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Supply chain management: an analytical framework for critical literature review

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Abstract

There can be little dispute that supply chain management is an area of importance in the field of management research, yet there have been few literature reviews on this topic (Bechtel and Mulumudi, 1996, Proceedings of the 1996 NAPM Annual Academic Conference; Harland, 1996, British Journal of Management 7 (special issue), 63–80; Cooper et al., 1997). This paper sets out not to review the supply chain literature per se, but rather to contribute to a critical theory debate through the presentation and use of a framework for the categorisation of literature linked to supply chain management. The study is based on the analysis of a large number of publications on supply chain management (books, journal articles, and conference papers) using a Procite© database from which the literature has been classified according to two criteria: a content- and a methodology-oriented criterion. © 2000 Elsevier Science Ltd. All rights reserved.

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1. Introduction

This paper is a 'thought paper' and arose from our discussions about the nature of the academic study of supply chain management, a conversation that has indeed been on going for a number of years (see Croom and Saunders, 1995). Our concern was with the nature of research in supply chain management, and more specifically with exactly what would constitute the domain of supply chain management as a management *discipline*. From these discussions this paper developed in order to present a basis for our debate and development around the field of supply chain management by attempting to consolidate current learning, identify possible gaps, and thereby pose possible future directions for development. Our contention that supply chain management should begin to be seen as a *discipline* in much the same way as marketing (Malhotra, 1999) has been seen as contentious, not least by early reviewers of the paper, yet we stand by this claim, citing Long and Dowells (1989) argument that "… disciplines are distinguished by the general (discipline) problem they address" (cited in Tranfield and Starkey, 1998). What we set out to establish in this paper is in fact the *general problem domain* of supply chain management, thereby, we hope, contributing to the development of a discipline in supply chain management. Tranfield and Starkey also note the underlying "soft, applied, divergent and rural" nature of management research, and further argue that there is a real need in any field of social research to identify the cognitive components of the subject (Tranfield and Starkey, 1998). Their paper has been instrumental in our approach to the challenge of undertaking a critical literature review of the field of supply chain management, and this paper's focus on mapping and classifying the area has been motivated by their claim that "… a key question for any applied field concerns the strategic approach taken to its mapping" (p. 349).

Supply chain management and other similar terms, such as network sourcing, supply pipeline management, value chain management, and value stream management have become subjects of increasing interest in recent years, to academics, consultants and business management (Christopher, 1992; Hines, 1994; Lamming, 1996; Saunders, 1995, 1998). It is recognised in some parts of the literature that the supply chain should be seen as the central unit of competitive analysis (Macbeth and

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Ferguson, 1994; Cox, 1997). Companies will not seek to achieve cost reductions or profit improvement at the expense of their supply chain partners, but rather seek to make the supply chain as a whole more competitive. In short, the contention that it is supply chains, and not single firms, that compete is a central tenet in the field of supply chain management (Christopher, 1992; Macbeth and Ferguson, 1994).

Supply chain management has received attention since the early 1980s, yet conceptually the management of supply chains is not particularly well-understood, and many authors have highlighted the necessity of clear definitional constructs and conceptual frameworks on supply chain management (Saunders, 1995, 1998; New, 1995; Cooper et al., 1997; Babbar and Prasad, 1998). Saunders (1995) warns that pursuit of a universal definition may "lead to unnecessary frustration and conflict", and also highlights the fragmented nature of the field of supply chain management, drawing as it does on various antecedents including industrial economics, systems dynamics, marketing, purchasing and inter-organisational behaviour. The scientific development of a coherent supply chain management discipline requires that advancements be made in the development of theoretical models to inform our understanding of supply chain phenomena. As an illustration, the application of Forrester's (1961) industrial dynamics model applied to supply chains (the 'Forrester Effect') exemplifies such a model. Its value lies in the ability to aid understanding of the actions of materials flows across a chain, and has provided a basis for further advancement of understanding supply chain dynamics (for example, see Sterman, 1989; Towill, 1992; Van Ackere et al., 1993; Lee et al., 1997). Cooper et al. (1997) support this view, pointing to the fact that whilst supply chain management as a concept is a recent development, much of the literature is predicated on the adoption and extension of older, established theoretical concepts.

In this paper our concern is not so much with advancing theory per se, but in providing a taxonomy with which to map and evaluate supply chain research. In the process, it is our contention that we also provide a topology of the field of supply chain management, which may provide a fruitful means of delineating or defining the subject domain. This is not necessarily a novel idea: Lamming (1993), for example, provides a map of antecedent literature for his development of the Lean Supply Model, which again supports our claim that there is a need for a topological approach to the development of supply chain theory. The paper presents the results of a literature survey in the field of supply chain management.

The main purposes of the survey are:

- to look at some major issues in supply chain management literature and to present a framework for classification and analysis;
- to describe and evaluate the methodologies used in supply chain management literature.

The paper is organised in five sections. In Section 1 some definitions of supply chain management are examined, underlining differences and common aspects, in order to better trace the boundaries of the concept and to highlight the difficulties of its definition. One of the reasons for the lack of a universal definition of supply chain management is the multidisciplinary origin and evolution of the concept. Section 2 considers the bodies of literature associated with supply chain management and discusses the different perspectives adopted by various authors. In Section 3 we explain the framework and the methodology used for classifying the literature analysed and we present the results of literature review. Section 4 presents a summary and some conclusions we can draw from the work in terms of moving towards a disciplinary approach to supply chain management.

2. The supply chain management landscape

In providing a topology of the supply chain landscape we support New (1995) and Saunders (1995) contention that within the supply chain management literature there is a confusing profusion of overlapping terminology and meanings. As a consequence, in the literature many labels can be found referring to supply chain and to practices for supply chain management, including: integrated purchasing strategy (Burt, 1984), supplier integration (Dyer et al., 1998), buyer–supplier partnership (Lamming, 1993), supply base management, strategic supplier alliances (Lewis, 1995), supply chain synchronisation (Tan et al., 1998), network supply chain (Nassimbeni, 1998), value-added chain (Lee and Billington, 1992), lean chain approach (New and Ramsay, 1995), supply pipeline management (Farmer and van Amstel, 1990), supply network (Nishiguchi, 1994), and value stream (Jones, 1995). As a first step, we set out in Table 1 to highlight a sample of definitions associated with the concept of supply chain management found in the literature analysed. This table is not intended to provide a comprehensive review of supply chain definitions (see, for example, Cooper et al., 1997), rather the purpose here is to highlight some of the contrasting approaches to supply chain management existing in the literature.

From these selected definitions we are able to partially confirm Saunders (1995) statement that most definitions of supply chain management share at least one thing in common with each other: "… they focus on the external environment of an organisation, with the boundaries of the latter defined conventionally in terms of an entity identified legally as a company or some other form of business unit …" As such definitions are based on metaphors (chains, pipelines, etc.) or "ideal types" rather than "objective entities", he concludes that "… attempts to

Table 1
A sample of definitions of supply chain management

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

pursue universal definitions may lead to unnecessary frustration and conflict". However, in a number of management fields the study of supply chains concentrates on internal supply chains (Harland, 1996), notably the business re-engineering (Lee and Dale, 1998) and operations management literature (Slack et al., 1998)

The lack of a universal definition of supply chain management is in part due to the way the concept of supply chain has been developed. In fact, as it will be explained in the next section, the concept of supply chain has been considered from different points of view in different bodies of literature. Such a multidisciplinary origin and evolution is reflected in the lack of robust conceptual frameworks for the development of theory on supply chain management. As a consequence the schemes of interpretation of supply chain management are mostly partial or anecdotal with a relatively poor supply of empirically validated models explaining the scope and form of supply chain management, its costs and its benefits.

3. Bodies of literature associated with supply chain management

The origins of the concept of supply chain management are unclear, but its development was initially along the lines of physical distribution and transport, using the techniques of industrial dynamics, derived from the work of Forrester (1961). Another antecedent can be found in the Total Cost approach to distribution and logistics (Heckert and Miner, 1940; Lewis, 1956). Both these approaches show that focusing on a single element in the chain cannot assure the effectiveness of the whole system.

The term supply chain management has not been used only with regard to the logistics activities and the planning and control of materials and information flows internally within a company or externally between companies. Some authors have used it to describe strategic, inter-organisation issues (Cox, 1997), others to discuss an alternative organisational form to vertical integration (Thorelli, 1986), others to identify and describe the relationship a company develops with its suppliers (Sako, 1992; Lamming, 1993; Hines, 1994). In this paper we have examined a number of subject areas we consider to be core to any supply chain management literature survey. Below we set out this list, but note that it is both brief and non-exhaustive of the literature or subject areas associated with supply chain management. The objective is to highlight how different subject literatures have contributed work in supply chain management from different perspectives.

1. Purchasing and supply literature
2. Logistics and transportation literature

3. Marketing literature
4. Organisational behaviour, industrial organisation, transaction cost economics and contract view literature
5. Contingency theory
6. Institutional sociology
7. System engineering literature
8. Network literature
9. Best practices literature
10. Strategic management literature
11. Economic development Literature

It should be noted that there is a partial overlapping among the subject areas we are going to discuss. In fact, the same topic can be considered from different perspectives in more than one subject area. Drawing on wider literature in the areas of network theory, industrial business marketing and social organisational theory, Croom (1995) and Croom and Batchelor (1997) note that the contention that organisational behaviour is conditioned and contextualised by its patterns of interaction with other firms in its supply chain/network is a common and complementary field of theoretical development for the supply chain management researcher.

In an attempt to clarify the agenda and methodology for future research we present a content overview of the existing literature under the antecedent headings identified above. Such a content analysis naturally will prove problematic due to multiple perspectives surrounding topics such as alliances, Just-in-time, Electronic Commerce, amongst many others. We have thus set out to provide an indicative delineation in Table 2, identifying the concerns within each of the six areas that we consider to relate to the field of supply chain management, those cases of duplication indicating that there are multiple perspectives surrounding the problem or process:

Table 2
Principal component bodies of supply chain literature

Strategic management	*Relationships/partnerships*
Strategic Networks	Relationships Development
Control in the supply chain	Supplier Development
Time-Based Strategy	Strategic Supplier Selection
Strategic Sourcing	Vertical Disintegration
Vertical Disintegration	Partnership Sourcing
Make or Buy decisions	Supplier Involvement
Core Competencies focus	Supply/Distribution Base Integration
Supply Network Design	Supplier Assessment (ISO)
Strategic Alliances	Guest Engineering Concept
Strategic Supplier Segmentation	Design for Manufacture
World Class Manufacturing	Mergers Acquisitions, Joint Ventures
Strategic Supplier Selection	Strategic Alliances
Global Strategy	Contract View, Trust, Commitment
Capability Development	Partnership Performances
Strategic Purchasing	Relationship Marketing
Logistics	*Best practices*
Integration of materials and information flows	JIT, MRP, MRP II
JIT, MRP, Waste Removal, VMI	Continuous Improvement
Physical Distribution	Tiered Supplier Partnerships
Cross Docking	Supplier Associations (kyoryoku kai)
Logistics Postponement	Leverage Learning Network
Capacity Planning	Quick Response, Time Compression
Forecast Information Management	Process Mapping, Waste Removal
Distribution Channel Management	Physically efficient Vs. Market Oriented Supply
Planning and Control of Materials Flow	Chains
Marketing	*Organisational behaviour*
Relationship Marketing	Communication
Internet Supply Chains	Human Resources Management
Customer Service Management	Employees' Relationships
Efficient Consumer Response	Organisational Structure
Efficient Replenishment	Power in relationships
After Sales Service	Organisational Culture
	Organisational Learning
	Technology Transfer
	Knowledge Transfer

4. Methodology — designing a taxonomy of the supply chain management literature

After discussing some definitions of supply chain management and some important bodies of literature associated with this concept, the next step is to define a framework for classifying and critically analysing the large number of contributions on supply chain management we have found. To achieve this we contest that it is necessary to explore the underlying phenomena and processes embodied within these contrasting yet complementary bodies of literature in order to develop a taxonomy encapsulating the evident processes and phenomena of interest to supply chain researchers (see Glaser and Strauss, 1967). In order to develop the taxonomy, we used *Procite*©, a software tool that supported us in creating the database containing the bibliographical sources we consulted. Citations were identified using a number of methods. Firstly, through citation search in existing conference, journal and working papers and doctoral theses. Secondly, using the abstracting and on-line services ProQuest, Searchbank, Anbar and BIDS. Thirdly, through discussions with colleagues at Warwick Business School and the University of Padua. All the publications stored in the database are retrievable by means of a set of codes (keywords) we created through intensive analysis of 84 leading and cited papers. The reference list to this paper contains all of the citations examined; we have also provided an on-line bibliography of references at http://www.supply-chain.org.uk/biblio.html, which is regularly up dated.

The papers were coded according to two classification criteria:

1. The *content-oriented criterion*, according to which the contributions have been classified on the basis of their content using the framework we have developed which will be explained in next section;
2. The *methodology-oriented criterion*, based on the framework used by Ellram (1995) which classifies researches as primarily descriptive or prescriptive and empirically or conceptually based.

This was very helpful not only in developing a literature review with a critical perspective, but also in assessing gaps in current theorising, methods and empirical finding in the field of study analysed. The classification scheme is now explained.

5. Content-oriented criterion

In setting out our framework one of the main challenges is how to address the many different aspects of networks and their analysis. For instance, one can classify literature on the basis of the operational processes with which it deals (e.g. manufacturing planning and control, design, accounting, human resource management, and so on) or on the basis of performances (cost, time, quality, flexibility, service, etc.): see Cooper et al. (1997) for such a treatment. It is our contention that a two-dimensional approach to literature content analysis enables us to address both the level of analysis and the processes of supply chain management.

5.1. Dimension one — level of analysis

The literature we examined associated with supply chain management concern different levels within the total network of operations (Harland, 1996). Therefore we propose that the first dimension used for classifying literature is the *level of analysis* of supply chain management. We have limited the study to only three levels:

1. *dyadic level*: which considers the single two party relationship between supplier and manufacturer or manufacturer and distributor/retailer;
2. *chain level*: which encompasses a set of dyadic relationships including a supplier, a supplier's supplier, a customer and a customer's customer;
3. *network level*: which concerns a network of operations (upstream/downstream or total/immediate).

Our concern in this paper was to follow the external chain definition supplied by Saunders (1995), and consequently in this paper do not explore the internal supply chain level of analysis.

5.2. Dimension two – element of exchange

Drawing on the work of Hakånsson (1987), who considers networks as composed of actors, resources and activities, our second dimension relates to the nature of exchange or transaction between actors in networks. The second dimension used to classify literature the *element of exchange*, is about "what" is exchanged (material assets, financial assets, human resource assets, technological assets, information, and knowledge) and "how" relationships between actors are conducted and managed. As to "what" is exchanged, it is important to consider both the static aspects (e.g. which actor owns an asset and where it is located) and the dynamic aspects (e.g. materials, information, financial, technology, and knowledge flows between actors).

5.3. Two dimensional content analysis matrix

The matrix shown in Table 3 has been obtained by combining the two dimensions we have highlighted and it will be used to summarise the location of publications in terms of the level of analysis and of the element of the exchange they consider. In general a single publication can deal with more than one element of exchange or level of analysis. In this case it can be classified in more than one cell in the matrix. Finally, it should be noted that the keyword system of the database we have created allows

Table 3
Supply chain content matrix

Level of analysis		Element of the exchange considered			
		Assets	Information	Knowledge	Relationships
Dyadic	Suppl. Manuf.	Transaction cost (specificity of assets)	Information Technology support	Collaborative design	Outsourcing/subcontracting
		Transportation routes rationalisation	Tools for analysis of information flow	Guest engineer	Trust/Power/Commitment
		Exchange of technology	Interplant planning and logistical integration (EDI)	HR development	Supplier development
		Redesign HR organisational incentives			Transaction cost approach
	Manuf. Distr.	Distribution channel redesign	Information Technology support	Product teams	Logistic partnership (with logistic services providers)
		Facilities location (warehouses, etc.)	Interplant planning and logistical integration (EDI)		Trust/Power/Commitment
		Transportation routes rationalisation	Communication processes		Outsourcing/subcontracting
Chain	Suppl. — Manuf. — Distr.	Quick Response, ECR, etc.	Industrial dynamic approach	Supply chain councils	Scenarios good for supply chain management
		Industrial dynamic approach	Information Technology support		Opportunism/Trust/Power/commitment
		Reverse supply chain management	Structured systems analysis and design method		Positioning in the chain
		Total cost of ownership	Modelling the information flow		Influence of product technology on supply chain relationships
		Value system analysis	Communication processes		
Network	Up stream	Supply network sourcing	Information Technology support	Suppliers meetings	Partnership sourcing
		Transportation routes rationalisation	Supply network communication processes		Lean supply
		Supply network structure	Interplant planning and logistical integration (EDI)		Network sourcing
		Redesign HR organisational incentives			Supply base integration
					Trust/Power/Commitment
	Down stream	Transportation routes rationalisation	Information Technology support		Logistic partnership (with logistic services providers)
		Distribution channel redesign	Supply network communication processes		Trust/Power/Commitment/Opportunism
		Facilities location (warehouses, etc.)	Interplant planning and logistical integration (EDI)		Outsourcing/subcontracting
		Design for supply chain management			
	Whole	Business network redesign approach	Information Technology support		Value system analysis
		Value system analysis	Business network redesign approach		Supply network partnership
		Design for supply chain management	Supply network communication processes		Trust/Power/Commitment/Opportunism
		Industrial dynamic approach			

us to classify literature also on the basis of processes and performance. In this paper our focus is not on applying the content analysis to the literature, rather we are concerned here with introducing and explaining the analytical matrix to assist in directing and locating future research.

5.4. Explanation of the matrix

The first element of exchange classified is *assets*. With respect to material assets, the literature is very rich in studies on inventory and transportation management, in part because these are the seminal subjects of logistics, but probably also because cost and delivery time pressures require that attention has to be paid to managing stocks and transportation modes. These subjects summarise both the static dimension of supply chain management (where to position inventories along the supply chain, in which physical form, how much to stock at each point, how many tiers or warehouses to use, to eliminate local inventory stocking points and to centralise inventories, to relocate consolidation/de-consolidation points, to add regional warehouses or to use warehouses for specific customers, etc.) as well as the dynamic ones (which form of shipment to use, whether to consolidate transportation routes and logistics service providers, to use faster modes of transportation like air freight, express delivery, etc.). On the other hand, few works consider technological and financial assets at a level of analysis wider than dyadic level (but see Miles and Snow, 1984). For instance, few companies include the accounts department as an integral part of the supply chain, while keeping control of the cash situation within the supply chain can all help to ensure that all the companies in it stay successful. As far as the human resource asset is concerned, an important issue is the request for redesigning organisational incentives systems (Lee and Billington, 1992).

The second element of exchange considered is *information*, both in the form of information flows that permit quick inter-organisation payments between supply chain members, and in the form of information accumulated, coded, and stored in firm database structures. A huge literature does exist concerning developments in information technology that have provided new opportunities through electronic commerce, where transactions are completed through a variety of electronic media, including electronic data interchange (EDI), electronic fund transfer (EFT), bar codes, point of sale systems (POS), fax, automated voice mail, CD-ROM catalogues, and a variety of others (Croom, 1999). These issues are dealt with not only at a dyadic level: information technologies are supply chain "enablers" in that they can help managers in developing information systems not visualising information as a set of repetitive transaction between entities such as buyers and suppliers, or distributors and retailers. Rather they should help them in developing ideal systems spanning all functions and organisations throughout the entire supply chain (Handfield and Nichols, 1999). A whole interplant planning and logistical integration throughout the supply chain requires centralised co-ordination of key data (order forecasts, inventory status at all sites, backlogs, production plans, supplier delivery schedule, and pipeline inventory) from the different entities, and permits to minimise inventories and to respond to fluctuation in demand in a timely and effective manner. Moreover, if information is available at any party in the chain, alignment problems can be effectively faced. These problems arise, for example, when different sites in the supply chain have operational goals that, if met, result in inefficiencies for the overall chain, or inadequate definition of customer service and non-linked information systems. On the other hand, not all organisations are available to share information, because they perceive information disclosure as a loss of power. This behaviour often determines a distortion of information flow through the supply chain. Some authors (Berry et al., 1994) have observed the ways in which information can become distorted as it is interpreted, processed and passed up and down supply chains (e.g. industrial dynamics literature). While this analysis of literature has highlighted a lot of contributions in this field at both the dyadic and chain level, there is a lower degree of coverage at the network level.

While the two prior elements (assets and information) are both relatively well understood and widely considered by literature, the third element, *knowledge* necessary for supply chain management is not so clearly or consistently presented. Handfield and Nichols (1999) cite time-base capabilities as a fundamental knowledge necessary for supply chain management. Another important subject of research about knowledge for supply chain management is the analysis of the links between individual competence, organisational competence, and network competence. While a very rich literature does exists on the links between organisational competence and corporate strategy, we have found only one work that highlights the links between organisational competence and individual competence (Knight, 1998), and none relating to the links between individual, organisational and competence required for good supply chain management. The links between the competence of individuals and organisation performance and between the competence of organisations and network performance is an area of importance (Cox, 1995), but one that is not particularly well understood.

Finally, the *relationships* between the actors in the network are perhaps the most important element of the exchange considered. Without a foundation of effective supply chain organisational relationships, any effort to manage the flow of information or materials across the supply chain is likely to be unsuccessful (Handfield and

Nichols, 1999). Relationships have been considered by literature both at the level of the market (macro) and at level of the single organisations (micro). From a "macro" point of view the arguments for supply chain management begin with the firm theory of Coase (1937) and the transactional economics work of Williamson (1975), sometimes addressing the inter-organisational relationships concepts of writers such as Van de Ven et al. (1975), which led theorists to identify the concepts of "networks" as opposed to supply chains (Lamming, 1996). In this perspective supply chain management is viewed as an alternative to different types of relationships such as integrated hierarchy and pure market. Ellram (1991) observed that vertical integration could be viewed as an alternative to supply chain management, in that it attempts to manage control channel efficiency through ownership. On the contrary, obligational contracting can be viewed as one form of supply chain management, in that attempts to link parts of the channel through formal agreement. In her opinion, situations where supply chain management techniques are likely to be most appropriate are short-term contract, long-term contract, and joint venture and equity/interest contract.

On the other hand, from the 'micro' perspective, an increasing number of organisations are finding it profitable to adopt strategies that require the development of closer 'partnership' relationships with their major suppliers. This is leading to an attitudinal shift in behaviour towards suppliers that Lamming (1993) defined as lean supply. Other important variables influencing relationships between the actors in the network are:

- The sourcing strategy (sole sourcing, single sourcing, dual sourcing, multi-sourcing, partnering sourcing, etc.).
- The attitude and commitment to collaborative improvement programmes.
- The positioning of the focal firm within the total network.
- The extent of dependence on the network measured as the proportion of a supplier's business which is dedicated to the supply network in question (the relative importance of the customer to the supplier's order book and second the relative importance of the supplier's supplies to the customer's purchased material).
  - The longevity of the relationships (the past behaviour, opportunism and the trust in suppliers).
  - The technological or process links (the supplier holds or owns the tools and dies needed to make his customer's product, existence of electronic links, etc).
  - The existence of legal ties (contracts, shared patents, etc.).
  - The degree of power and influence of each party.
  - The length and complexity of the chain: the greater the distance (in number of stages) from the end-customer, the less an organisation will of its own accord perceive itself as ultimately dependent upon end-user demand.

6. Methodology-oriented criterion

In the move towards developing theory in supply chain management we have set about establishing a framework for literature analysis that categorises according to two epistemological dimensions — from theoretical to empirical, and prescriptive to descriptive. These dimensions are not particularly radical or novel, representing the form of literature analysis with which many researchers are familiar (Gill and Johnson, 1991). The first distinction is made between theoretical works which set out to provide explanations of cause and effect, define underlying laws, or propose analytical concepts and empirical work which focuses on reporting practice. The second distinction we make is between prescriptive and descriptive work, highlighting the emphasis of the work on either proposing normative models or summarising current practises. The concern here has been to identify the theoretical foundations of supply chain management in terms of its antecedents, but more importantly in terms of the development of an supply chain management theory, to identify and analyse the development of research into the management of supply chains.

In our analysis we found that the literature is dominated by descriptive empirical studies. Little in the way of theoretical work has been developed. However, where theoretical works have been identified, they are largely concerned with the dynamics of inventory systems (materials flows and stocks). In Fig. 1 we provide an overview of our original classification returns (in percentage terms) within each of the four quadrants.

7. Conclusion — implications for the development of supply chain management theory

One of the most significant findings from our literature analysis has been the relative lack of theoretical work in

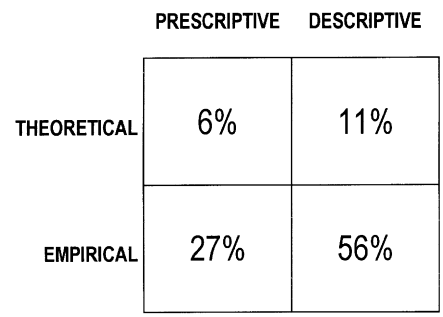

Fig. 1. Framework for classifying literature according to the Methodology oriented criterion.

the field when compared to empirical based studies. Our concern with the finding that the literature is primarily empirical-descriptive is that any development of a cognate supply chain management discipline requires more rigorous and structured research in the topic. We would argue that theoretical development is critical to the establishment and development of supply chain management study. However, it is not our contention that empirical studies are valueless. Rather, we feel that the inductive–deductive dichotomy is best addressed through the constant reflection of empirical against theoretical studies. However, what is of concern is the lack of a significant body of a priori theory — a point Andrew Cox argues forcibly in his 1997 treatise. Furthermore, our content analysis of the supply chain literature highlights the contrasting themes and antecedents of the field. In some ways we feel this offers an even greater challenge for the development of supply chain management research. As an illustration of this we recently conducted a survey of published research into supply chain management currently conducted at the University of Warwick — a leading UK research university. By applying our content-oriented matrix to the analysis of publications within all the departments of the University, we found that research covering at least one of the cells in the matrix could be found in science, social science, engineering and a number of humanities departments.

We recognise that developments in our understanding of supply chain management require multi-disciplinarity in order to address the contrasting antecedents. Certainly the importance of transaction cost economics and inter-organisational theory has been recognised by a number of researchers (Lamming, 1993; Harland, 1994; Croom, 1996). In addition, our survey at the University of Warwick identified a number of key antecedent disciplines currently evidenced in supply chain research — included amongst these being systems thinking, information theory, industrial dynamics, production economics, social theory, game theory and production engineering. If one begins to include some of the hybrid field such as marketing or strategic management, then it is apparent that the subject is being explored from a multiplicity of perspectives.

This paper has thus set out to provide a taxonomy or topology of the field of supply chain management as an aid to both the classification of research in the field, and as a means of providing a framework for the identification of the key content of the subject. Of significance we feel is the need for researchers to be aware of complementary studies outside of their own 'normal' domain of expertise. Thus, as Dietrich (1994) pointed out, future developments in theory concerned with business to business phenomena may require a more cosmopolitan approach, incorporating a combination of contrasting social and technical disciplines.

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