A TAXONOMIC REVIEW OF SUPPLY CHAIN MANAGEMENT RESEARCH

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1. Introduction

In the previous chapters, we focused largely on quantitative approaches to solving Supply Chain Management (SCM) problems including such issues as: inventory management, supply contracts, information flow, product variety, and international operations. In this chapter, we will broaden our focus to include other approaches to SCM problems, by presenting a broad taxonomy for understanding SCM research.

1.1. Why present a Taxonomy on SCM Research?

Efforts to describe and explain supply chain management (SCM) have recently led to a plethora of research and writing in this field. At the same time, the level of attention SCM now receives in business practices also heavily influences the growing interest in SCM research. SCM is now seen as a governing element in strategy (Fuller, O'Conner and Rawlinson, 1993) and as an effective way of creating value for customers. However, despite the growing interest in supply chain management, there is still a lack of cohesive information that explains the SCM concept and emphasizes the variety of research work being accomplished in this area.

Other researchers have also provided taxonomies and frameworks that help both practitioners and academics understand how to manage supply chains. For example, Bowersox (1969), in addition to reviewing relevant streams of thought in physical distribution, suggested that the distribution function can provide a competitive advantage through channel-wide integration beyond the firm. Shapiro (1984) provided a prescriptive framework that can enable a company to gain leverage by ensuring a good fit between its logistics system and competitive strategy. Houlihan (1985) made

a strong case for viewing the supply chain as a single entity by incorporating a logistics focus into the strategic decisions of the firm. Langley (1992) cast the evolution of logistics into three specific contexts: past (1950-1964), present (1965 - present) , and future. Since that time, a variety of authors [Stevens, 1989, Masters and Pohlen, 1994, Mourits and Evers, 1995, and Thomas and Griffin, 1996] have added to this body of literature by providing integrative frameworks to help design and manage supply chains.

Despite the efforts of previous authors, we believe that the growing literature in SCM warrants a close re-examination of published SCM works to date. The purpose of such an update is to carefully chart the historical development of SCM and to synthesize future directions of research. Simply starting off with a literature search into this SCM field quickly becomes overwhelming due to the amount of work being done that seemingly falls into the subject of supply chain management. Therefore, it would be beneficial, to both the novice and even those familiar with the subject, for us to discuss, describe, and categorize the work being done in supply chain management.

We have intentionally limited our focus to articles that have already been published at the time of this writing as an attempt to understand the state of research at a fixed point in time. Naturally, in an emerging field like SCM, there is much research in the pipeline and a new "chapter" is needed periodically. We hope this is useful for today's researchers.

1.2. How this chapter is organized

In section 2, we explore the basics of SCM from a conceptual perspective by tracing the roots of the definition and the origins of the concept from a broad stream of literature. Recognizing that there is not a clear consensus on the definition of supply chain management, we look at the various approaches to defining SCM from the 1980's to the present, and provide our own interpretation based on the literature.

In section 3, we show that the paths leading to the current state of SCM has evolved over the past four decades. In particular, we characterize SCM as evolving over the years from materials management, physical distribution, and integrated logistics. We also show that SCM benefits from a variety of concepts that were developed in several different disciplines including marketing, economics, operations research, management science, operations management, and logistics.

In section 4, we summarize the volume of SCM research into three broad categories -- competitive strategy, firm focused tactics, and operational efficiencies -- based on the level and detail of the SCM problems being addressed.

In section 5, we focus on the research methodologies and solution approaches that have been used to address SCM problems. In particular, we categorize these research methodologies into four broad categories: concepts, case-oriented, frameworks, and models.

Finally, in the appendix, we provide a database of selected papers to help summarize the volume of research that has been done in the SCM arena.

2. The Concept of Supply Chain Management

2.1. Supply Chain "Defined"

The SCM literature offers many variations on the same theme when defining a supply chain. The most common definition [see for example, Houlihan (1985), Jones and Riley (1984), Stevens (1989), Scott and Westbrook (1991), Lee and Billington (1993), and Lamming (1996)] is a system of suppliers, manufacturers, distributors, retailers, and customers where materials flow downstream from suppliers to customers and information flows in both directions.

Our working definition of a supply chain is from Stevens (1989) who defines it as:

". . . a connected series of activities which is concerned with planning, coordinating and controlling materials, parts, and finished goods from supplier to customer. It is concerned with two distinct flows (material and information) through the organization."

Several authors include strategic decision making as a differentiating virtue of a supply chain. For example, Oliver and Webber (1992) state that a supply chain should be viewed as a single entity that is "guided by strategic decision-making." They emphasize that systems integration, not just interface, is the key to success in SCM. Some researchers also include the carriers in the supply chain [Gentry (1996)]. Still others [O'Brien and Head (1995)] include governments as part of the chain since, as a global concept, managing the supply chain would also include all of the issues associated with government regulations and customs.

2.2. The "Management" in SCM - Scope of Responsibility

Trying to assess the actual scope of supply chain management is much more difficult than simply defining a supply chain. Towill (1997) argues that the definition needs to be flexible because it "applies right across the business spectrum ranging from international supply chains down to a number of related sequential activities undertaken under one roof but covering a number of independent cost centers." In our view, this is essentially how it has been applied throughout the literature. Houlihan (1985) is credited with first coining the term "supply chain," but it seems that researchers have varying interpretations of exactly what managing a supply chain means.

A firm, be it manufacturing or service, belongs to at least one supply chain. How widely or narrowly the chain is managed is an indicator of the extent to which supply chain management is being practiced. On one hand, supply chains can be managed as a single entity through a dominant member (referred to as the "predator" by Towill,

1997), and on the other, through a system of partnerships requiring well-developed cooperation and coordination. Cooper, Ellram, Gardner, and Hanks (1997) suggest that the span of management control should be determined by the added value of any relationship to the firm. Additionally, Forrester (1961) suggests that the five flows of any economic activity -- money, orders, materials, personnel, and equipment -- are interrelated by an information network, which gives the "system," what has now come to be called a supply chain, its own character. Therefore, the scope of responsibility for managing a supply chain seems highly specific to the firm and its myriad of relationships with its suppliers, vendors and customers.

2.3. Who Manages the Supply Chain?

We can break down SCM into various its various elements but one must not lose sight of the fact that SCM is rooted in senior-level decision making. Otherwise, SCM may well be reduced to its component functions of purchasing, distribution, materials management or even integrated logistics. Of course, SCM includes implementation and operational aspects in which day to day operations are managed below the senior management level.

One can argue that a proliferation of interpretations of what SCM means has led to some confusion among researchers and practitioners. There should be some characteristics unique to supply chain management that differentiates it from past research that previously fell under the aegis of integrated logistics. Houlihan (1985) makes it clear that the differentiating factor is the strategic decision making aspect of supply chain management. SCM reaches out beyond the boundaries of cost containment and links operating decisions to strategic considerations within and beyond the company. In the past, these issues were primarily in the domain of middle management. But, in channel-wide supply chain management, these issues are now part of the responsibilities of upper management.

3. The Evolution of Supply Chain Management

3.1. The Evolutionary Paths Leading to SCM

The literature suggests that SCM has its roots in the evolutionary path followed through materials management and physical distribution after WWII, functional logistics (different managers for all functions), and integrated logistics (one manager for all the functions).

Forrester (1958) justifies the first step beyond functional logistics by using a systems analysis approach to describe the forces that determine growth, fluctuation, and decline. He develops a complete company model that described the flows of information, materials, manpower, capital, equipment, and money. Bowersox (1969) discusses the evolution of integrated logistics and touches upon what will become known as the supply chain. He states that related responsibilities seldom terminate

when product ownership transfer occurs and that firms are linked together in cooperative vertical marketing systems providing total channel-wide performance. Langley (1992) suggests four stages of development: (i) cost control, (ii) profit-center orientation recognizing the positive impact on sales, (iii) view of logistics as key to product differentiation, and (iv) as a principal strategic advantage. Masters and Pohlen (1994) describe the evolution of logistics into three phases: (1) functional management (1960 - 1970) - functions such as purchasing, shipping, and distribution are each managed separately, (2) internal integration (1980s) - the management of supply chain functions of a single facility are unified and become the responsibility of a single individual, and (3) external integration (1990s) - the management of supply chain functions throughout the chain are unified requiring cooperation and coordination between links in the chain. La Londe (1994) describes the evolution of integrated logistics in three phases: (1) physical distribution - the distribution of goods is all that needs to be managed by a logistics manager, (2) internal linkages - it is important for the logistics manager to control both internal supply functions and physical distribution, and (3) external linkages - logistics management requires cooperation in management with upstream and downstream entities in order to maximize the benefits of the total logistic system.

3.2. Contributions from Various Disciplines

Many different disciplines, including marketing, economics/systems dynamics, operations research / management science, and operations management, have contributed concepts that originated outside the original SCM theory but are used throughout the SCM literature.

Marketing has spawned such ideas as EDLP (every day low pricing) [Blattberg, Eppen and Lieberman (1981)] and postponement [Alderson (1957)]. The SCM literature has largely developed postponement in conjunction with inventory management and control [Jones and Riley (1984), Lee and Billington (1995), Zinn and Levy (1988), and Zinn and Bowersox (1988)].

Economics and systems dynamics has contributed with Forrester's (1958, 61) work describing growing variation upstream in a supply chain and is now popularized as the "Bullwhip Effect" or the "Forrester Effect" [Lee, Padmanabhan and Whang (1997), Berry and Naim (1996)].

OR/MS and Operations Management, the primary focus of this book, are used in several areas including: (i) multi-echelon inventory models [Clark and Scarf (1960), Clark (1972)], (ii) plant and distribution center location models [Geoffrion and Graves (1974), Cohen and Lee (1988), Revelle and Laporte (1996), Camm et al. (1996)], (iii) order allocation schemes [Anupindi and Akella (1993)], (iv) lean manufacturing [Lamming (1996), Levy (1997)], (v) quick response (QR) [Fisher (1997], (vi) vendor managed inventories (VMI) [Cachon and Fisher (1997)], (vii) enterprise & distribution resource planning [Hammel and Kopczak (1993), Verwijmeren, Viist, and Karel (1996)], and (viii) JIT supply [Leenders, Nollet, and Ellram (1994), O'Brien and Head (1995)].

Logistics pioneered the concept of: (i) integrated logistics that eventually came to be called SCM [Bowersox (1969), Slater (1976)], and (ii) partnership building and management [Slater (1976), Gentry (1996), and Walton (1996)].

3.3. Key Factors that Influence SCM Research

In analyzing these papers from a historical perspective, we found an interesting stream of factors that the authors listed as being influential to supply chain management problems that they addressed in their papers.

In the early years, the importance of cost control and internal efficiencies were influenced by the economic climate of the late 1950s. Bowersox (1969), posits that the cost control concerns that emerged in the 50's acted as a catalyst to the renewed interest in logistics management. Additionally, the introduction of computers and the adoption of many mathematical models and other optimization tools had a great impact upon the development of SCM. This was predicted by Forrester who wrote that electronic data processing, decision making, simulation, feedback control, and systems analysis were "the tools of process" that will influence the future direction of the management of information through the five flows of economic activity alluded to earlier.

In the 60's, Bowersox (1969) notes that computers emerged from their infancy and found fertile applications in physical distribution. At this time, Bowersox also addresses the concept of integrated physical distribution and argues that physical distribution has the potential for system integration beyond the firm into the total cooperative channels of distribution. Slater (1976) states that management's emphasis on liquidity, cost reduction and the impact on change has led to the recognition of logistics as an important method of improving the bottom line. Slater argues that a total systems approach to the logistics channel will reduce total cost and considerably improve the overall quality of the operations.

Gradually, the growing importance of logistics is noted as potential competitive advantage in response to increasing competition and growing customer requirements. Fuller (1993) sums it up nicely by stating:

". . . logistics has the potential to become the next governing element of strategy as an inventive way of creating value for customers, an immediate source of savings, a discipline on marketing, and a critical extension of production flexibility."

In the last two decades, as logistics slowly evolved into SCM, several researchers (see for example Houlihan (1988) Copacino and Rosenfield (1992), Lee and Billington (1993), Fuller (1993), Thomas and Griffin (1996)) have tried to account for the increasing awareness and implementation of supply chain management. We note seven factors here that have consistently been mentioned in the literature as influencing supply chain/strategic logistics planning: (1) new customer service

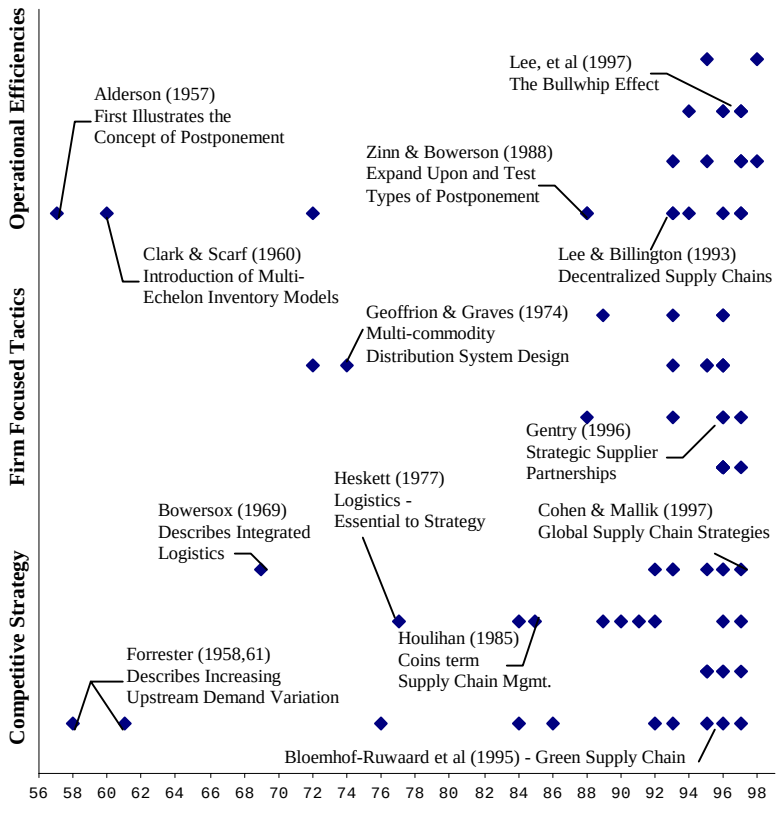
requirements, (2) competitive pressure, (3) changing costs (for example, the cost of logistics estimated at 30% of cost of goods sold) (4) pressure for improved financial performance, (4) need to redesign and improve logistics systems, (5) regulatory changes, (6) improved communications, and (7) information technology.

In recent times, changing environmental awareness have also influenced supply chain management research. For example, Bloemhof-Ruwaard, Van Beek, Hordijk, and Van Wassenhove, (1995) cite factors that might influence future direction of SCM: (1) legal requirements or consumer pressure to reduce waste, (2) green supply chain management to include waste treatment, (3) reuse of materials and packaging, (4) recovery of products, (5) adaptation of new materials, (6) product redesign, and (7) process changes.

3.4 The SCM Time-line

The historical development of SCM can be illustrated through the use of a time line (See Figure 1) that highlights a few of the many significant research papers that have led to the development of SCM as a new concept. The vertical axis of the time line represents, as the ensuing discussion will show, our method of categorization of supply chain research. The dots show the distribution of this research from our sample of articles.

Figure 1. SCM's Evolutionary Timeline



4. Classifying Research on Supply Chain Management

In this section, we classify the supply chain management research into three broad perspectives: competitive strategy, firm focused tactics, and operational efficiencies.

Competitive strategy issues have a long range impact on the firm, firm focused tactical issues operate in a shorter time frame and operational efficiencies involve day to day decisions that can be altered quickly. Stevens (1989) offers us some simple guidelines to follow in categorizing the perspective (competitive strategy, firm focused tactics and operational efficiencies) in which each research effort fits. These are fundamental descriptions of each perspective found in many textbooks but not necessarily universally accepted. We believe that the basic structure is simple, well known and lends itself nicely to taxonomic categorization.

Readers should refer to appendix A for a listing of the articles that were reviewed for classification. Appendix A provides information beyond the author and year of publication such as summaries of: (1) key factors that influenced the research, (2) the main problems or concerns addressed by the research, (3) the solution methodology used and (4) the authors' conclusions.

4.1. Research on Competitive Strategy in SCM

Competitive decisions are made within multiple planning horizons, usually monthly, annually, or over multi-year planning horizons to achieve an enterprise wide, or supply chain wide, optimal solution which reflects global objectives considering the tradeoffs among functional or organizational demand management structure requirements. Examples of competitive strategy decisions include, but are not limited to: site selection, new product introductions, go/no go decisions on new production/distribution resources, or new markets, as well as overall guidelines for firm wide objectives.

Research which addresses company strategy: (1) should develop objectives and policies for the entire supply chain AND clearly analyze how these support the needs of the firm, (2) should determine the shape of the supply chain in terms of design, and (3) should discuss how supply chain management can enhance the competitiveness of the firm.

We classify each research paper dealing with competitive strategy issues by considering the competitive advantage sub-categories we have outlined in Table 1.

4.2. Research on Firm-Focused Tactics

Tactical planning reflects decisions for the coming days, weeks, or months. Higher level decisions and cross-functional objectives/metrics have already been determined at the strategic level; but, actual demand may deviate from plan. Local opportunities require more detailed planning solutions within the local problem domain; this is needed to realign the availability of people, materials and other resources to meet actual demand and bring the operation back within business objectives.

Research which addresses company tactics: (1) should focus on the implementation of strategic decisions, (2) are functional in nature, and may deal with only a few players in the overall chain and (3) may involve systems (MRP, DRP, JIT, etc.) necessary to manage the supply chain.

	Strategic Subcategory	Definition	List of Papers on Strategic SCM Issues
A	Objectives	Understanding the dynamics of the supply chain and the development of objectives for the entire supply chain that includes analysis of how such goals support the needs of the firm. Includes contextual evaluation of supply chain alternatives.	Beamon (1996); Bloemhof-Ruwaard, et al. (1995); Davis (1993); Ernst and Kamrad (1996); Fisher (1997); Forrester (1958); Forrester (1961); Fuller, et al. (1993); Gopal (1992); Oliver and Webber (1992); Shapiro (1984); Slater (1976)
B	Design	Should determine the shape of the supply chain. Includes the design of supply chains or location decisions. Needs to focus on the objectives of the design and not just the development of a tool used in decision making.	Arntzen et al (1995); Berry and Naim (1996); Camm et al (1997); Mourits and Evers (1995); Revelle and Laporte (1996); Towill et al (1992)
C	Competitive Advantage	How supply chain management can enhance the competitiveness of the firm. Includes strategic planning tools.	Cohen and Mallik (1997); Copacino & Rosenfield (1992); Heskett (1977); Houlihan (1985); Jones and Riley (1984); McMullan (1996); Roberts (1990); Scott and Westbrook (1991); Stevens (1989); Towill (1997)
D	Historical Perspectives	Evolutionary or historical perspectives which give us insight to the strategic nature of supply chain management.	Bowersox (1969); Carter & Narasimhan (1996); LaLonde (1993); Langley (1992); Lee and Billington (1995); Masters and Pohlen (1994); Thomas and Griffin (1996)

Table 1: Summary of Research on Competitive Strategy

We subcategorized the tactical decisions into the four main areas that determine how supply chains achieve higher strategic goals and objectives. The categories are:

- Relationship Development
- Integrated Operations
- Transportation and Distribution

- Systems

Therefore, we classified each of the papers that deal with the tactical issues by considering the major issue the paper focuses on. For example, we categorized Choi and Hartley's (1996) paper, which compares supplier-selection practices based on a survey of companies at different levels in the auto industry, as tactical (subcategory, 21). Similarly, we categorized Geoffrion and Graves' (1974) paper on *Multicommodity Distribution Systems* as tactical (subcategory: transportation and distribution) because it focuses on distribution system design. Table 2 gives a summary of the SCM research in the tactical area listed by subcategory.

	Firm Focused Tactics Subcategory	**Definition**	**List of Papers on Tactical SCM Issues**
A	Relationship Development	Developing upstream and downstream relations, third-party issues	Choi and Hartley (1996); Gentry (1996); Henig et al (1997); Holmlund and Kock (1996); Prida and Gutierrez (1996); Tagaras and Lee (1996); Walton (1996)
B	Integrated Operations	Managing firm operations as an integrated unit while achieving efficiencies in operations management, including engineering, manufacturing, purchasing & may include immediate up & downstream links	Cohen and Lee (1988); Lamming (1996); Leenders et al. (1994); Roy and Potter (1996); Viswanathan and Mathur (1997)
C	Transportation and Distribution	Achieving efficiencies in managing transportation and physical distribution as an integrated system.	Anupindi & Bassok (1996); Bowersox (1972); Caputo and Mininno (1996); Geoffrion and Graves (1974); Geoffrion and Powers (1995); Min (1996); Robinson et al (1993); Satterfield and Robinson (1996);
D	Systems	Development of operations and information systems or the use of information to aid the achievement of strategic objectives.	Bhaskaran (1996); Bowersox & Morash (1989); Hammel & Kopczak (1993); Verwijmeren et al (1996)

Table 2: Summary of Research on Firm-Focused Tactics

4.3. Research on Operational Efficiency:

Typically, operational decisions reflect day to day operations up to two weeks ahead. This area is concerned with the daily operation of a facility such as a plant or distribution center to ensure that the most profitable way to fulfill actual order requirements is considered and executed.

Research that addresses the operational perspective: (1) is concerned with the efficient operation of the company within the supply chain and (2) focuses on controls and performance measures (inventory investment, service level, throughput efficiency, supplier performance and cost).

We sub-categorized these operational problem areas in the following manner:

- Inventory Management and Control
- Production, Planning and Scheduling
- Information Sharing, Coordination, and Monitoring
- Operational Tools

As an example, we categorized Clark and Scarf's (1960) paper, in which they examine policies for a multi-echelon inventory problem, as operational (sub-category, inventory management and control). Table 3 gives a summary of the SCM research in the operational area listed by subcategory.

	Operational Subcategory	**Definition**	**List of Papers on Operational SCM Issues**
A	Inventory Management and Control	In terms of the operating efficiency of the supply chain, determining & measuring the performance of inventory. Also includes inventory investment, service levels, allocation schemes & multi-echelon inventory theory	Alderson (1957); Anupindi and Akella (1993); Cachon and Fisher (1997); Clark (1972); Clark and Scarf (1960); Garg and Tang (1997); Lee and Billington (1993); Stenger (1994); Stenger (1996); Zinn and Levy (1988); Zinn and Bowersox (1988);
B	Production, Planning and Scheduling	Determining & measuring the performance of production, planning and scheduling to aid the efficient operation of the supply chain.	Graves et al. (1998); Kruger (1997); Lederer and Li (1997); Levy (1997); O'Brien and Head (1995)
C	Information Sharing, Coordination, and Monitoring	Specifies schemes for coordination and control in the sharing of information needed in the efficient operation of the supply chain.	Fisher and Raman (1996); Gavirneni et al (1998); Lee et al (1997); Moinzadeh and Aggarwal (1997); Srinivasan et al (1994)

D	Operational Tools	Development of tools which aid in the efficient operation of the supply chain	Bagahana and Cohen (1998); Slats et al. (1995)

Table 3: Summary of Research on Operational Efficiency

5. Solution Methodology

5.1 Categorizing Research Methodologies

For each research paper, we categorized the solution methodology used by the author to address the specific SCM problem areas. We divided the solution methodologies into the following areas:

1. Concepts and Non-Quantitative Models - research that analyzes the supply chain in an attempt to define, describe, and develop methods for the management of the supply chain without using quantitative models.
2. Case Oriented and Empirical study - research that works with specific firms or industries and uses data collected by the researcher or another qualified source to aid in the management of the supply chain.
3. Frameworks, Taxonomies, and Literature Reviews - research that categorizes or explains concepts in SCM as an effort in the understanding of the breadth and depth of the concept.
4. Quantitative Models (to include optimization, simulation, stochastic models, and heuristics) - research that attempts to develop methods for the management of the supply chain using quantifiable models.

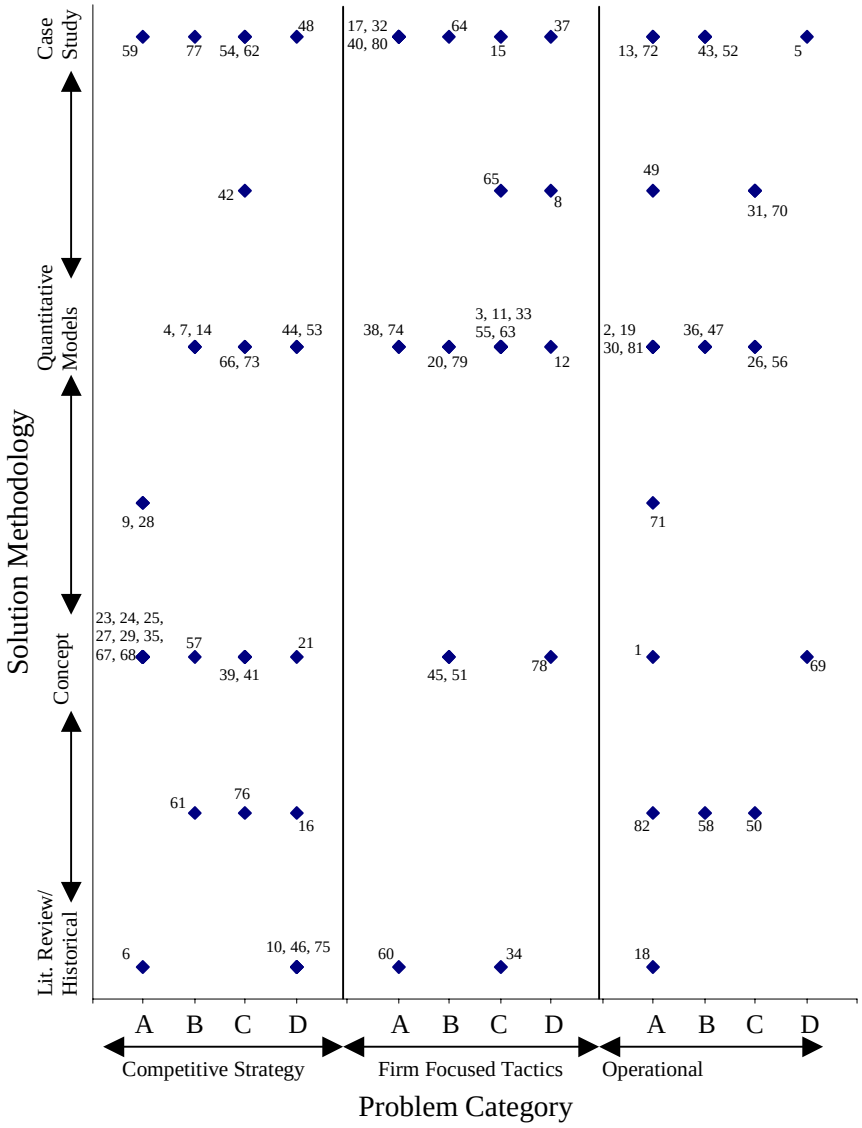
For example, Steven's (1989) paper on Integrating the Supply Chain, we categorize as concepts and non-quantitative models because it presents a three-phase analytical but non-quantitative process that can be used to develop an integrated supply chain strategy. Similarly, we categorized the solution methodology presented in Camm et al's (1997) paper on restructuring Procter and Gamble's supply chain as a quantitative model (LP-based) solution methodology. Table 4 represents a categorization of the solution methodologies presented in this research.

In addition, Figure 2 illustrates the comparison between the research methodologies with the type of SCM problem addressed in our classification scheme. As one might expect, most of the strategic work is of a conceptual nature while quantitative models are mostly found dealing with operational and tactical issues. The numbers correspond with the first column of the table in Appendix A so that the reader can quickly find where a specific article lies in the matrix.

Solution Methodology	List of SCM Papers Sorted by Solution Methodology
Concepts and Non-Quantitative Models	Alderson (1957); Beamon (1996); Bowersox (1969); Forrester (1958, 1961); Gopal (1992); Heskett (1977); Houlihan (1985); Lamming (1996); Lee et al (1997); Lenders et al (1993); Min (1996); Scott and Westbrook (1991); Slats et al (1995); Towill (1997); Verwijmeren et al (1996);
Case Oriented and Empirical study	Bagahana and Cohen (1998); Cachon and Fisher (1997); Caputo and Mininno (1996); Carter and Narasimhan (1996); Choi and Hartley (1996); Davis (1993); Fuller et al (1993); Hammel and Kopczak (1993); Holmlund and Kock (1996); Jones and Riley (1984); Lee and Billington (1995); Levy (1997); McMullan (1996); O'Brien and Head (1995); Oliver and Webber (1992); Revelle and Laporte (1996); Roberts (1990); Roy and Potter (1996); Srinivasan et al (1994); Stenger (1996); Walton (1996);
Frameworks, Taxonomies, and Literature Reviews	Bloemhof-Ruwaard et al (1995); Clark (1972); Cohen and Mallik (1997); Copacino and Rosenfield (1992); Ernst and Kamrad (1996); Fisher (1997); Geoffrion and Powers (1995); La Londe (1994); Langley (1992); Masters and Pohlen (1994); Mourits and Evers (1995); Prida and Gutierrez (1996); Shapiro (1984); Slater (1976); Stenger (1994); Stevens (1989); Thomas and Griffin (1996); Zinn and Levy (1988)
Quantitative Models	Anupindi and Akella (1993); Anupindi and Bassok (1996); Arntzen et al (1995); Berry and Naim (1996); Bhaskaran (1996); Bowersox (1972); Bowersox et al (1989); Camm et al (1997); Clark and Scarf (1960); Cohen and Lee (1988); Fisher and Raman (1996);Garg and Tang (1997); Gavirneni et al (1998); Gentry (1996); Geoffrion and Graves (1974); Graves et al (1998); Henig et al (1997); Kruger (1997); Lederer and Li (1997); Lee and Billington (1993); Moinzadeh and Aggarwal (1997); Robinson et al (1993); Satterfield and Robinson (1996); Tagaras and Lee (1996); Towill et al (1992); Viswanathan and Mathur (1997); Zinn and Bowersox (1988)

Table 4: Summary of Solution Methodologies

Overall, we recognize that some of these papers can also be placed in multiple categories. However, we elected to place each paper in one specific category based on the overriding focus of the work presented in the paper. We recognize that cross-referencing these papers into several categories could be beneficial. Therefore, we view this as an opportunity for further clarification.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Quantitative Models
Concept
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27, 29, 35,
67, 68
57
39, 41
21
45, 51
78
1
69
61
76
16
82
58
50
6
10, 46, 75
60
34
18
A
B
C
D
Competitive Strategy
Firm Focused Tactics
Operational
Problem Category

Figure 2: Problem Category Vs. Solution Methodology

6. Conclusions

This paper recognizes that many other frameworks have been developed and presented in SCM literature. However, the value of this framework is as a tool to help researchers synthesize the volume and breadth of being accomplished on SCM.

Defining supply chain management requires that we answer three questions; (1) **what is a supply chain?** - There appears to be some convergence in the literature as to what a supply chain is and can be generally summed up as a series of interconnected activities which are concerned with planning, coordinating and controlling materials, parts, and finished goods from supplier to customer, (2) **what managing the supply chain means** - Supply chains are managed as a single entity either through a dominant member or through a system of partnerships requiring well developed cooperation and coordination. The scope of responsibility for managing a supply chain is specific to the firm and its myriad of relationships with its suppliers, vendors and customers, and (3) **who manages the supply chain** - We can break down SCM into various parts but one must not lose sight of the fact that SCM is rooted in senior level decision making. Otherwise, what is to distinguish SCM from purchasing, distribution, materials management or even integrated logistics? Of course, SCM includes implementation and operational aspects in which day to day operations are managed below the senior management level.

From an analysis of the key factors that have influenced SCM research in the past, we conclude that external market forces have largely driven SCM. As many of the papers suggest, the keys to success in SCM require heavy emphasis on integration of activities, cooperation, coordination, and information sharing throughout the entire supply chain. We do not expect this to change. The realities of implementing a system that requires integration, coordination and cooperation will, however, call for a major change in business culture. Bowersox (1997) argues that the main challenge for SCM will be the management of intense relationships across enterprises that involve such issues as collaboration, information sharing, partitioning, diverse corporate cultures, shared risks, cost sharing, integrity, and trust. Bowersox calls for comprehensive performance metrics to manage, measure and reward performance on an integrated basis. He also suggests that these measures should link the supply chain's performance directly to the relevant stakeholders since logistics cost represents 10 percent of the national gross domestic product.

To have the most benefit, the supply chain must be managed as a single entity. Firms must avoid sub-optimization through self-interest at any link in the chain by managing the entire chain as a single entity while simultaneously dealing with the power relationships that are inherent in the chain. On the other hand, we note that many firms belong to multiple supply chains and little has been written to address the issues associated with multiple relationships.

It appears that the thrust of the SCM research has been focused in logistics and operations management areas. However, we have found that many other fields have

contributed to this research and this trend should continue in the future. The synthesis of research from as many fields as possible helps us to establish a better definition of the concept of SCM and to show how it can potentially be managed more effectively.

Researchers recognize how well developed the field has become in the last decade and they point to some of the accomplishments of the recent past and to the needs of the future. For example, Baganha and Cohen (1998) point out that amplification of the variability of demand up the supply chain has been recognized and described. Bhaskaran (1996) notes that manufacturers have recognized the need to optimize the performance of the supply chain connecting raw material to finished product. Ernst and Kamrad (1996) discuss that the concepts of postponement and modularization have been well researched and they add to this by discussing the combined potential of these two approaches. Geoffrion and Powers (1995) point out that using optimization to design distribution systems became technically feasible a little more than two decades ago, and developments have occurred at a rapid rate ever since. They conclude that creative logistics analysts and planners have found ingenious and unanticipated ways to use and embellish classic models. They believe that this trend should continue, as these tools become more widely used and accessible through personal computers. Gavirneni, Kapuscinski, and Tayur (1998) note that the focus of managing the supply chain has led to radical changes in thinking about supplier/customer relations.

Cohen and Mallik (1997) review the state of knowledge and practice of SCM and find that in terms of practice, what's been written about supply chain management is conceptual and somewhat impractical, inspirational but sometimes vague, or too company specific and therefore too hard to apply to other situations. They illustrate that many attempts at modeling supply chains are overwhelmed by oversimplified underlying assumptions. Researchers point out that firms are able to share information because IT costs have been reduced dramatically and the advantages of cheap information are widely accepted but their value has yet to be quantitatively explored. Fisher (1997) finds that "the performance of supply chains have never been worse despite implementation of new concepts (quick response, mass customization, lean manufacturing, agile manufacturing), and the application of new technology." Also, as globalization increases among firms, the need will be even more pressing in the future for usable supply chain management tools. Fortunately, interest in supply chain management remains high and research continues to develop at a rapid pace. The state of knowledge, practice and the tools that are developed will continue to improve, for these are the daunting challenges that spur on good research.

Appendix A SCM Quick Reference

LN	*Year*	*Author*	*Title*	*Problems Addressed*	*Conclusions*
1	57	Alderson, W.	Marketing Behavior and Executive Action: A Functionalist Approach to Marketing Theory	Marketing efficiency within a complete system of distribution can be promoted through application of the principal of postponement.	Postponement can reduce the cost of carrying inventory and reduce marketing risk. It is a major analytical tool that can be derived from the view that inventory management is an essential marketing function.
2	93	Anupindi, R. & Akella, R.	Diversification Under Supply Uncertainty	Dual (or more) sourcing strategies provide a hedge against supplier quality and delivery uncertainty. The operational issue of quantity allocation between two suppliers needs to be explored due to impacts on inventory policy and costs.	Optimal inventory policies can be determined using these models but application to real world situations is questioned and limitations are discussed.
3	96	Anupindi, R. & Bassok, Y.	Distribution Channels, Information Systems and Virtual Centralization	What are some of the challenges that present themselves when retailers decide to explore this horizontal link? The transhipment of goods and distribution needs to be reexamined under this new condition.	The system of decentralized retailers with info. sharing (virtual centralization) gives more revenues to the manufacturer. All retailers will gain from such a system but not all equally.
4	95	Arntzen, B.C., Brown, G.G., Harrison, T.P. and Trafton, L.	Global SCM at Digital Equipment Corporation	shows how DEC evaluates global SC alternatives and determines worldwide manufacturing and distribution strategy using the global SC model	GSCM is a very general approach to modeling SCs applicable to to any firm involved in multistage, multiproduct manufacturing (using the global bill of materials)
5	98	Baganha, M.P. & Cohen, M.A.	The Stabilizing Effect of Inventory in Supply Chains	Develop a model to explain the observations of the bullwhip effect and indicate mechanisms which can promote stabilization at various points in the chain.	Wholesalers can introduce a degree of stabilization into the supply chain by transmitting an order process to manufacturers with variability lower than the variability inherent in the retailer replenishment order process.

LN	*Year*	*Author*	*Title*	*Problems Addressed*	*Conclusions*
6	96	Beamon, B. M.	Performance Measures in Supply Chain Management	Evaluate existing supply chain performance measures and establish a general framework for their development and application	Effective performance measures are often neglected in the design and analysis of supply chains. This paper providesa general framework for their effective development and appliation
7	96	Berry, D. and Naim, M.	Quantifying the relative improvements of redesign strategies in a PC supply chain	outlines the dev. of simulation models that describe implications of SC redesign	dynamic performance improvements can be achieved at each successive stage of the redesign process
8	96	Bhaskaran, S.	Simulation Analysis of a Manufacturing Supply Chain	Need a tool to manage the transmission of schedule instability and the resulting inventory fluctuation. Controlling fluctuations in forecasted demand can have a great impact on inventory levels throughout the SC.	Operations in series in the pipeline need to be coordinated. Kanban can use forecasts to help reduce demand errors. The model can help to 1)simulate differences between MRP & kanban systems 2)simulate the effects of mfg. smoothing at the top of the pipe.
9	95	Bloemhof-Ruwaard, J.M., Van Beek, P., Hordijk, L., and Van Wassenhove, L.N.	Interactions between operational research and environmental management	How to incorporate environmental issues when analyzing supply chains	OR may be a suitable science to cope with the cradle-to-grave approaches in SCM and with the global problems in the environmental chain. More complicated models are needed to cope with recovery mgt and regional problems in env. chain approach.

10	69	Bowersox, D.J.	Physical Distribution Development, Current Status, and Potential	A flurry of attention has focused upon the concept of integrated physical distribution since the mid-1950's and a synthesis of contemporary physcial distribution thought is needed.	Physical distribution has evolved into an issue of competitive advantage and includes not only single firm issues of total cost and system integration but also integration beyond the firm into the total cooperative channels of distribution.

LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
11	72	Bowersox, D.J.	Planning Physical Distribution Operations with Dynamic Simulation	This article reviews a dynamic simulation model, LREPS, which is capable of simulating the physical distribution system of a manufacturing firm engaged in national distribution of packaged goods.	The LREPS model has proven to be of assistance in the planning of physical distribution systems. Using this model, a synthesis of results into some general priciples to guide integrated physical distribution system design will emerge.
12	89	Bowersox, D. and Morash, E.	The Integration of Marketing flows in Channels of Distribution	Integrating channelwide marketing strategies can provide enhanced potential for strategic leveraging of channel efficiency and effectiveness	Answers to questions include:amount of slack time (postponement potential), cost ramifications of network modifications, advisability of "crash programs" (flow acceleration) on the critical path
13	97	Cachon, G. & Fisher, M.	Campbell Soup's Continuous Replenishment Program: Evaluation and Enhanced Inventory Decision Rules	Describe how a continuous replenishment program works in practice. Could more sophisticated inventory rules improve performance.	Under the revised system it was found that retailer inventories were reduced 66% without reducing service level. Cost of goods sold fell by 12%. These savings could have been achieved without VMI.
14	97	Camm, J., Chorman, T., Dill, F., Evans, J., Sweeney, D., and Wegryn, G.	Restructuring P&G's Supply chain	choose the best location and scale of operation for making each product: provide modeling support tool to ensure best possible solution across SC	Two models were tied using aggregation and parameterization to avoid significant suboptimization. Synergy of OR/MS and GIS led to high level of acceptance
15	96	Caputo, M. and Mininno, V.	Internal, vertical and horizontal logistics integration in Italian grocery distribution	focus on branded products industry and large-scale retail trade business to increase	Successful strategy depends on clear delineation of responsibility at each echelon and the quickness

				operating efficiency and improve interfunctional and interorganizational coordination in logistics channels in Italian grocery distribution	of processing and exchange of information (EDI); vertical integration (systematic coord of physical and informational flows)

LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
16	96	Carter and Narasimhan	North American vs European Future Purchasing Trends	Document the changes and emerging trends in sourcing and supply mgt. and their impacts on supply mgt.	Most significant trends: greater strategic importance; reliance on Info Tech.; EDI; Env sensitive purchasing; sourcing teams
17	96	Choi, T. and Hartley, J.	An exploration of supplier selection practices across the SC	Compare supplier-selection practices based on a survey of companies at different levels in the auto industry	No difference found (among auto assemblers, direct and indirect suppliers) for the importance placed on consistency (quality and delivery), reliability, relationship, flexibility, price, and service. Price is one of the least important selection items.
18	72	Clark, A.J.	An Informal Survey of Multi-Echelon Inventory Theory	To fully appreciate the directions of multi-echelon research, it is useful to have a basic familiarity with analytical approaches to the problems.	It is probable that research in multi-activity inventory therory has reached a point where marginal returns from further work are likely to diminish. The principle work to be done lie in refinements and extensions of previous results.

19	60	Clark, A.J. & Scarf, H.	Optimal Policies for a Multi-Echelon Inventory Problem	There is a need to consider the problem of determining optimal purchasing quantities in a multi-installation model.	Optimal solutions for multi echelon inventory models are possible.
20	88	Cohen, M. and Lee, H.	Strategic Analyis of Integrated Production-Distribution Systems	measuring cost/service/ flexibility tradeoffs in production/ distribution systems	methodology considers relationships between production and distribution control policies that affect inventory control, plant product mix, and production sched. Other manuf. strategy decisions (e.g. facility location, capacity planning) are assumed fixed
LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
21	97	Cohen, M.A. & Mallik, S.	Global Supply Chains: Research and Application	The objective of the paper is to review the state of knowledge & practice of SCM. A global supply chain will realize competitive advantage only if management is coordinated & value added activities are flexible in response to changes in market conditions.	Majority of models lack practiaclity & would be difficult to implement. Globalization has increased considerably among big US firms. Evidence of the growth of SC coordination is less clear. Paper concludes with several specific areas for future work.
22	92	Copacino, W. and Rosenfield, D.	Analytical tools for Strategic Planning	Focus on analytical tools for strategic logistics planning	None Given
23	93	Davis, T.	Effective Supply Chain Management	Hewlett-Packard has developed a framework for addressing the uncertainty that plagues the performance of suppliers, the reliability of manufacturing and transportation processes, and the changing desires of customers.	The author describes several cases in which entire product families have been reevaluated in a supply chain context. The methodology employed should help others manage their supply chain.

24	96	Ernst, R. & Kamrad B.	A Conceptual Framework for Analyzing Supply Chain Stuctures	Evaluate different supply chain structures in the context of modularization and postponement.	Specific examples of companies that fall into each category are cited. Verticle integration along the supply chain is not desirable. The framework provides a way to start the decision process by helping to contrast the chain design options.
25	97	Fisher, M.	What is the right supply chain for your product? Effective Supply Chains	Managers lack the framework for deciding which ideas and technologies best fit their particular company's situation	To take the right approach, comapnies should first determine whether their products are functional (predictable demand) or innovative. Then select either an efficient (cost) SC or a responsive (time) SC strategy
LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
26	96	Fisher, M. and Raman, A.	Reducing the Cost of Demand Uncertainty through accurate response to early sales	How to avoid stockouts and inventory obsolescence because long lead times coupled with a concentrated selling season force all or at least most production to be committed before demand information is available.	Relative to the cost that would have been incurred if no response were used, optimized response reduces cost by enough to quadruple profits.
27	61	Forrester, J. W.	Industrial Dynamics	Industrial Dynamics studies the behavior of industrial systems to show how policies, decisions, structures, and delays are interrelated to influence growth and stability.	The five flows are interrelated by an info network; I.D. recognizes the critical importance of this info network in giving the system its own dynamic character. Uses models to show how info. and policy create the character of the organization.

28	58	Forrester, J.W.	Industrial Dynamics	Predict the specific kinds of progress which will be achieved and describe the concepts which will make it posssible	Companies will come to be recognized not as a collection of separate functions but as a system in which the flows of information, materials, manpower, capital equip., and money set up forces than determine growth, fluctuation and decline
29	93	Fuller, J., O'Conner, J., & Rawlinson, R.	Tailored Logistics: The Next Advantage	The goal of logistics strategy is to organize companies to compete across the span of their markets without overcharging customers or underserving others	Logistics have become central to product strategy because it is increasingly clear, products are not just things-with-features. they are TWF bundeled with services
30	97	Garg, A. & Tang C.S.	On Postponement Strategies for Product Families with Multiple Points of Differentiation	There is a need to develop research which studies products with more than one point of differentiation. Discovering the conditions when one type of postponement is the most beneficial. Extenstion of Eppen & Schrage (1981)	Centralized model - variability & correlation of demands play an important role in which postponement strategy to use. Decentralized model - magnitudes of lead times have a strong impact on inventory. A simple way to ID the optimal point to be postponed.
LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
31	98	Gavirneni, S., Kapuscinski, R. & Tayur, S.	Value of Information in Capacitated Supply Chains	The degree of cooperation varies significantly from one supply chain to another. How much cooperation and coordination is needed for firms to derive the benefits of improved relationships?	Info. is most beneficial @ moderate variances. The benefit of info. flow is higher at higher capacities. If the variance of the demand seen by the customer is small, we can expect the benefit of info. flow to increase with increase in penalty cost.

32	96	Gentry, J.	The Role of the Buyer-Supplier Strategic Partnerships: A SCM Approach	Reports on the nature and degree of carrier involvement within buyer-supplier strategic partnerships	Study indicates that three-way relationships are typical. Therfore, buyer-supplier partnerships can establish a solid foundation for the formation of successful SCs over time. ShoIld integrat carrier operations into overall buyer-supplier planning/comm.
33	74	Geoffrion, A. and Graves, G. W.	Mulitcommodity Distribution System Design by Benders Decomposition	distribution system design: optimal location of intermediate distribution facilities between plants and customers	Remarkable effectiveness of Benders Decomposition as a computational strategy for static multicommodity intermediate location problems
34	95	Geoffrion, A.M & Powers R.F.	Twenty Years of Strategic Distribution System Design: An Evolutionary Perspective	An overview of the state of design in distribution systems would be helpful in understanding why the tools we use today exist in the form that they do.	Creative logistics analysts and planners have found ingenious & unanticipated ways to use and embellish classic models. This should continue as these tools become more widely used and accessible thru personal computers.
35	92	Gopal, C.	Manufacturing systems for a competitive global strategy	Explores aspects of an integrated system and the logistics chain, from purchasing to distribution, necessitated by a global policy	Benefits of a global system include: better coordination of customer service in multiple markets, fast and accurate info transfer, less difficulty complying with local laws and regs, conformance of both central and local planning to overall objectives
LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
36	98	Graves, S., Kletter, D. & Hetzel, W.	A Dynamic Model for Requirements Planning with Application to Supply Chain Optimization	Develops a new model for requirements planning multi-stage production inventory systems.	Provides some evidence of the value of taking a corporate wide view by optimizing the supply chain rather than sub-optimizing each of the pieces.

37	93	Hammel, T. and Kopczak	Tightening the Supply Chain	describes how HP successfully used its "Frontier Program" through product redesign and DRP to improve its series 700 terminals operations	product redesign was essential (including CIM); enhanced product availability through demand pull DRP; warranty cost in check with US manufacture
38	97	Henig, M., Gerchak, Y., Ernst, R., and Pyke, D.	An Inventory Model Embedded in Designing Supply a Contract	Explore the joint optimization of contract parameter and inventory control policy in an environment characterized by demand uncertainty in order to specify the frequency of, and volume for, future deliveries	Show that the difference in costs can be significant when comparing the costs of suboptimal policies, in conjunction with the best contract volume, to those of the optimal inventory policy and associated contract volume.
39	77	Heskett, J.L.	Logistics - Essential to Strategy	Many firms develop competitive logistics strategies based in part on concepts like postponement, standardization, consolidation, & differentiation. Firms redesign systems to provide more effective support for corporate strategy.	Finds that logistics managment must participate in strategic decision making. Argues that globalization will have a huge impact on the importance of good logistics design and development within corporate strategy.
40	96	Holmlund, M. & Kock, S.	Buyer Dominated Relationships in a Supply Chain - A Case Study of Four Small Sized Suppliers	There is a need to analyze the relationships, and bonds between a dominating buyer and small sized suppliers in a supply chain.	Although the relationships between the buyer and the small vendors was quite old, few strong bonds were found. Contracts remained relatively short term. Buyer has no incentive to help vendor max. profits and vendor was forced to make unprofitable parts.

LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***

41	85	Houlihan, J. B.	International Supply-Chain Management	Describes the concepts underlying the new approaches to managing change in international chains, the barriers to be overcome and the lessons learned	A holistic approach to Int SCM requires the incorporation of a logistics focus into the strategic decisions of the firm;
42	84	Jones, T. and Riley, D.	Using Inventory for competitive andantage through SCM	Focus on the myths of the past	Barriers to SCM are traditional, organizational, legal, and non-integrated mgt systems--mgt objectives and measures are in fundamental conflict. Key to success: mutually advantegous relationships that make the chain work more smoothly at lower costs.
43	97	Kruger, G. A.	The Supply Chain Approach to Planning and Procurement Management	The supply chain approach models stochastic events influencing a manufacturing organization's shipment and inventory performance in the same way that an engineer models tolerance buildup in a new product design.	The actual performance the factory experiences will depend upon whether the supply chain performs according to the inputs provided the statistical model.
44	94	La Londe, B. J.	Evolution of the Integrated Logistics Concept	Describes the evolution of Integrated Logistics: (1) Physical distbn; (2) Internal linkages; (3) external linkages;	None Given
45	96	Lamming, R.	Squaring lean supply with SCM	To understand lean production better, we must investigate SCM.	Challenge: redesign the way in which responsibility for value mgt is shared. Precept of vantage point and customer superiority that are central to SCM are directly contrary to those of lean supply; need shared beliefs; customer infallibility-problematic

LN	*Year*	*Author*	*Title*	*Problems Addressed*	*Conclusions*
46	92	Langley, C.J.	The Evolution of the Logistics Concept	Casts the evolution of logistics into three specific contexts: past (1950-1964); present (1965-); future	Four stages in development of Logistics function: (1) cost control; (2) profit-center orientation recognizing positive impact on sales; (3) view logistics as key to product differentiation; (4) principal strategic adv. revolves around logistics.
47	97	Lederer, P. and Li, L.	Pricing, production, scheduling, and delivery-time competition	studies competition between firms that produce goods or services for customers sensitive to delay time. Firms compete by setting prices and production rates for each type of customer and by choosing scheduling policies.	A faster, lower variability and lower cost firm always has a larger market share, higher capacity utilization, and higher profits. Also, customers with higher waiting costs pay higher full prices, and that each firm charges a higher price and delivers faster to more impatient customers.
48	95	Lee, H. and Billington, C.	The Evolution of SCM models and practice at HP.	Show how HP successfuly used an integrated team approach to implement SCM and improve customer satisfaction	SCM is a business fundamental
49	93	Lee, H.. & Billington, C.	Material Management in Decentralized Supply Chains	Need a decentralized model that allows for 1) generalized network structure 2)uncertainties (demand, process & supply) 3)simplicity in computation 4)capacitated production systems.	A simple model based DSS can be used by practioners to evaluate alternative supply chain designs and determine the most practical inventory control under uncertain conditions in a system of decentralized control.
50	97	Lee, H., Padmanaabhan, V. & Whang S.	Information Distortion in a Supply Chain: The Bullwhip Effect	An analysis of the sources of the bullwhip effect and strategies that can be employed to lessen the negative impact of the effect are explored.	Demand distortion may arise as a result of optimizing behaviors of individuals in the supply chain. Cooperation and coordination among members of the chain is necessary to combat this problem. Net benefits of such actions can be shared by members.

LN	*Year*	*Author*	*Title*	*Problems Addressed*	*Conclusions*
51	94	Leenders, Nollet, and Ellram	Adapting Purchasing to SCM	purchasing function must become fully integrated into the customer-employer SC	suppliers and the way in which we relate to them must provide a strategic advantage. The PM should manage the SC by integrating the org's internal and external ops.
52	97	Levy, D.L.	Lean Production in an International Supply Chain	While the business press has championed both globalization and lean production as inevitable and valuable, there has been little investigation into the interaction of the two.	Lean production requires frequent, rapid flows of info. & goods along the value chain, which is costly when value chain activities are geographically dispersed. Two key elements of lean production; design for mfg. and low defect levels stabilize the SC.
53	94	Masters J. & Pohlen, T.	Evolution of the Logistics Profession	Describes the evolution of Logistics profession into 3 pahases: functional mgt (1960-70s); Interanl integration (1980s); External integration (1990s)	None Given
54	96	McMullan. A.	Supply chain management practices in Asia pacific today	Examines how managers in Asia Pacific are responding to pressures of competition and the strategies they are implementing to enhance SCM (mgt issues, roles and responsibilities, competitive strategies, performance mgt)	To successfully implement SCM, many firms will have to change their organizational structures, SCM relationships, and performance measures. Also requires implementation of new information technology.

55	96	Min, H.	Distribution channels in Japan	Effective way of enahacing ability of US co's to penetrate Japanese market is to study Japanese practices (e.g. an indigeneous channel dist. which disfavors foreign firms due to legal impeds & "locked-up relationships"	Strategies for successful penetration include: targeting specialized niche markets; selling under Japanese brand names; empahasize follow-up service; piggyback; sell in non-keiretsu system; direct marketing

LN	*Year*	*Author*	*Title*	*Problems Addressed*	*Conclusions*
56	97	Moinzadeh, K and Aggarwal, P.	An Information Based Multiechelon Inventory System with Emergency Orders	(S-1,S) multiechelon inventory system where all the stocking locations have the option to replinish their inventory through either a normal or a more expensive emergency resupply channel	Incorporating information on the remaining leadtimes of the outstanding orders, when selecting a resupply mode, can result is considerable cost savings when compared to policies which allow a single resupply mode.
57	95	Mourits, M. and Evers, J.	Distribution Network Design: An Integrated Planning Support Framework	Many logistics support systems have been developed to assist design but there are too many shortcomings--need coherent approach. Goal of paper is to make optimization easier to use & make solutions meaningful to customers.	IPSF provides a systematic approach to the challenges firms face in designing their supply chain.
58	95	O'Brien, C. & Head, M.	Developing a Full Business Environment to Support JIT Logistics	Establish a business cycle (the transactions needed to complete a purchase of goods or services) appropriate to JIT supply to the motor industry. The business cycle also includes the communication between all partners in the chain.	EDI was seen to be necessary to support a JIT full business cycle. There are significant savings to be gained from the use of the concept when the FBC is integrated throughout the SC. More work is needed to support the financial aspects of SCM.
59	92	Oliver, K. and Webber, M.	SCM: Logistics catches up with strategy	Booz-Allen study of a variety of industries worldwide found that traditional approaches of seeking tradeoffs among the various conflicting objectives of key functions along the SC no longer worked well	Unlike traditional approaches (manipulation of inventories and improved material mgt), SCM requires and underlying strategic focus along with the involvement and commitment of top mgt.

60	96	Prida, B. & Gutierrez, G.	Supply Management: From Purchasing to External Factory Management	The role of the purchasing function (buyer) has changed dramatically with the onset of SCM. The authors propose to discuss the challenges that face purchasing employees.	The evolution in supply chain management has occured in three stages:1)traditional purchasing role 2)SCM thru subcontracting 3)SCM through innovation.
LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
61	96	Revelle, C. S. & Laporte, G.	The Plant Location Problem: New Models and research Prospects	Objectives needed: 1) Capacitated Plant, Fixed charge Transport 2) Max. ROI Location has been ignored in past 3)Multiobjective Problemss should be considered 4)Multiple product/Multiple Machine Problems 5) Probs with spatial interaction models	Plant location problems can be expanded and restrictions can be relaxed to bring more realism into models while providing new challenges for solving plant location problems.
62	90	Roberts, J. H.	Formulating and Implementing a Global Logistics Strategy	Provide the background scenario for which ILC is developing their corporate logistics strategy	None Given
63	93	Robinson, E.P., Gao, L., and Muggenborg, S.D.	Designing and Integrated Distribution System at DowBrands, Inc.	Developed an optimization-based decision support system for designing two-echelon, multi-product distribution systems and applied it to DowBrands, Inc.	Optimization procedure gave management the analytical support it needed to eliminate uncertainties and develop guidelines for change
64	96	Roy, R. & Potter, S.	Managing Engineering Design in Complex Supply Chains	Literature on "supplier partnerships" has largely overlooked the implications for managing design and development.	The case studies identify several factors that determine the extent to which it is appropriate to devolve design and development to suppliers. These factors include; the type of industry, firm and product and level of innovation.

65	96	Satterfield, R.K. & Robinson, E.P.	Designing Distribution Systems to Support Vendor Strategies in Supply Chain Management	The interactions between cost, distribution service, market share, and revenue are largely ignored by existing optimization based system design models.	Successful application of framework for designing a distribution system. Model draws upon research from varied disciplines and includes revenue considerations in addition to cost minimization. Integrated approaches for vendor dist. design are justified.
LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
66	91	Scott, C. and Westbrook, R.	New Stategic Tools for SCM	How to overcome major barriers to SC Integration	Celebrated examples of SCM are more admired than emulated. Managers should ask three questions: (1) what is the current shape of the SC?; (2) How collaborative are the relationships?; (3) which combination of physical & info. processing to use?
67	84	Shapiro, R. D.	Get Leverage from Logistics	Managers should understand precisely what their companies are trying to do and bring their logistical capabilities in line with corporate purpose-- What must our logistics system do well?	A Company can gain leverage by ensuring a good fit between its logistics system and competitive strategy
68	76	Slater, A.	The Significance of Industrial Logistics	There is a need for a framework which fully describes the role and organization of industrial logistics. A definition, the structure and a discussion of it's significance to the bottom line are needed.	A total systems approach to the logistics channel will reduce total costs and considerably improve the overall quality of the operation. The isolation and individual aims of channel members should be replace by cooperation.
69	95	Slats, P.A., Bhola, B., Evers, J.J., and Dijkhuizen, G.	Logistic Chain Modelling	Analyze and evaluate the role OR can paly in logistic chain integration and BPR	OR models and techniques are well suited to analyze the local performance of logistic sub-chains and processes.

70	94	Srinivasan, K., Kekre, S. & Mukhopadhyay, T.	Impact of Electronic Data Interchange Technology on JIT Shipments	Does the use of EDI enhance the shipment performance of suppliers in a JIT environment?	EDI technology facilitiates accurate and timely information which aids in the coordination of material movement and leads to better shipment performance. Firms pursuing a single source strategy are prone to greater shipment errors.

LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
71	94	Stenger, A.	Inventory Decision Framework	Provides a framework within which to view inventory decisions in logistics	Inventory decisions must be made within the context of the efficient functioning of the entire SC. Approach include: eliminate need for inventory; maintain min inventory required; use scientific approaches to manage inventory
72	96	Stenger, A.	Reducing Inventories in a Multi-Echelon Manufacturing Firm	Presents a method to help a firm identify the relative impact of various determinants of inventories as a means of setting priorities for inventory reduction.	rough-cut models seem to offer potential to better gauge the magnitude of the opportunities in a given situation
73	89	Stevens, G.	Integrating the Supply Chain	Develop an integrated supply chain strategy	companies that consider the supply chain during the strategic debate, will be more successful in terms of increased market share and lower asset base.

74	96	Tagaras, G. & Lee, H. L.	Economic Models for Vendor Evaluation with Quality Cost Analysis	Vendor selection criteria needs to go beyond costs and delivery performance and also address the quality of incoming materials.	Vendors must not be evaluated only on the basis of their own quality and prices. The attractiveness of a vendor also depends on the quality and cost characteristics of the purchaser.
75	96	Thomas, D. and Griffin, P.	Coordinated SCM	Review the literature addressing coordinated planning between two or more stages of the supply chain, placing emphasis on models that address a total supply chain model.	Strategic models based on case studies are popular; most of these models are based on complicated integer LPs with underlying network structure that can be exploited using decomposition; advancement in comm and info tech present many SCM opportunities
LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
76	97	Towill, D.R.	The Seamless Supply Chain - The Predator's Strategic Advantage	The paper reviews the techniques available to "predators" seeking to gain competitive advantage for their supply chains.	Must go beyond the lean supply chain to the seamless supply chain. Partnerships between members of the supply chain take a attitudnal change as well as a change of ownership in the process.
77	92	Towill, Naim and Wikner	Industrial Dynamics Simulation Models in the Design of Supply Chains	Review the operation of supply chains, and provide simple conclusions about ways of reducing demand amplification	By using a simulation model of proposed supply chains, different strategies can be compared and costed.
78	96	Verwijmeren, M., van der Vlist, P., & van Donselaar, K.	Networked Inventory Management Information Systems: Materializing Supply Chain Management	Need to elevate the SCM research from global concepts to some tangible information systems for inventory managment in practice.	A group of networked systems can act as a single integrated decision system thus removing amplification in the supply chain.

79	97	Viswanathan, S. and Mathur, K.	Integrating Routing and Inventory Decisions in One-warehouse Mulitretailer Multiproduct Distribution Systems	Consider distributions systems with a central warehouse and many retailers that stock a number of different products. Objective is to determine replinishment policies that specify delivery quantities and vehicle routes to minimize long-run inv. and trans costs.	Proposed heuristic is an excellent planning tool to control inventory and transportation costs in a multiechelon inventory/distribution system.
80	96	Walton, L.W.	Partnership Satisfaction: Using the Underlying Dimensions of Supply Chain Partnership to Measure Current and Expected Levels of Satisfaction	The question of partnership satisfaction has generally gone unanswered. Need to assess current satisfaction and future expectation of partnerships as perceived by business executives.	Planning dimension found to be stat. sig., limited sharing of benefits between partners, managers are generally pleased with value of partnerships. Managers are not satisfied with their current level of communication and info. exchange with partners.

LN	***Year***	***Author***	***Title***	***Problems Addressed***	***Conclusions***
81	88	Zinn, W. & Bowersox, D.J.	Planning Physical Distribution with the Principle of Postponement	To provide effective support, managers need to serve an increased number of delivery destinations, while simultaneously supporting a growing number of SKU's. The principal of postponement can help in keeping costs down in this chaotic environment.	Under specific conditions, the principle of postponement offers an opportunity for management to improve the productivity of physical distribution systems by reducing cost associated with anticipatory distribution.

82	88	Zinn, W. & Levy M.	Speculative Inventory Management: A Total Channel Perspective	Determine the best place in the supply chain for speculative inventory.	CFS is found to be useful in explaining actual company behavior in cases in which mgmt.'s objective is to minimize costs. Postponement/Speculation is more suitable for deciding under what circumstances a speculative inventory should appear in the chain.

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