help synchronize supply and demand during contingencies.	○	○	○	○	○	○
10	Our firm has developed formal DM metrics.	○	○	○	○	○	○
11	Our firm understands how DM metrics impact financial performance.	○	○	○	○	○	○
12	Our firm's key suppliers understand how their decisions/actions affect the DM process.	○	○	○	○	○	○
13	Our firm's key customers understand how their decisions/actions affect the DM process.	○	○	○	○	○	○

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Section VI: Supplier Relationship Management (SRM)

SRM is the supply chain management process that provides the structure for how relationships with suppliers are developed and maintained. With regard to your organization's supplier relationship management process, please choose the appropriate number to indicate the extent to which you agree or disagree with each statement.

Product and service agreement (PSA): Formal or informal contract or agreement (that may be referred to by different names from company to company) between the two organizations with the purpose of specifying the level of performance that will be provided to meet the needs of both parties.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has examined how corporate strategy influences the SRM process.	○	○	○	○	○	○
2	SRM process requirements are determined by a cross-functional team.	○	○	○	○	○	○
3	Our firm has not identified key criteria for segmenting suppliers.	○	○	○	○	○	○
4	Our firm documents our relationships with suppliers through formal PSAs.	○	○	○	○	○	○
5	Our firm provides supplier teams with formal boundaries for the degree of customization desired in PSAs.	○	○	○	○	○	○
6	Our firm has SRM metrics that are related to our firm's financial performance.	○	○	○	○	○	○
7	Our firm does not have formal performance goals for supplier relationship management.	○	○	○	○	○	○
8	Our firm regularly measures our supplier's contributions to our profitability.	○	○	○	○	○	○
9	Our firm regularly measures the impact our business has on a supplier's profitability.	○	○	○	○	○	○
10	Conflicting functional objectives often hinder the performance of the supplier relationship process.	○	○	○	○	○	○
11	People throughout our firm understand how their decisions/actions affect the SRM process.	○	○	○	○	○	○
12	Our key suppliers understand how their decisions/actions affect the SRM process.	○	○	○	○	○	○
13	Our customers understand how their decisions/actions affect the SRM process.	○	○	○	○	○	○
14	Our firm does not share benefits from process improvements with suppliers.	○	○	○	○	○	○

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Section VII: Manufacturing Flow Management (MFM)

MFM is the supply chain management process that includes all activities necessary to obtain, implement, and manage manufacturing flexibility in the supply chain and to move products through the plants.

Postponement: Retaining the product in a neutral and non committed status as long as possible in the manufacturing process.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, **5** = Strongly Agree, **6** = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has examined how our corporate strategy influences the MFM process.	○	○	○	○	○	○
2	Our firm has a formal process for evaluating the expertise that will be needed to use future technologies or fulfill future market needs.	○	○	○	○	○	○
3	Our firm has a formal process for assessing future changes in laws and regulations that might affect our manufacturing practices.	○	○	○	○	○	○
4	Our firm cannot offer different degrees of manufacturing flexibility to different customers.	○	○	○	○	○	○
5	Manufacturing flexibility requirements are determined by a cross-functional team.	○	○	○	○	○	○
6	Our firm does not plan for capacity growth for the future.	○	○	○	○	○	○
7	Make/buy decisions are based on multiple criteria, with a long term focus.	○	○	○	○	○	○
8	Postponement opportunities are evaluated jointly with key customers.	○	○	○	○	○	○
9	Postponement opportunities are evaluated jointly with key suppliers.	○	○	○	○	○	○
10	Manufacturing capabilities are formally communicated internally.	○	○	○	○	○	○
11	Manufacturing capabilities are formally communicated with key customers.	○	○	○	○	○	○
12	Manufacturing capabilities are formally communicated with key suppliers.	○	○	○	○	○	○
13	Our firm has formal metrics focused on the MFM process.	○	○	○	○	○	○
14	Our firm understands how MFM metrics impact financial performance.	○	○	○	○	○	○
15	Our firm has formal performance goals relating to the MFM process.	○	○	○	○	○	○
16	Our firm has communicated performance goals relating to MFM throughout the firm.	○	○	○	○	○	○
17	Conflicting functional objectives hinder the performance of the MFM process.	○	○	○	○	○	○
18	People in our firm have a limited understanding of how their decisions/actions affect the MFM process.	○	○	○	○	○	○

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Section VIII: Product Development and Commercialization (PD&C)

PD&C is the supply chain management process that provides structure for developing and bringing to market new products jointly with customers and suppliers. With regard to your organization's product development and commercialization process, please choose the appropriate number to indicate the extent to which you agree or disagree with each statement.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	Our firm has examined how our corporate strategy influences the PD&C process.	○	○	○	○	○	○
2	Our firm has an extensive (cross-functional) understanding of our supply chain's constraints/capabilities as they relate to product development activities.	○	○	○	○	○	○
3	Our firm does not consider customer feedback with respect to product development activities	○	○	○	○	○	○
4	Our firm provides incentives for new product ideas.	○	○	○	○	○	○
5	Our firm has evaluated the value of all potential sources of new product ideas and uses them appropriately.	○	○	○	○	○	○
6	Our firm does not have an explicit methodology for developing new product ideas.	○	○	○	○	○	○
7	Our firm has formal guidelines concerning supplier and/or customer involvement in our PD&C process.	○	○	○	○	○	○
8	Our firm does not have formal procedures in place to identify product rollout issues/constraints.	○	○	○	○	○	○
9	Our firm has formal guidelines for establishing time-to-market expectations for our PD&C process.	○	○	○	○	○	○
10	Our firm has formal guidelines for establishing product profitability targets for our PD&C process.	○	○	○	○	○	○
11	Our firm has formal procedures for assessing the strategic fit of new products.	○	○	○	○	○	○
12	Our firm has formal metrics focused on product development and commercialization.	○	○	○	○	○	○
13	Our firm understands how our PD&C metrics impact financial performance	○	○	○	○	○	○
14	Our firm has formal performance goals relating to the PD&C process.	○	○	○	○	○	○
15	Our firm's formal performance goals are communicated throughout the firm.	○	○	○	○	○	○
16	Our firm's formal performance goals are communicated to our suppliers.	○	○	○	○	○	○
17	Our firm's formal performance goals are communicated to our customers.	○	○	○	○	○	○
18	Our firm's PD&C metrics are aligned with other metrics used throughout the firm.	○	○	○	○	○	○

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Section IX: Competitive Advantage

Competitive advantage is the extent to which an organization is able to create a defensible position over its competitors.

Please indicate the extent to which you agree or disagree with each statement with regard to the competitive advantage of your firm.

The scale below utilizes a five-point Likert type scale with responses ranging from:
1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree, 6 = NOT APPLICABLE.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	NOT APPLICABLE
		1	2	3	4	5	6
1	We offer competitive prices.	○	○	○	○	○	○
2	We are able to offer prices as low or lower than our competitors.	○	○	○	○	○	○
3	We offer high quality products/services to our customer.	○	○	○	○	○	○
4	We are not able to compete based on quality.	○	○	○	○	○	○
5	We offer products/services that are highly reliable.	○	○	○	○	○	○
6	We offer products that are very durable.	○	○	○	○	○	○
7	We rarely deliver customer orders on time.	○	○	○	○	○	○
8	We provide dependable delivery.	○	○	○	○	○	○
9	We provide customized products/services.	○	○	○	○	○	○
10	We alter our product/services offerings to meet client needs.	○	○	○	○	○	○
11	We do not respond well to customer demand for 'new' features/services.	○	○	○	○	○	○
12	We are first in the market in introducing new products/services.	○	○	○	○	○	○
13	We have time-to-market lower than industry average.	○	○	○	○	○	○
14	We have fast product development.	○	○	○	○	○	○

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Section X: Organizational Performance

Organizational performance is the extent to which a firm achieves its market-oriented goals as well as its financial goals. .

Please select the number which best indicates your firm's overall performance for the following areas as compared to the industry average:

The organizational performance scale utilizes a five-point Likert type scale with responses ranging from 1 = Significantly Lower, 2 = Lower, 3 = Average, 4 = Higher, 5 = Significantly Higher, 6 = NOT APPLICABLE (*DO NOT KNOW*)

		Significantly Lower	Lower	Average	Higher	Significantly Higher	NOT APPLICABLE
		1	2	3	4	5	6
1	Market share	○	○	○	○	○	○
2	Return on investment	○	○	○	○	○	○
3	The growth of market share	○	○	○	○	○	○
4	The growth of sales	○	○	○	○	○	○
5	Growth in return on investment	○	○	○	○	○	○
6	Profit margin on sales	○	○	○	○	○	○
7	Overall competitive position	○	○	○	○	○	○

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Section XI: Demographics

Individual Profile

		CEO/President/Vice President	Director	Manager	Other
		1	2	3	4
1	What is your current job title?	○	○	○	○

If other, please explain

		Under 2 years	2 – 5 years	6 – 10 years	Over 10 years
		1	2	3	4
2	How many years have you been in your current position?	○	○	○	○

		Under 2 years	2 – 5 years	6 – 10 years	Over 10 years
		1	2	3	4
3	How many years have you been in your current organization?	○	○	○	○

4	In your current job, what function(s) best describe your responsibilities? Check all that apply.
☐	Finance
☐	Production/Operations Management
☐	Logistics/Transportation/Distribution
☐	Supply/Purchasing/Procurement
☐	Information Technology
☐	Sales/Marketing
☐	Engineering/Product Development
☐	Other

If other, please explain

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Section XI: Demographics (continued)

Company Profile

		Less than 100	100 – 250	251 – 500	501 – 1000	Over 1000
		1	2	3	4	5
1	How many full time employees are in your organization?	○	○	○	○	○

		Under 10	10 – < 25	25 – < 50	50 – < 100	100 – < 500	Over 500
		1	2	3	4	5	6
2	What is your organization's annual volume of sales measured in millions of dollars?	○	○	○	○	○	○

3	Please select the industry classification code which best describes your firm. Please indicate not applicable ("N/A") if appropriate.	
○	11	Agriculture, Forestry, Fishing and Hunting
○	21	Mining, Quarrying, and Oil/Gas Extraction
○	22	Utilities
○	23	Construction
○	31 - 33	Manufacturing
○	42	Wholesale Trade
○	44 - 45	Retail Trade
○	48 - 49	Transportation and Warehousing
○	51	Information
○	52	Finance and Insurance
○	53	Real Estate/Rental and Leasing
○	54	Professional, Scientific, and Technical Services
○	55	Management of Companies and Enterprises
○	56	Administrative and Support and Waste Management and Remediation Services
○	61	Educational Services
○	62	Health Care and Social Assistance
○	71	Arts, Entertainment, and Recreation
○	72	Accommodation and Food Services
○	81	Other Services (except Public Administration)
○	92	Public Administration
○	999	N/A

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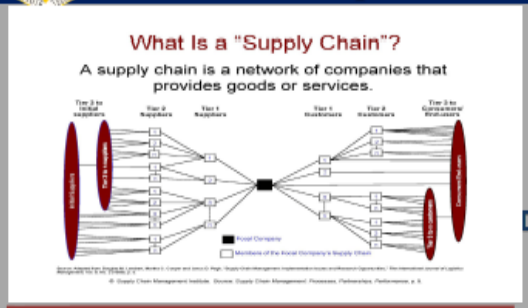
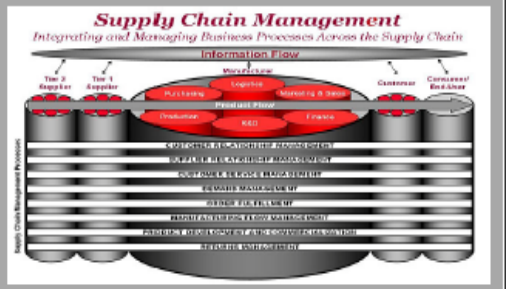


SMSgt Ronald Salazar
Advisor: Dr. William Cunningham
Member: Lt Col Sharon Heilmann
Member: Maj Daniel Mattioda
Department of Operational Sciences (ENS)
Air Force Institute of Technology



Introduction

Effective supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance since competition is no longer between organizations, but among supply chains. This research conceptualizes and develops three dimensions of SCM practice (supplier relationship management, manufacturing flow management, and product development and commercialization) and tests the relationships between these SCM practices, competitive advantage, and organizational performance.

Research Model

Hypothesis

H1: Supplier relationship management practices will be positively related to competitive advantage within an organization.
H2: Supplier relationship management practices will be positively related to organizational performance.
H3:Manufacturing flow management practices will be positively related to competitive advantage within an organization.
H4: Manufacturing flow management practices will be positively related to organizational performance.
H5: Product development and commercialization practices will be positively related to competitive advantage within an organization.
H6: Product development and commercialization practices will be positively related to organizational performance.

Hypothesis Results (n=400)

Hypothesis	Result	*r*
H1	Supported	.95 ($p < .01$)
H2	Supported	.90 ($p < .01$)
H3	Supported	.69 ($p < .01$)
H4	Supported	.44 ($p < .01$)
H5	Supported	.94 ($p < .01$)
H6	Supported	.86 ($p < .01$)

Variable Descriptive Statistics (Response Data)

	Cronbach's α	Mean	Std. Deviation	n
Supplier Relationship Management	.97	3.66	.78	400
Manufacturing Flow Management	.98	3.94	.82	400
Product Development & Commercialization	.97	3.90	.72	400
Competitive Advantage	.96	3.65	.61	400
Organizational Performance	.96	4.25	.54	400

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14. ABSTRACT

One of the most significant changes in the paradigm of modern business management is that individual businesses no longer compete as solely autonomous entities, but rather as supply chains. In this emerging competitive environment, the ultimate success of the business will depend on management's ability to integrate the company's intricate network of business relationships. Effective supply chain management (SCM) has become a potentially valuable way of securing competitive advantage and improving organizational performance since competition is no longer between organizations, but among supply chains. This research conceptualizes and develops three dimensions of SCM practice (supplier relationship management, manufacturing flow management, and product development and commercialization) and tests the relationships between these SCM practices, competitive advantage, and organizational performance. Data for the study was collected from prominent organizations and the relationships proposed in the framework were tested using rigorous statistical techniques. The results indicate that higher levels of SCM practice can lead to enhanced competitive advantage and improved organizational performance.

15. SUBJECT TERMS
Supply chain management, Supplier relationship management, Manufacturing flow management, Product development

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