

The Scope and Span of Supply Chain Management

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Studies on supply chain management suggest that the scope of business processes being coordinated across supply chains is broad. However, little empirical evidence exists that corroborates such claims. In this study executives randomly selected from a diverse array of industries were surveyed to determine the scope of processes that are being integrated across organizational borders, the extent to which they are being jointly managed, and the span in terms of the number of tiers across which they are being managed. The results indicate that a large proportion of companies that practice supply chain management are attempting to integrate logistics, marketing, and operations-oriented processes with those of other companies in their supply chains. Also, the span of a company's supply chain management efforts significantly relates to the extent to which it jointly manages business processes with other firms.

The literature on supply chain management suggests that the discipline involves more than simply the coordination of material and information flows from original supplier to end user.

The literature on supply chain management suggests that the discipline involves more than simply the coordination of material and information flows from original supplier to end user [1]. For example, in their definition of a supply chain, Mabert and Venkataramanan imply that the domain of supply chain management covers the coordination of logistical, marketing, and operations activities or processes:

"[The] supply chain is the network of facilities and activities that performs the functions of product development, procurement of material from vendors, the movement of material between facilities, the manufacturing of products, the distribution of finished goods to customers, and after-market support for sustainment." [2]

Lambert, Cooper, and Pagh go further. They develop a comprehensive normative model of supply chain management that company executives might consult when making decisions concerning supply chain management. Their three-component model is based on the definition that:

"Supply chain management is the integration of key business

processes from end user to original suppliers that provides products, services, and information that add value for customers and other stakeholders." [3]

One component of their model is focussed on decisions about the number and types of business processes that may be integrated across firms in the supply chain. They offer evidence from case studies that some firms are integrating up to six major business processes involving personnel from two or more functional areas. These and other recent works indicate that the scope of supply chain management is broad and includes diverse sets of business activities, functional personnel, general management activities, and supply chain members in the integration efforts. This broad scope of supply chain management is intuitively appealing.

While studies about the causes, forms, and effectiveness of inter-organizational relationships are not new [for example, see 4], there has been little or no empirical evidence to date that reflects the scope of business processes or activities that companies are coordinating across company boundaries. The purpose of this study was to provide preliminary evidence that addresses this question and validates the notion that

supply chain management involves more than just the coordination of logistics activities across firms. Because Lambert, Cooper, and Pagh's normative framework provided the jumping off point for this study, the next section briefly reviews that framework and provides background information about the development of the study's objectives. Descriptions of the methodology and analysis of survey data follow. Next, managerial and research implications are considered followed by the study's limitations and directions for future research.

Background and Objectives

According to Cooper, Lambert, and Pagh, the practice of supply chain management is comprised of three key decisions areas: the number and types of business processes to integrate, the supply chain network over which they are integrated, and the aspects of general management to focus the integration upon [5]. Regarding the first decision area, in line with the principles of business reengineering and process management [6], they identify internal

business processes as opposed to particular functional activities as the unit of integration in supply chain management. Building on Davenport's definition, they characterize a process as a specific ordering of work activities with clearly defined inputs and outputs and a structure for action. They propose that all business processes that focus on meeting end customer requirements are candidates for supply chain management. Further, they identify eight processes representative of those being integrated by the firms they interviewed. These processes and their key concerns, which are central to this study, are summarized in Table 1.

Processes exist in all companies. They are cross-functional in nature [7] and can be broken down hierarchically into process elements, activities, and tasks, respectively, that transform materials and information into something of value to customers [8]. The approach or orientation to organizing work that a firm follows has clear implications in terms of its organizational structure, process characteristics, communication, people, technology, and culture [9]. Yet, whether companies organize work by process or

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Table 1
Representative Processes Being Integrated Across Supply Chains

Process	Key concerns
Customer Relationship Management	Identifying key customer target markets, and developing and implementing programs with key customers
Customer Service	Providing one face to the customer using on-line information systems with current information about the order, as well as production and distribution status. This process also provides product information to the customer.
Demand Management	Recognizes that the flow of materials and products is intertwined with customer demand. Forecasting and reducing variability are key concerns of this process.
Order Fulfillment	Provides for timely and accurate delivery of customer orders with the objective of exceeding customer need dates.
Manufacturing Flow Management	Concerned with making the products that customers want. This is resulting in manufacturing processes that are more flexible and efforts to have the right mix of products.
Procurement	Focuses on managing relationships with strategic suppliers. The objective is to support the manufacturing flow management process and new product development.
Product Development and Commercialization	Focuses on integrating key customers and suppliers into the product development process in order to reduce time to market.
Returns	Focuses on recovering the greatest value from reverse product and materials flows, with emphasis on recycling, reuse, and source reduction.*

Adapted from Martha C. Cooper, Douglas M. Lambert and Janus D. Pagh, "Supply Chain Management: More Than a New Name for Logistics," *The International Journal of Logistics Management*, Vol. 8, No. 1 (1997), pp. 1-13.

*Adapted from Council of Logistics Management, *Reuse and Recycling—Reverse Logistics Opportunities*, Oak Brook, IL: Council of Logistics Management, pp. 2-5; Toby B Gooley, "Diminishing Returns," *Logistics Management and Distribution Report*, Vol. 40, No. 6 (June 2001), pp. 43-47; and Jos van Hillegersberg, Rob Zuidwijk, Jo van Nunen and Diana van Eijk, "Supporting Return Flows in the Supply Chain," *Communications of the ACM*, Vol. 44, No. 6 (June 2001), pp. 74-79.

function, the transforming activities that help a firm carry out its mission occur nonetheless. In fact, many successful companies still assign responsibility for major activities and tasks along functional lines. Many also succeed under a process orientation in which process ownership and responsibility is assigned to cross-functional teams led by a functional specialist whose expertise is most critical to the design and execution of process activities.

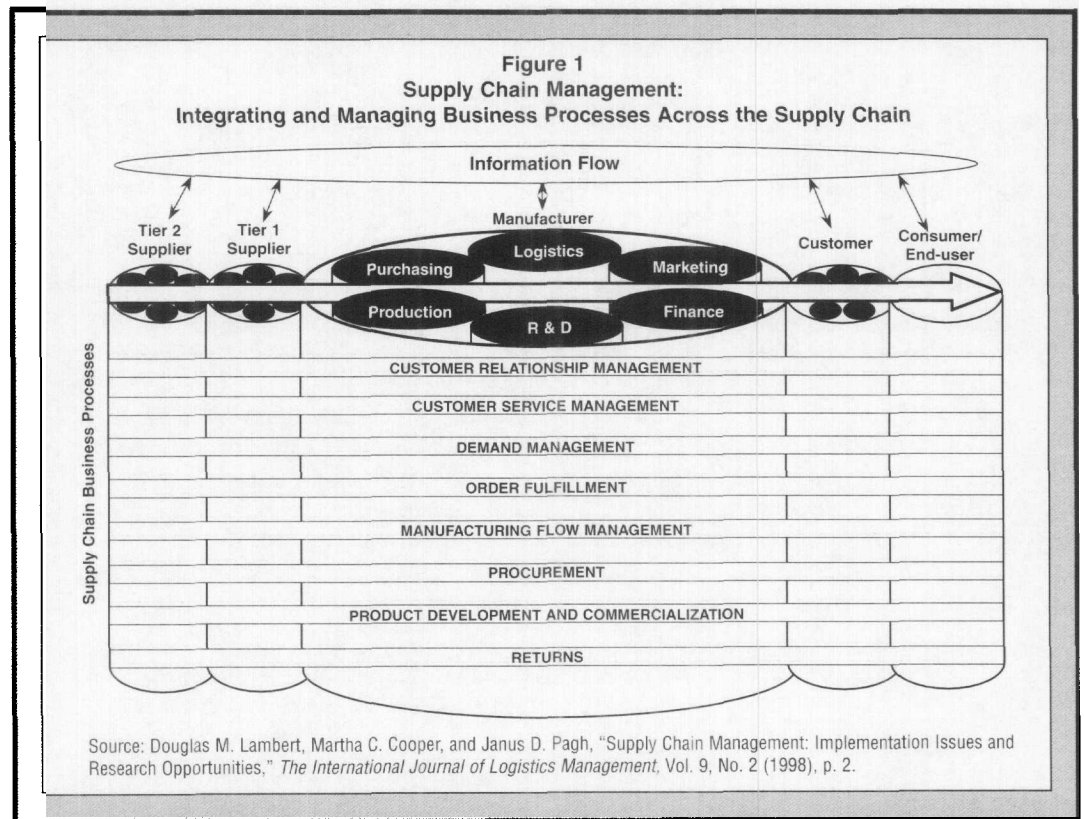
A second major decision area deals with establishing the network of firms in the supply chain with which a company will integrate processes. This decision is influenced by a number of factors, including the complexity of the product, the length of the supply chain, and the number of suppliers and customers at each level of the chain. Given that most firms participate in multiple supply chains, it becomes important for a firm to identify the most critical chains and levels in each chain that will be managed, and pursue the inter-organizational relationships needed to do so.

Lambert, et al., [10] characterize the network structure of a supply chain in terms of its horizontal and vertical dimensions. Horizontal structure refers to the number of tiers of suppliers and customers across a firm's

supply chain. For example, in Figure 1, the immediate suppliers and customers of the focal company reside in the first upstream and downstream tiers, respectively, of its supply chain. Likewise, its suppliers' suppliers and customers' customers reside in the second upstream and downstream tiers, respectively. The vertical structure of a firm's supply chain is characterized by the number of different suppliers or customers that reside in each tier of its supply chain. For example, in Figure 1, if the focal company's first tier of suppliers consisted of only two companies, its vertical structure at that point of its supply chain could be characterized as narrow. In contrast the vertical structure of a company that deals with many first-tier suppliers would be considered as wide. Building from these definitions, three concepts termed the horizontal span, vertical span, and horizontal span radius of a firm's supply chain management efforts can be defined.

Horizontal span refers to the number of tiers across which a process is integrated. For example, a company that integrates its order fulfillment process with a first-tier supplier and first-tier customer would have a horizontal span of three tiers when the focal

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firm's tier is counted. Alternatively, a company that only integrates a process with a first-tier supplier and a second-tier supplier would also have a three-tier span. Similarly, the vertical span of a company's supply chain management efforts refers to the number of firms within a tier with whom it integrates a process or processes. Horizontal span radius, which derives from a firm's horizontal span, measures the longest length of horizontal span from the focal firm in either direction, upstream or downstream. According to this definition, a one-tier radius indicates that the focal firm's integration efforts do not reach beyond its first tier of suppliers or customers, while a two-tier radius indicates that its efforts involve first and second-tier companies, and so on.

The third major decision area under this framework concerns the general management issues. For example, management attempting to integrate a process across firms need a work structure that details how tasks and activities will be performed across the span of the integration effort. Cooper, et al., [11] identify 10 supply chain management components that firms must address when trying to integrate business processes: planning and control, work structure, organizational structure, product flow facility, information flow facility structure, product structure, measurement methods, power and leadership structure, risk and reward structure, and culture and attitude.

The normative framework embodying these major decision areas springs from case observation and is logically sound. Yet, empirical evidence corroborating its validity is scarce in the literature which provided us with the motivation for this study. The research is focused on validating the business process and network structure aspects of Lambert, Cooper, and Pagh's [12] normative model, with the major goal being to provide empirical evidence about the scope and span of supply chain management practices existing today. The five objectives that guided the study's design were to determine:

- The extent to which managers are practicing this broad form of supply chain management.
- The scope in terms of the number and types of business processes that managers are integrating across supply chains.

- The degree to which business processes are being integrated across supply chains.
- The horizontal spans and span radii of supply chain integration.
- Whether horizontal span and span radius are significantly related to the degree to which processes are being integrated.

To meet these objectives, a descriptive study was designed and aimed at managers in companies considered most likely to be practicing supply chain management. The study used a mail survey instrument to gather data about the types business processes that companies are integrating and the members of the supply chain that they practice supply chain management with.

Methodology

A short questionnaire containing questions seeking information relevant to each of the research objectives was designed and pre-tested for content and language by five logistics professionals from industry and academia. It was mailed to a single member of management at 448 companies randomly drawn from two sources: the Supply Chain Council, an association of leading companies and institutions that endorse the Supply Chain Operations Reference (SCOR) model; and, managers who attended the Council of Logistics Management Annual Conference. Representatives from member companies of the Supply Chain Council selected for inclusion in the sampling frame were the contact delegates listed on their membership roster. Potential sample respondents from companies represented at the CLM conference were chosen from the most senior members of each company's attendees.

Each questionnaire was mailed with a cover letter, a self-addressed return envelope with first-class postage, and a one-dollar bill as an incentive for the recipient to respond. Follow up postcards reminding and encouraging sample members to fill out and return the questionnaire were sent 7-10 days after the initial mailing. The cover letter instructed recipients to return the unanswered questionnaire if they did not wish to participate in the survey. Forty questionnaires addressed to managers who were no longer with a firm or whose mailing address had changed were returned, leaving an effective sample size of 408. A total of 101 completed

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Table 2
Respondents' Characteristics

	Frequency	Percent
Respondent's title		
Owner/CEO/Other executive officer	20	19.8
Transportation/traffic/shipping manager or director	9	8.9
Purchasing manager or director	7	6.9
Quality manager or director	1	1.0
Logistics/supply chain manager or director	50	49.5
Other manager or director	14	13.9
Total	101	100.0
Firm's total number of employees		
Less than 1,000	29	28.7
1,000-2,499	14	13.9
2,500 or more	58	57.4
Total	101	100.0
Firm's average annual sales volume in dollars		
\$100 million or less	17	16.9
More than \$100 million, up to \$500 million	17	16.8
More than \$500 million, up to \$1 billion	17	16.8
More than \$1 billion	50	49.5
Total	101	100.0
Firm's industry		
Food	14	13.9
Consumer goods (non-food)	25	24.8
Chemicals	11	10.9
Computers/communications	13	12.9
Pharmaceutical	4	4.0
Automotive	6	5.9
Paper/packaging	2	2.0
Transportation	6	5.9
Other	20	19.8
Total	101	100.0

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questionnaires were returned. Although eight of the questionnaires contained missing item responses, they were kept as usable since no one questionnaire contained more than two missing responses. The 101 usable questionnaires yielded a 24.8 percent response rate.

A profile of respondents' firms, shown in Table 2, revealed that a majority of the firms, 58 percent, employ 2,500 or more people. Two-thirds of the respondents reported that their firms realize average annual revenues of greater than \$500 million—and 50 of those reach annual sales greater than \$1 billion. A majority of the respondents' firms, 62 percent, were from the food, consumer non-food goods, chemical, and computer/communication industries. The remaining firms represented a broad array of industries, including the aerospace, building materials,

fabricated metals, forest products, and hospital and medical equipment industries.

Data Analysis

The study's first objective focused on determining the extent to which companies are coordinating more than one business process across their supply chains. Two questions on the survey instrument were designed to elicit this information. One was meant to identify companies that integrate any business processes with other firms in their supply chain and how long they have been doing so. The other asked respondents to rate the extent to which their companies jointly manage key business activities with other firms.

The first question on the survey instrument referred respondents to a part of the questionnaire instructions that defined

Table 3
Proportion of Respondents' Firms that Integrate One or More Logistical, Marketing, Purchasing, or Other Business Processes

95% Confidence Interval					
	<u>Frequency</u>	<u>Valid Percent</u>	<u>Estimated standard error</u>	<u>Lower Bound</u>	<u>Upper Bound</u>
No*	26	25.7			
Yes**	75	74.3	4.41%	65.4%	82.6%
Total	100	100.0			

* Respondent indicated that their firm did not integrate one or more processes.

** Respondent indicated that their firm did integrate one or more processes.

supply chain management as:

"...the integration of one or more logistical, marketing, purchasing, or other business processes from end user to original suppliers that provides products, services, and information that add value for customers."

Respondents were asked whether or not their company currently practices supply chain management as defined above. Those who indicated "No" were directed to skip more probing questions and simply provide demographic information about their firm. The primary purpose of this question was to identify whether or not a company was

Table 4
Degree to Which Process Elements are Jointly Managed

Supply Chain Process Element (Parent Supply Chain Process in parentheses)	n	Mean*	Std. Deviation	Firms rating "Not at All"	
				Number	Percent
Delivery of customer orders in timely fashion (Order Fulfillment)	74	5.66 ^a	1.48	2	2.7
Improving product quality (Manufacturing Flow Management)	73	4.75	1.73	4	5.4
Providing customers access to information about their orders' status (Customer Service)	72	4.51 ^b	1.85	6	8.2
Supporting the needs of manufacturing operations (Procurement)	74	4.46	1.60	5	6.7
Forecasting of customer demand (Demand Management)	74	4.32	1.68	4	5.3
Ensuring that manufacturing rapidly adjusts to customer (Manufacturing Flow Management)	73	4.27	1.81	6	8.1
Implementing marketing programs with customers (Customer Relationship Management)	74	4.27	1.72	8	10.7
Supporting new product development (Procurement)	74	4.26 ^c	1.81	8	10.7
New product development (New product development)	74	4.11	1.78	7	9.3
Identifying key markets (Customer Relationship Management)	74	3.87	1.67	6	8.0
Reducing fluctuations in customer demand (Demand Management)	74	3.78	1.71	8	10.7

* (Scale: 1 = Not at All; 7 = Great Extent)

^a T-test of mean found value to be significantly greater than 5.0.

^b T-tests of each mean found values to be significantly greater than 4.0.

^c T-tests of each mean found values to be significantly greater than 3.0.

Number of process elements Not jointly managed	Number of Companies	Percent	Cumulative Percent
0	54	72	72
1	9	12	84
2	5	7	91
3	1	1	92
4	1	1	93
5	1	1	95
6	1	1	96
8	1	1	97
9	1	1	99
10	1	1	100
Total	75	100.0	

actively integrating major business processes with other members of their supply chains. An affirmative response to this question did not necessarily mean that the respondent's company integrated more than one process, but simply that some degree of external integration was occurring. Respondents from 75 of the 101, or 74.3 percent, of the companies represented in the sample indicated that their firms integrated one or more business processes across their supply chain. A 95 percent confidence interval, shown in Table 3, estimates the true proportion of firms in the population to be between 65 and 83 percent which corroborates a similar finding in another study [13].

Information about the number of processes being integrated by these 74 firms was generated from responses to the second question. It asked qualifying respondents to rate the extent to which their company jointly managed each of the 11 major business activities listed in Table 4. They are referred to as process elements since they correspond to key concerns of the supply chain processes listed in Table 1. While the brevity of the questionnaire prevented the inclusion of the process element for each of the eight supply chain processes (e.g., the concerns of the returns process were not represented) in the survey, the 11 process elements represented seven of the eight processes in Table 1. Respondents rated each process element on a scale that ranged from one to seven, where one indicated that a process element was not at all jointly managed and seven indicated that it was jointly managed to a great extent.

The mean ratings assigned to each of the 11 process elements are listed in Table 4. If a respondent answered "Yes" to the first question, it was expected that they would rate at least one process element higher than one. Respondents whose companies integrate a broad scope of process elements with other companies were expected to assign ratings higher than one to multiple elements. Moreover, it was expected that if companies in general were integrating a broad scope of process elements, the proportions of respondents assigning a rating of one to each element would be very low. The results in Table 4 indicate that this is indeed the case. Among the 75 respondent companies that integrated one or more supply chain processes, the proportions of those that did not jointly manage a given process with other firms ranged from 3 to 11 percent. This suggests that a substantial proportion of companies that practice supply chain management integrate two or more process elements with those of other companies in their supply chains.

The second research objective was to determine how many process elements and the types of elements the average company was integrating. To address this objective, the number of process elements that each company did not jointly manage at all was counted and a frequency distribution of the count values analyzed. The frequency distribution is shown in Table 5. A count value of zero indicates that a company jointly managed to some degree each of the 11 process elements shown in Table 4, while a

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value of 10 indicates that it jointly managed only one of the process elements. The results in Table 5 show that 54, or 72 percent of the 74 companies in the sample identified as integrating business processes across their supply chains, jointly managed to some degree all 11 of the process elements listed in Table 4 with other firms. Moreover, 68, or 91 percent of the 74 firms jointly managed to some extent at least nine of the 11 process elements, strongly suggesting that a large proportion of companies practicing supply chain management integrate a high number of supply chain process elements across their supply chains. It should be noted that these process elements and the major business concerns they address encompass a broad scope of activities whose performance involves a variety of the functional domains—logistics, marketing, operations, etc.—within companies. The evidence presented in Tables 3, 4, and 5 strongly supports claims that the scope of supply chain management is broad in terms of the number and types of business processes involved.

The third research objective called for determining the extent to which companies jointly manage various process elements. The mean ratings and standard deviations for each process element shown in Table 4 suggest that in the average firm each process element was jointly managed to some extent, although no process was managed to a great extent. Independent t-tests to evaluate whether each process element is not jointly managed with other firms that is its mean rating equaled 1 revealed that companies attempt to externally

integrate each of the 11 process elements. This does not mean that each process element was jointly managed to a great degree but simply that in the average company where supply chain management is practiced, there is some effort to coordinate each of these process elements with other firms. To better identify those process elements to which greater cooperative efforts were devoted, additional t-tests were conducted to judge whether each process was jointly managed to moderate and slightly more than moderate extents, that is, its mean rating equaled 4 and 5, respectively. The findings suggest that in companies where supply chain management is practiced five of the 11 process elements are jointly managed to a moderate degree: the timely delivery of customer orders, improving product quality, providing customers access to information about their orders' status, supporting the need of manufacturing operations, and forecasting of customer demand. Only the timely delivery of customers' orders was jointly managed to a slightly more than moderate extent. These five process elements represent the key components of five major supply chain processes identified by Lambert et al: order fulfillment, manufacturing flow management, customer service, procurement, and demand management [14]. The findings imply that in companies where supply chain management is practiced, managers concentrate a fair amount of effort and resources to the integration of a broad, diverse array of key cross-functional processes as claimed in previously cited definitions[15].

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Table 6
Proportions of Companies Practicing Supply Chain Management with Various Members of Their Supply Chains

Question: "Does your firm practice supply chain management with one or more..."	Response Category		Percent Responding "Yes"	95% Confidence Interval	
	Yes	No		Lower Bound	Upper Bound
Suppliers' suppliers (Second-tier)	24	43	34.3	23.1	45.5
Direct or first-tier suppliers	64	8	87.7	80.1	95.3
Direct or first-tier customers	66	6	89.2	82.1	96.3
Customers' customers (Second-tier)	20	46	28.6	17.9	39.3
Transportation suppliers	54	16	77.1	67.2	87.1
Warehousing companies	37	22	53.6	41.8	65.5
Third-party logistics providers	38	25	55.1	43.3	66.9
Foreign-based companies	28	28	41.8	29.9	53.7

The fourth research objective aimed at gathering evidence about the network structure over which firms are practicing supply chain management. Specifically, focus was placed on determining the horizontal spans and span radii of firms' supply chain management practices. An oft-repeated description of supply chain management identifies the span of integration as extending from a firm's suppliers' suppliers to their customers' customers. However, some have suggested that the efforts of most companies do not extend beyond the first tier of their supply chains and often times only focus efforts upstream or downstream, but not in both directions. In order to gain insight regarding this matter, respondents were asked to indicate whether or not they practiced supply chain management with various members of their supply chains. The list of members presented and the sample proportions of respondents who indicated that their firms coordinated business processes with them are shown in Table 6.

The vast majority of respondents reported that their companies practiced supply chain management with first tier suppliers and customers.

The vast majority of respondents reported that their companies practiced supply chain management with first tier suppliers and customers. Nearly 88 percent indicated coordinating with first-tier suppliers, while almost 90 percent worked together with first-tier customers. In contrast, the proportions of firms practicing supply chain management with second-tier suppliers and customers were much lower at 34 and 29 percent respectively. The estimated confidence intervals of these proportions

suggest that at least 23 percent of companies coordinated business processes with their suppliers' suppliers and at least 18 percent coordinated with their customers' customers. Given the challenges that firms face when trying to coordinate business processes with suppliers and customers one tier removed from their business boundaries, these sample proportions might be considered promising in the sense that they were not lower.

The data reflected the important role that facilitating agencies play in companies' efforts to integrate their supply chains. A strong majority, 77 percent of the companies that practice supply chain management involve transportation providers in the external integration of their business processes. Moreover, significant proportions, 54 and 55 percent, of companies appear to work closely with warehousing companies and third-party logistics providers, respectively. It should be noted that the sample proportion of firms coordinating with third-party logistics providers might be slightly over-reported, given that many transportation and warehousing companies also offer third-party logistics services. Nonetheless, it is apparent that significant proportions of companies today rely on the expertise of transportation and storage agencies to help them implement supply chain initiatives.

The data also permitted estimation of the proportions of firms that pursue supply chain initiatives of varying horizontal span lengths and span radii. Table 7 reports the horizontal configurations of supply chain relationships

Table 7
Horizontal Span Length and Span Radius of Sample Firms Practicing Supply Chain Management

Horizontal Configuration	Span Length	Span Radius	Number of firms	Valid Percent
1st-tier supplier and focal firm	Two-tier	One-tier	3	4.8
Focal firm and 1st-tier customer	Two-tier	One-tier	5	7.9
1st-tier supplier, focal firm, and 1st-tier customer	Three-tier	One-tier	22	34.9
2nd-tier supplier, 1st-tier supplier, and focal firm	Three-tier	Two-tier	2	3.2
Focal firm, 1st-tier customer, and 2nd-tier customer	Three-tier	Two-tier	1	1.6
2nd-tier supplier, 1st-tier supplier, focal firm, and 1st-tier customer	Four-tier	Two-tier	12	19.0
1st-tier supplier, focal firm, 1st-tier customer, and 2nd-tier customer	Four-tier	Two-tier	10	15.9
2nd-tier supplier, 1st-tier supplier, focal firm, 1st-tier customer, and 2nd-tier customer	Five-tier	Two-tier	8	12.7
			Total	63
				100.0

reported by respondent companies, the span length and span radius associated with each configuration, and the sample proportions of firms in each configuration category. Examining horizontal span length first. Table 7 shows that a two-tier span length indicates that the focal firm coordinated with either a 1st-tier supplier or 1st-tier customer, but not both. Eight firms or nearly 13 percent of those practicing supply chain management fell into this category. Their cross-company coordination efforts focus either on managing inputs from suppliers or outputs to consumers, but not both. Three of the eight firms focused coordination efforts on inbound process flows, while five concentrated on outbound flows.

A three-tier span length indicates that a firm coordinated processes with a 1st-tier supplier and customer, a 1st-tier and 2nd-tier supplier, or a 1st-tier and 2nd-tier customer. Table 7 shows that 25 or about 40 percent of the firms in the sample practicing supply chain management had one of these horizontal configurations, with 22 of the 25 reporting a configuration of 1st-tier supplier-focal firm-1st-tier customer. Two of the remaining three firms' spans began with suppliers' suppliers and ended with the company, while the third's span began with the company and ended at their customers' customers.

Companies whose horizontal span length reaches four tiers coordinate processes with 1st-tier suppliers and customers and either a 2nd-tier supplier or customer. A little more than one-third or 22 of the respondent companies that integrated one or more supply chain processes had configurations of this span length. Of these 22 firms, 12 had spans that stretched from their suppliers' suppliers to their direct customers, while 10 firms have spans reaching from their suppliers to their customers' customers. Finally, firms with a five-tier span length coordinate supply chain processes with their 1st-tier suppliers and customers as well as their 2nd-tier suppliers and customers. Supply chain initiatives of this horizontal configuration are long—they reach from the focal firm's suppliers' suppliers to their customers' customers—and balanced, in that the focal firm occupies the middle of the span configuration. The sample results in Table 7 suggest that one in eight firms practice

supply chain management across a five-tier configuration.

When responding firms are grouped according to horizontal span radius, their proportions suggest that roughly half of all firms that attempt to integrate supply chain processes pursue initiatives that reach into the second tiers of their supply chains. Table 7 shows that 48 and 52 percent of the respondents' companies that practiced supply chain management had a one-tier and a two-tier span radius, respectively.

Span Length, Span Radius, and the Extent to Which Companies Jointly Manage Supply Chain Processes

The final objective of the study was to determine whether the span length and span radius of a company's supply chain initiative are significantly related to the degree to which they jointly manage supply chain processes. It is reasonable to expect span length and span radius to be positively related to the extent to which a company jointly manages processes with other firms. Longer span length and span radius imply that a greater number of companies and interdependent processes are involved in the supply chain initiative, conditions that place greater management demands on the companies involved. Among other things, the need to ensure control and integrity of the integrated processes increases as the number of processes and companies grows.

To test for the presence of these relationships, four multivariate analysis-of-variance (MANOVA) procedures were designed to compare the mean extents to which companies with different span lengths and span radii jointly managed various combinations of the process elements that appeared on the questionnaire. MANOVA was deemed appropriate for two reasons. One is that the sample data revealed significant correlations between the degrees of joint management across process elements (see Table 8). This suggests that the degree to which a company's jointly manages one process element might be related to the extent to which they jointly manage others. The differences in the degrees to which companies with different span lengths and span radii jointly manage supply chain

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Table 8
Correlation Matrix-Relationships between the Degrees of Process Element Joint Management

Process Element	Process Element	Delivery of customer orders in timely fashion	New product development	Ensuring that manufacturing rapidly adjusts to customer demand	Forecasting of customer demand	Identifying key markets	Implementing marketing programs with customers	Improving product quality	Providing customers access to information about their orders' status	Reducing fluctuations in customer demand	Supporting new product development	Supporting the needs of manufacturing operations
Delivery of customer orders in timely fashion		1.00	0.15	0.44**	0.20	0.26*	0.30*	0.19	0.41**	0.20	0.31**	0.23*
New product development			1.00	0.46**	0.29*	0.47**	0.41**	0.51**	0.06	0.29*	0.75**	0.58**
Ensuring that manufacturing rapidly adjusts to customer demand				1.00	0.63**	0.48**	0.34**	0.38**	0.34**	0.48**	0.49**	0.56**
Forecasting of customer demand					1.00	0.51**	0.44**	0.29*	0.23	0.39**	0.37**	0.37**
Identifying key markets						1.00	0.42**	0.54**	0.19	0.34**	0.56**	0.52**
Implementing marketing programs with customers							1.00	0.54**	0.28*	0.29*	0.57**	0.37**
Improving product quality								1.00	0.16	0.39**	0.67**	0.55**
Providing customers access to information about their orders' status									1.00	0.40**	0.14	0.26*
Reducing fluctuations in customer demand										1.00	0.40**	0.53**
Supporting new product development											1.00	0.62**
Supporting the needs of manufacturing operations												1.00

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

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

Strong associations existed between a company's propensity to jointly manage the seven supply chain processes with other companies and the span length and span radius of its supply chain initiatives.

processes might be due to some combination of process elements and the differences might otherwise go undetected if process elements were examined independently. The second reason is that in order to assess these relationships at the process level, one must consider the extent to which all relevant process elements contained in a process are jointly managed. For example, supporting new product development and manufacturing operations are the key concerns of the procurement process listed in Table 1. Conclusions about how span length or span radius relate to the extent to which companies jointly manage the procurement process should be drawn from analysis that considers both process elements simultaneously.

The first two MANOVA procedures were designed to detect differences in the degree to which companies with different span lengths and span radii, respectively, jointly manage all supply chain processes. The categorical variables for these procedures, span length and span radius, were created by dividing the companies into four groups (two-tier, three

tier, four tier, and five-tier) and two groups (one-tier radius and two-tier radius), respectively. The variable set common to both procedures was the combination of the eleven process element variables listed in Table 4, which represent key concerns for seven of the eight supply chain processes identified by Lambert, et al., [16]. Strong associations existed between a company's propensity to jointly manage the seven supply chain processes with other companies and the span length and span radius of its supply chain initiatives.

Unfortunately, the first MANOVA procedure, designed to detect differences in the degrees to which companies of different span length jointly manage the eleven process elements could not be conducted because the two-tier and five-tier categories of companies contained only eight observations each which was less than the number of process elements (eleven). However, cell size was not a problem for the second MANOVA procedure, which tested for differences in joint management across groups with different

span radii. Results from that test (Wilk's Lambda = .75, $p = .16$), shown in Table 9, indicate that companies with a two-tier radius do not jointly manage the combination of eleven process elements any more or less than those with a one-tier radius. This suggests that span radius and the average degree to which firms jointly manage all of the seven supply chain processes represented by these eleven processes elements were not strongly related.

This does not imply that span radius is not significantly related to the extent to which a single process element or lesser combinations of elements are jointly managed. The between subject-effects shown in Table 9 suggest otherwise. The independent F-tests for differences in the mean ratings for each process element revealed strong associations between span radius and joint management for four process elements. The extent to which one-tier and two-tier companies jointly work to reduce fluctuations in customer demand (F value = 9.52, $p = .003$), improve product quality (F value = 7.90, $p = .01$), support the needs of manufacturing operations (F value = 8.18, $p = .01$), and implement marketing programs with customers (F value = 4.70, $p = .03$) differed significantly. There were also marginally significant differences in the mean extent to which these groups jointly work to ensure that

manufacturing rapidly adjusts to customer demand (F value = 3.29, $p = .07$) and forecast customer demand (F value = 3.32, $p = .07$). These findings suggest that significant relationships between span radius and the extent to which companies jointly manage individual processes might exist. The third and fourth MANOVA procedures were designed to investigate these possibilities.

The third MANOVA procedure tested for differences in the degree to which companies with different span lengths jointly manage single processes. Four separate tests were conducted using this procedure with span radius the categorical variable in each test. The continuous variables in the four tests were the joint management ratings of those combinations of process elements that make up the customer relationship management, demand management, manufacturing flow management, and procurement processes, respectively. For example, identifying key markets and implementing marketing programs with customers were the process elements used to test the relationship between span length and the extent to which firms manage customer relationship management. Tests for customer service, order fulfillment, and new product development processes were precluded because each of these processes was represented in the data set by only a single process element. Test statistics

...companies with a two-tier radius do not jointly manage the combination of eleven process elements any more or less than those with a one-tier radius.

Table 9
Results of MANOVA Test for Relationship between Span Radius and Extent to Which All Process Elements are Jointly Managed

Continuous Variables	Test	F Value	F Statistic	Hypothesis df	Error df	Sig.
	Statistic					
All eleven process elements	Wilk's Lambda	0.75	1.51	11	49	.16
	Pillai's Trace	0.25	1.51	11	49	.16
Tests of Between Subjects Effects						
Process Element			df	Mean Square	F Statistic	Sig.
Delivery of customer orders in timely fashion			1	1.49	0.92	0.34
New product development			1	6.15	1.89	0.17
Ensuring that manufacturing rapidly adjusts to customer demand			1	9.65	3.29	0.07
Forecasting of customer demand			1	8.86	3.32	0.07
Identifying key markets			1	2.76	1.01	0.32
Implementing marketing programs with customers			1	12.64	4.70	0.03
Improving product quality			1	21.84	7.90	0.01
Providing customers access to information about their orders' status			1	3.61	1.15	0.29
Reducing fluctuations in customer demand			1	23.61	9.52	0.003
Supporting new product development			1	7.37	2.18	0.14
Supporting the needs of manufacturing operations			1	19.36	8.18	0.01

Continuous Variables (Supply Chain Process)	Test Statistic	Value	F Statistic	Hypothesis df	Error df	Sig.
Customer Relationship Management ^a	Wilk's Lambda	0.92	0.83	6	124	0.55
	Pillai's Trace	0.08	0.84	6	126	0.54
Demand Management ^b	Wilk's Lambda	0.82	2.14	6	124	0.05
	Pillai's Trace	0.18	2.08	6	126	0.06
Manufacturing Flow Management ^c	Wilk's Lambda	0.84	1.88	6	120	0.09
	Pillai's Trace	0.17	1.84	6	122	0.10
Procurement ^d	Wilk's Lambda	0.85	1.75	6	124	0.12
	Pillai's Trace	0.15	1.72	6	124	0.12

^a Process elements tested: Identifying key markets; Implementing marketing programs with customers.
^b Process elements tested: Forecasting customer demand; Reducing fluctuations in customer demand.
^c Process elements tested: Ensuring that manufacturing rapidly adjusts to customer demand; Improving product quality.
^d Process elements tested: Supporting new product development; Supporting the needs of manufacturing operations.

Continuous Variables (Supply Chain Process)	Test Statistic	Value	F Statistic	Hypothesis df	Error df	Sig.
Customer Relationship Management ^a	Wilk's Lambda	0.92	2.57	2	61	0.09
	Pillai's Trace	0.08	2.57	2	61	0.09
Demand Management ^b	Wilk's Lambda	0.87	4.73	2	61	0.01
	Pillai's Trace	0.13	4.73	2	61	0.01
Manufacturing Flow Management ^c	Wilk's Lambda	0.87	4.44	2	59	0.02
	Pillai's Trace	0.13	4.44	2	59	0.02
Procurement ^d	Wilk's Lambda	0.86	4.95	2	61	0.01
	Pillai's Trace	0.14	4.95	2	61	0.01

^a Process elements tested: Identifying key markets; Implementing marketing programs with customers.
^b Process elements tested: Forecasting customer demand; Reducing fluctuations in customer demand.
^c Process elements tested: Ensuring that manufacturing rapidly adjusts to customer demand; Improving product quality.
^d Process elements tested: Supporting new product development; Supporting the needs of manufacturing operations.

shown in Table 10 indicated a significant relationship between the degree to which companies jointly manage demand management and the span length of their supply chain initiatives (Wilk's Lambda = .82, $p = .05$). They also revealed a marginally significant relationship between span length and the degree to which firms jointly manage the manufacturing flow management process (Wilk's Lambda = .84, $p = .09$).

The final MANOVA procedure was designed to detect differences in the degree to which firms with different span radii jointly manage specific processes. This procedure was identical to the previous one except for the fact that span radius replaced span length

as the grouping variable. As with the prior procedure, four separate tests were conducted to see if span radius and the extent to which firms jointly manage the customer relationship management, demand management, manufacturing flow management, and procurement supply chain processes were related. Test results in Table 11 showed that a company's span radius is significantly related to the extent to which it jointly manages demand management (Wilk's Lambda = .87, $p = .02$), manufacturing flow management (Wilk's Lambda = .87, $p = .02$), and procurement (Wilk's Lambda = .86, $p = .01$) with other firms. Moreover, a marginally significant relationship exists between span

radius and the degree to which customer relationship management is jointly managed (Wilk's Lambda = .92, p = .09).

Managerial Implications

The evidence from this exploratory study indicates that a high proportion of companies in which executives believe they are practicing supply chain management are actively managing a broad scope of business process elements along their supply chains. Although certain process elements are being jointly managed to a greater degree than others, companies from a variety of industries are trying to compound gains in efficiency and effectiveness across their supply chains by externally integrating multiple process elements. The findings also suggest that the span of supply chain initiatives is strongly related to the degree to which companies jointly manage specific processes with other firms in the supply chain. These findings have several important implications.

First, companies that pursue supply chain initiatives involving a broad scope of processes and long span lengths might enjoy greater competitive advantage than firms that tackle less ambitious initiatives. Initiatives that involve the integration of a single process or process element or that do not span beyond the first tier of suppliers and customers might not be enough to ensure cost or value advantages over supply chains that pursue broader initiatives. Researchers in a recent study by the National Research Council claim exactly that:

Integration is most beneficial when it occurs across multiple processes that have significant effects on supply chain performance, such as information technology, marketing, and finance. Integration across multiple processes can enable customization of the supply chain according to delivery channels, manufacturing requirements, or market segments. [17]

The evidence presented here seems to support this claim. It suggests that in response to external forces, management is seeking greater access to non-core capabilities or competencies. These forces include increased cost competitiveness, shorter new product development and product life cycles, the

globalization of industries, mass customization, and the movement to base strategy on core competencies [18]. Moreover, the breadth of processes and process elements being coordinated implies that management is not responding in opportunistic or ad hoc fashion, but rather is pursuing planned initiatives based on the strategic assessment of company and supplier capabilities [19]. The strategic aims of these initiatives include focusing resources and expertise, improving capital productivity, managing inventory, operations, and transaction costs, and leveraging innovation across the supply chain [20].

Indeed, industry level initiatives, such as Efficient Consumer Response (ECR) or Efficient Foodservice Response (EFR), that try to eliminate cost, duplication, and waste as well as increase the value produced by supply chains, testify to this. These initiatives explicitly address the need to coordinate marketing, operations, and logistics-oriented processes across organizational boundaries. For example, the ECR initiative involves aligning and coordinating four processes that occur across grocery supply chains: the selection of product assortments, product replenishment, product promotion, and new product introduction [21]. Category management, continuous replenishment, and flexible manufacturing are key marketing, logistics, and operations strategies that support this initiative.

This is not meant to imply that initiatives that focus on one or a few processes or process elements are shortsighted. In many cases, the differential advantage that firms in a supply chain seek will require the integration of one or two processes rather than the entire scope of supply chain processes. For example, the competitive success of a supply chain for a product category characterized by low variety, stable demand patterns, and long product life cycles might depend more on its ability to integrate order fulfillment and customer service management across the supply chain than on the integration of new product development and commercialization or demand management. Inexperienced companies that face the need to integrate multiple processes might better tackle the challenge by first focusing on a narrow scope of processes to

Although certain process elements are being jointly managed to a greater degree than others, companies from a variety of industries are trying to compound gains in efficiency and effectiveness across their supply chains by externally integrating multiple process elements.

“Integration is most beneficial when it occurs across multiple processes that have significant effects on supply chain performance...”

nurture their abilities to achieve efficiency and effectiveness gains. As management develops experience and expertise in the discipline of supply chain management, they should closely weigh whether the integration of additional processes would bring further gains.

A second implication of broad scoped integration initiatives is that their success depends more on the firm's ability to develop and maintain cooperative relationships [22]. This is because as the number of processes in an initiative grows the tasks of role allocation and guideline and procedure development—two key drivers of supply chain unification [23]—become more complex. Hughes, Ralf, and Michels allude to the capability to unify the supply chain when they suggest that firms pursuing supply chain management develop increasing levels of “relational competence” or a systematic framework for relationship development. Frameworks of this nature ensure that a sufficient combination of mutual need, complementing strategic capabilities, congruent values, available resources, and quality management exists among companies involved in a supply chain initiative [24]. The development of relational competence should include clarifying the nature of the dependencies between the processes or process elements involved and establishing whether or not they are amenable to coordination. Malone and Crowston point out that the three types of interdependencies—pooled, sequential, and reciprocal—that exist between activities can be managed by a variety of coordination mechanisms such as standardization, direct supervision, and mutual adjustment [25]. Understanding how processes within and between organizations behave is the first step towards deciding if coordination is a feasible alternative and which coordination mechanisms would best suit the task.

The decision to expand the scope or span of an integration initiative should be based on a careful assessment of the costs of resources consumed by processes and the benefits or supply chain outputs they will produce. For example, the manufacturing flow management process aims at ensuring that the right varieties of finished product required in the marketplace are ready for delivery when demanded by the end customer. Finished

product releases are the supply chain output, and flexibility, responsiveness, and reliability the performance attributes of this process. The decision by two or more companies to integrate this process across the supply chain requires weighing increased output performance against the costs of resources used in the process, such as production planning and operations labor, manufacturing facilities, and materials. Adding more processes such as order fulfillment and procurement to their integration initiative would increase the types of resources consumed and outputs produced, and complicate the task of supply chain costing [26].

The integration of two or more processes or process elements should not be contemplated in isolation from one another. As the number of processes being integrated grows, additional efficiency and effectiveness gains might accrue in two ways. First, gains from integration of additional processes might accrue independently of those from the prior integration of another process. In this sense, they would simply be additive and in proportion to the number of processes being integrated. For example, two firms that integrate their product development and commercialization processes might double their channel efficiency and effectiveness by also integrating customer relationship management processes.

A more promising scenario would occur if the experience that two or more firms gain from the integration of a process compounds any gains they might realize from the integration of additional processes. In this scenario, the gains from integrating multiple processes would be more than proportional to the number of processes being integrated. For instance, the experience and knowledge that two firms gain from successful integrating their product development and commercialization processes might make it easier for them to plan and implement the coordination of other commonly shared sets of processes, such as order fulfillment, customer service, and demand management. Indeed, the degree of correlation between the extent of process element joint management suggests that many companies recognize this as an additional incentive for considering inter-organizational process integration.

The decision to expand the scope or span of an integration initiative should be based on a careful assessment of the costs of resources consumed by processes and the benefits or supply chain outputs they will produce.

Directions for Future Research

The study was limited in terms of the issues it addressed and the factors controlled. For one, while the evidence corroborates parts of the normative model proposed by Lambert, et al., [27], it does not address other aspects of that model. For example, it provides no insight about the nature and intensity of company efforts to integrate the 10 management components identified by those authors. It also offers no insight about the vertical structure of the supply chain networks that firms maintain and the impact that vertical structure has on the scope and intensity of coordination efforts. Evidence about those structures would allow researchers to induce theoretical models about the relationships between the horizontal and vertical makeup of supply chain networks. For example, it would be interesting to understand how the horizontal and vertical reach of a firm's network together impact the intensity and effectiveness of joint management within supply chain alliances. The data also did not address whether the proportion of companies pursuing supply chain initiatives with longer horizontal spans is growing. The results suggest that more than half the companies that practice supply chain management integrate processes as far as the second tier of suppliers and customers. However, the study did not establish a benchmark against which this proportion could be compared. Repeated measures of these proportions in future surveys would provide this insight.

A second limitation of this study is that it addressed neither the scope nor extent of intra-organizational integration of processes. The commitment to internal process integration and the inter-organizational extension of internal process integration are two key drivers of a company's logistical positioning competency [28]. Research that addresses questions about the relationship between the scope of internal and external integration initiatives could provide insights that help answer questions about the mechanisms and models that guide such initiatives. For example, should management pursue comprehensive internal initiatives before attempting any external initiatives? Does this approach yield greater supply chain

efficiency and effectiveness than a piecemeal approach, where a process is externally integrated as soon as it is internally integrated?

Third, the findings of this study are based on respondents' perceptions regarding the level of integration their companies pursue and the supply chain members with whom coordinate. Since supply chain processes are cross-functional in nature, it was assumed that respondents had enough knowledge about most processes and the span of company integration efforts to provide the requested information. It is reasonable to question whether some respondents had enough knowledge to respond about every supply chain process element or every tier of supply chain members listed in the questionnaire.

Fourth, the study did not address power issues in the supply chains of the firms involved in the study. The need to coordinate or integrate business processes across organizational boundaries stems directly from companies' recognition of the interdependencies between those processes that they share. This implies that power relationships will necessarily play a role in the structuring of roles and norms among firms involved in supply chain management initiatives. If the inter-organizational scope of processes being integrated is as broad as the evidence here suggests, it would imply an increase in the scope and complexity of power relationships.

Finally, the findings indicated that the proportion of companies with span lengths that reach from second tier suppliers to second tier customers is relatively small. This naturally raises a question about how far upstream or downstream coordination initiatives span.

Conclusions

As the number of studies focusing on supply chain management continues to increase [29], interest in the topic has spread beyond logistics and operations management. Publications on supply chain topics are appearing in the accounting [30], marketing [31], and finance [32] literatures. For instance, one article suggests that finance professionals should gain a better appreciation of the distinction between

...while the evidence corroborates parts of the normative model proposed by Lambert, et al., it does not address other aspects of that model.

The empirical evidence presented here supports the notion that supply chain management is an umbrella business discipline that deals with issues, problems, and questions related to the inter-organizational integration of a wide scope of supply chain processes.

customer driven and asset-driven approaches to supply chain management in order to enhance their credibility in cross-functional teams charged with integrating business processes [33]. The increased interest by multiple functional areas reflects recent claims that the practice of supply chain management covers a wide scope of processes. The purpose of this exploratory study was to investigate such claims. The empirical evidence presented here supports the notion that supply chain management is an umbrella business discipline that deals with issues, problems, and questions related to the inter-organizational integration of a wide scope of supply chain processes. Moreover, the findings suggest that a relationship exists between the degree to which companies jointly manage supply chain processes and the span of their coordination efforts.

References

- [1] Guinpero, Larry C. and Richard R. Brand, "Purchasing's Role in Supply Chain Management," *The International Journal of Logistics Management*, Vol. 7, No. 1 (1996), pp. 29-38; Martha C. Cooper, Douglas M. Lambert and Janus Pagh, "Supply Chain Management: More Than a New Name for Logistics," *The International Journal of Logistics Management*, Vol. 8, No. 1 (1997), pp. 1-14; Vincent A. Mabert and M. A. Venkataramanan, "Special Research Focus on Supply Chain Linkages: Challenges for Design and Management for the 21st Century," *Decision Sciences*, Vol. 29, No. 3 (Summer 1998), pp. 537-552; Douglas M. Lambert, Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19; Fu-Ren Lin, and Michael J. Shaw, "Reengineering the Order Fulfillment Process in Supply Chain Networks," *The International Journal of Flexible Manufacturing Systems*, Vol. 10, (1998), pp. 197-229; and, Keah Choon Tan, "A Framework of Supply Chain Management Literature," *European Journal of Purchasing and Supply Management*, Vol. 7, No. 1 (2000), pp. 39-48.
- [2] Mabert, Vincent A. and M. A. Venkataramanan, "Special Research Focus on Supply Chain Linkages: Challenges for Design and Management for the 21st Century," *Decision Sciences*, Vol. 29, No. 3 (Summer 1998), pp. 537-552.
- [3] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.
- [4] Oliver, Christine, "Determinants of Interorganizational Relationships: Integration and Future Directions," *Academy of Management Review*, Vol. 15, No. 2 (1990), pp. 241-265; and, Paul D. Larson, "An Empirical Study of Inter-Organizational Functional Integration and Total Costs," *Journal of Business Logistics*, Vol. 15, No. 1, (1994), pp. 153-169.
- [5] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.
- [6] Hammer, Michael and James Champy, *Reengineering the Corporation: A Manifesto for Business Revolution*, New York, New York: Harper Business, 1993; and, Thomas H. Davenport, *Process Innovation: Reengineering Work through Information Technology*, Boston, Massachusetts: Harvard Business School Press, 1993.
- [7] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.
- [8] Armistead, Colin and Philip Rowland, "Managing by Business Processes," in *Managing Business Processes: BPR and Beyond*. Colin Armistead and Philip Rowland, Editors, Chichester, England: John Wiley & Sons, 1996, pp. 46-49.
- [9] Armistead, Colin, Alan Harrison, and Philip Rowland, "Business Processes: Lessons from Operations Management" in *Managing Business Processes: BPR and Beyond*, Colin Armistead and Philip Rowland, Editors, Chichester, England: John Wiley & Sons, 1996, pp. 115-125.
- [10] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain

Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.

[11] Martha C. Cooper, Douglas M. Lambert and Janus Pagh, "Supply Chain Management: More Than a New Name for Logistics," *The International Journal of Logistics Management*, Vol. 8, No. 1 (1997), pp. 1-14

[12] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.

[13] Wisner, Joel D. and Keah Choon Tan, "Supply Chain Management and Its Impact on Purchasing," *The Journal of Supply Chain Management*, Vol. 36, No. 4 (Fall 2000), pp. 33-42.

[14] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.

[15] Vincent A. Mabert, and M. A. Venkataramanan, "Special Research Focus on Supply Chain Linkages: Challenges for Design and Management for the 21st Century," *Decision Sciences*, Vol. 29, No. 3 (Summer 1998), pp. 537-552; Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.

[16] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.

[17] National Research Council, Committee on Supply Chain Integration, *Surviving Supply Chain Integration: Strategies for Small Manufacturers*, Washington, DC: National Academy Press, 2000, p. 37.

[18] Hughes, Jon, Mark Ralf, and Bill Michels, *Transform Your Supply Chain: Releasing Value in Business*, London, England: International Thompson Business Press, 1998, pp. 34-35; National Research Council,

Committee on Supply Chain Integration, *Surviving Supply Chain Integration: Strategies for Small Manufacturers*, Washington, DC: National Academy Press, 2000, p. 28; and, Martin Christopher, *Logistics and Supply Chain management: Strategies for Reducing Cost and Improving Service*, Second Edition, Harlow, Great Britain: Financial Times/Prentice-Hall, 1998, pp. 23-28.

[19] Hughes, Jon, Mark Ralf, and Bill Michels, *Transform Your Supply Chain: Releasing Value in Business*, London: International Thompson Business Press, 1998, pp. 139-146; and, National Research Council, Committee on Supply Chain Integration, *Surviving Supply Chain Integration: Strategies for Small Manufacturers*, Washington, DC: National Academy Press, 2000, pp. 22-23.

[20] Hughes, Jon, Mark Ralf, and Bill Michels, *Transform Your Supply Chain: Releasing Value in Business*, London, England: International Thompson Business Press, 1998, p. 41.

[21] Kurt Salmon Associates, Inc., *Efficient Consumer Response: Enhancing Consumer Value in the Grocery Industry*, Washington, DC: Food Marketing Institute, 1993; and, Robert P. King, and Paul F. Phumpiu, "Reengineering the Food Supply Chain: The ECR Initiative in the Grocery Industry," *American Journal of Agricultural Economics*, Vol. 78, No. 5 (1996), pp. 1181-1185.

[22] The Global Logistics Research Team, *World Class Logistics: The Challenge to Managing Consistent Change*, Oak Brook, IL: The Council of Logistics Management, 1995, pp. 127-136.

[23] The Global Logistics Research Team, *World Class Logistics: The Challenge to Managing Consistent Change*, Oak Brook, IL: The Council of Logistics Management, 1995, pp. 127-136.

[24] Hughes, Jon, Mark Ralf and Bill Michels, *Transform Your Supply Chain: Releasing Value in Business*, London, England: International Thompson Business Press, 1998, p. 61.

[25] Malone, Thomas W. and Kevin Crowston, "The Interdisciplinary Study of Coordination," *ACM Computing Surveys*, Vol. 26, No. 1 (March 1994), pp. 87-119.

[26] LaLonde, Bernard J. and Terrance L. Pohlen, "Issues in Supply Chain Costing," *The*

International Journal of Logistics Management, Vol. 7, No. 1 (1996), pp. 1-12.

[27] Lambert, Douglas M., Martha C. Cooper and Janus Pagh, "Supply Chain Management: Implementation Issues and Research Opportunities," *The International Journal of Logistics Management*, Vol. 9, No. 2 (1998), pp. 1-19.

[28] The Global Logistics Research Team, *World Class Logistics: The Challenge to Managing Consistent Change*, Oak Brook, IL: The Council of Logistics Management, 1995, pp. 63-77.

[29] Larson, Paul and Dale Rogers, "Supply Chain Management: Definition, Growth, and Approaches," *Journal of Marketing Theory and Practice*, Vol. 6, No. 4 (Fall 1998), pp. 1-5.

[30] Seal Willie, John Cullen, Alec Dunlop, Tony Berry; and, Ahmed Mirghani, "Enacting a European Supply Chain: A Case Study on the Role of Management Accounting," *Management Accounting Research*, Vol. 10, No. 3 (September 1999), pp. 303-322.

[31] Vokurka, Robert J. and Rhonda R

Lummus, "Balancing Marketing and Supply Chain Activities," *Journal of Marketing Theory and Practice*, Vol. 6, No. 4 (Fall 1998), pp. 41-50; John T. Mentzer, Soonhong Min, and Zach G. Zacharia, "The Nature of Interfirm Partnering in Supply Chain Management," *Journal of Retailing*, Vol. 76, No. 4 (Winter 2000), pp. 549-568; and Rajendra K. Srivastava, Tasadduq A Shervani, and Liam Fahey, "Marketing, Business Processes, and Shareholder Value: An Organizationally Embedded View of Marketing Activities and The Discipline of Marketing," *Journal of Marketing*, Vol. 63, Special Issue (1999), pp. 168-179.

[32] Cloud, Randall J., "Supply Chain Management: New Role for Finance Professionals," *Strategic Finance*, Vol. 82, No. 2 (Aug 2000), pp. 28-32; and, Noah P. Barsky, and Alexander E. Ellinger, "Unleashing the Value in the Supply Chain," *Strategic Finance*, Vol. 82, No. 7 (January 2001), pp. 32-37.

[33] Barsky, Noah P. and Alexander E. Ellinger, "Unleashing the Value in the Supply Chain," *Strategic Finance*, Vol. 82, No. 7 (January 2001), pp. 32-37.

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