SYSTEMS THINKING, RELATIONSHIP MANAGEMENT AND SUPPLY CHAINS

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ABSTRACT

Managed supply chain systems typically begin from business-to-business relationships which over time expand to encompass more and more parts of the chain. Harland (1996) first classified supply chains in terms of four sequential levels of management and integration: a firm's internal integration (level 1); buyer - supplier integration (level 2); through - chain integration (level 3); and network integration (level 4). Globalization has spawned cross hemisphere and cross country supply chains that operate in a far more dynamic and influential external environment than ever before. Evidence is accumulating that this external environment significantly impacts on supply chain performance at all four levels of integration, but in different ways at each level. It impacts least at level 1, and most at level 4. This paper shows that in level 2 and 3 China-Australia agrifood supply chains, the influence on whole-of-chain performance of the external environment of the country itself is more powerful than the influence of within-chain relationships. This finding suggests that firms engaging in relationship management at the chain level need to take a more holistic approach. Managing within-chain relationships is necessary but insufficient unless it is done in the context of the chain and its external environment as a dynamic system.

Key words: system performance; supply chain management; external environment; agrifood chains; relationship management.

INTRODUCTION

A supply chain is described as the chain linking each element of the manufacturing and supply process from raw materials through to the end user, encompassing several organizational boundaries (Scott and Westbrook, 1991; New and Payne 1995). Supply chain management (SCM) is a term that has been used in the literature in a number of ways. The original definition of SCM referred to logistics and transportation, focusing on the efficient physical distribution of final products from producers to the end consumers (Lamming, 1996; Christopher et al., 1998; Tan, 2001). SCM has also been described from the purchasing and supply perspective (e.g., Farmer, 1997; Morgan and Monczka, 1996; Lamming and Hampson, 1996, Tan, 2001). This perspective, synonymous with supplier based integration, emphasized purchasing and materials management as a strategic business process rather than a narrow specialized supporting function to overall business strategy (Reck et al., 1992). Most recently, SCM has been defined in terms of a broader system that integrates technical, economic, marketing, informational and governance perspectives, but with an emphasis on the central importance of relationships among firms in the supply chain (Corsten and Felde 2004; Scannell et al., 2000; Ellram, 1995). The rationale behind this definition is that cooperation and mutual interest can lead to performance improvement at the system level (Vaaland and Heide, 2007). Overall SCM may be seen as a management philosophy that extends traditional internal activities by embracing an inter-enterprise scope, bringing trading partners together with the common goal of optimization and efficiency (Harwick, 1997).

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Systems theory was initially used to optimize manufacturing operations in the early 1950s and it lead to further uses of systems methodologies to build and reorganise internal business processes (Day et al., 2000). The main focus was to optimize business process and performance through the co-ordination of a business' internal functions (Forrester, 1961). Issues beyond the firm, such as relationships with other firms upstream or downstream in the supply chain were not addressed.

Child (1969) argued that changes in global markets from being production orientated to being consumer oriented forced manufacturers to adopt systems thinking if they aimed to enhance their ability to delivery products that can meet changing market requirements. This meant that when redesigning and planning, manufacturers had to attempt to accommodate external environmental needs such as product markets, factor markets, technical knowledge and social and political factors. Christpher (1992) suggested that such a system could be viewed as a network of companies connected by a need for co-ordination. Optimizing such a system meant that manufacturers had to consider their customers' needs and they had to design their distribution strategically (Subramanian, 2001; Lertpattarapong, 2002).

Systems modelling of supply chains were first explored by Forrester (1961), who applied system dynamics modelling to four chain components: a factory, a warehouse, a distributor and a retailer. Material flows from the factory via the factory warehouse, to the distributor, retailer and customer. Information (orders) flows in the opposite direction. Forrester suggested that the success of industrial companies depends on the interaction between the flows of information, materials, orders, money, manpower, and capital equipment. Since then, many applications of system dynamics modelling to SCM have been published, addressing issues such as inventory management, policy development, time compression, demand amplification, supply chain design and integration, and international supply chain management (Angerhofer and Angelides, 2000).

System dynamics modelling can be very useful in describing and modelling the physical flow of materials, inventory data and demand patterns if data required for generating model parameters is available, accessible when needed and reliable. The required data is generally quantitative due to the relatively quantifiable nature of the dynamics of variability in order patterns or location significance of work-in-progress (Day et al., 2000). This requirement for quantitative data, to a large degree, limited the application of system dynamics modelling in through-chain management.

There always exits an "uncertainty area" between firms in information sharing, which makes it difficult for a firm to obtain full sets of reliable, accurate and timely information. For a firm to optimize its activities in a wider context by coordinating with other firms so as to make the whole chain more competitive, sufficient information or data is need for parameter estimation. Without reliable, accurate and timely information, the application of system dynamics modelling across the chain becomes difficult (Sterman, 1989).

Research evidences showed that the 'uncertainty area' between firms in a chain was influenced by relationship formation, development and occasional breakdown (Sako,1992) . Other evidence has shown that the improvement of relationships between firms can have a significant impact on information transparency, the

reduction of uncertainty and the subsequent quality of decision making (Sterman, 1989) as illustrated in Fig 1.

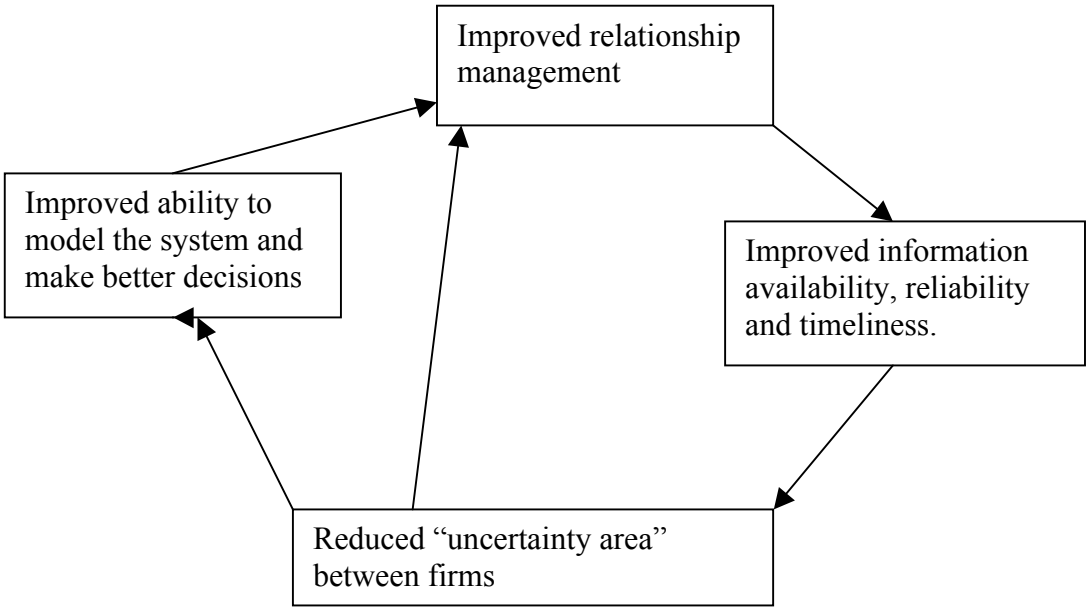

Fig 1: Relationship between firms' relationship, information transparency, uncertain area and firms' decision-making.

In spite of the systems perspectives described above, much of the literature on relationship management has focused on trust, commitment, adaptation, shared values, communication, opportunistic behaviour, satisfaction and cooperation (Anderson and Narus,1990; Anderson and Weitz ,1992; Athaide *et al.*, 1996; Doney and Cannon, 1997; Frazier *et al.,*1989; Ganesan, 1994; Gundlach *et al.* 1995; Morris *et al*. 1998 and Morgan and Hunt, 1994). These are within-chain perspectives. Given evidence indicating that chain performance was also influenced by its environmental context, this research uses systems thinking to examine relationship management among businesses in supply chains. Using data from a study of China-Australia agrifood supply chains, it challenges the view that within-chain relationship management is central to the performance of the supply cahin as a system.

FOUR LEVELS OF RELATIONSHIP MANAGEMENT IN SUPPLY CHAIN

Supply chain integration has been shown to involve four sequential levels (Harland et al.1999, Harland, 1996; Tan, 2001).

1. First, the internal supply chain integration involved in the flow of materials and information;
2. Secondly, relationships with a firm's immediate suppliers and customers in the chain;
3. Thirdly, extended relationships with firms' suppliers' suppliers and customers' customers; and;
4. Fourthly, networks of inter-connected businesses.

It may be concluded, therefore, that relationships in a supply chain can be also regarded to have four sequential levels: a firm's internal relationships between its different functional areas; dyadic relationships between immediate business partners;

relationships with firms beyond immediate business partners; and relationships within the network of inter-connected business (as shown in Fig 2).

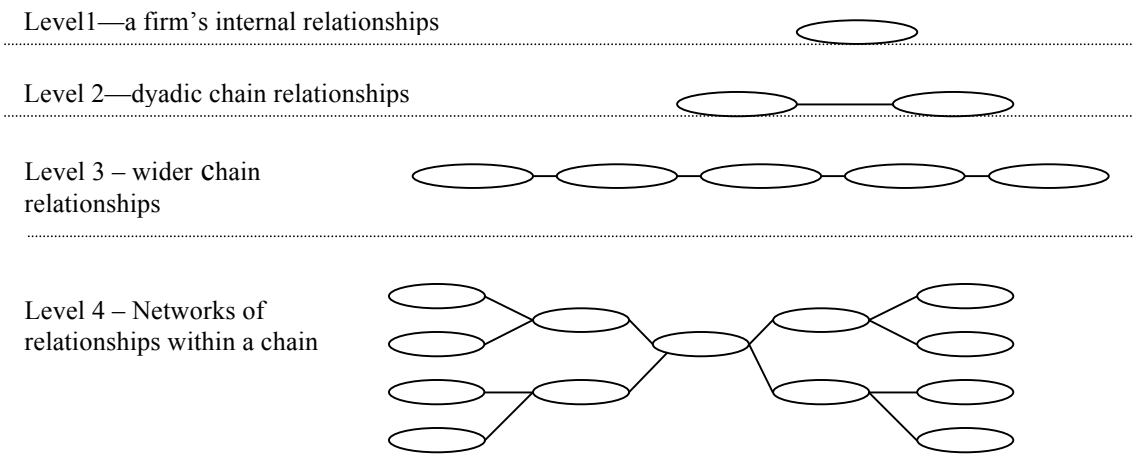

Fig 2: Four levels of relationships in supply chains (based on Harland (1996))

There is a significant body of evidences that relationship management at levels 1 and 2 can enhance individual firms' performance (Kannan and Tan, 2006) but there is scant research on how relationship management within firms or with their immediate business partners can affect whole chain or chain network performance. Harland (1996) proposed that a systems approach should be taken to examine how one level of chain performance can affect the others. His research showed that dyadic relationships had little impact on the performance of the whole chain and suggested more research was needed to confirm his findings, but since then, little has been reported. In keeping with Harland's recommendation, we compared firms' relationships with their immediate partners as well as their relationships with suppliers' suppliers and customers' customers, between Chinese and Australian agrifood supply chains. The research addressed two issues: to what degree a firm's relationship with its immediate business partners can contribute whole chain relationships; and to what degree the effect of the country itself can contribute whole chain relationships.

Results initially showed significant differences between China and Australia in firms' relationships with their immediate business partners. Chinese firms had weaker relationships with their partners than did Australian firms. In examining whole chain relationships, those of the Chinese were again weaker than in Australian chains. Given that the two countries have totally different cultural, social and distribution systems, the research further examined whether the poor whole chain relationships in China were due to the country itself or the weak relationships of firms with their immediate business partners.

Findings indicated that poor whole chain relationships, to a large degree, were caused by the country itself, although the relationships of firms with their immediate business partners did have some influence. In other words, good dyadic relationships may not translate into good whole chain relationships because they are mitigated by the business environment in which the chain is operating.

Given evidence that relationship management within a firm (level one) and between firms (level two) can significantly impact on a firm's performance (Kannan and Tan, 2006) and the findings of our research that relationship management had less impact on whole chain performance than the external environment of the chain, we postulated that the impact of a firm's relationship management on supply chain performance could diminish, and the impact of the external environment become greater, the higher the level of integration, as shown in Fig 3. In other words, the greater the number of firms in the chain involved in cooperation and integration, the higher the impact of the external environment on chain performance, because of its mitigating impact on relationship management between firms. Using relationship management to coordinate internal operations or operations between adjacent firms is much easier than coordinating a chain or chain network that involves many firms operating under different business conditions.

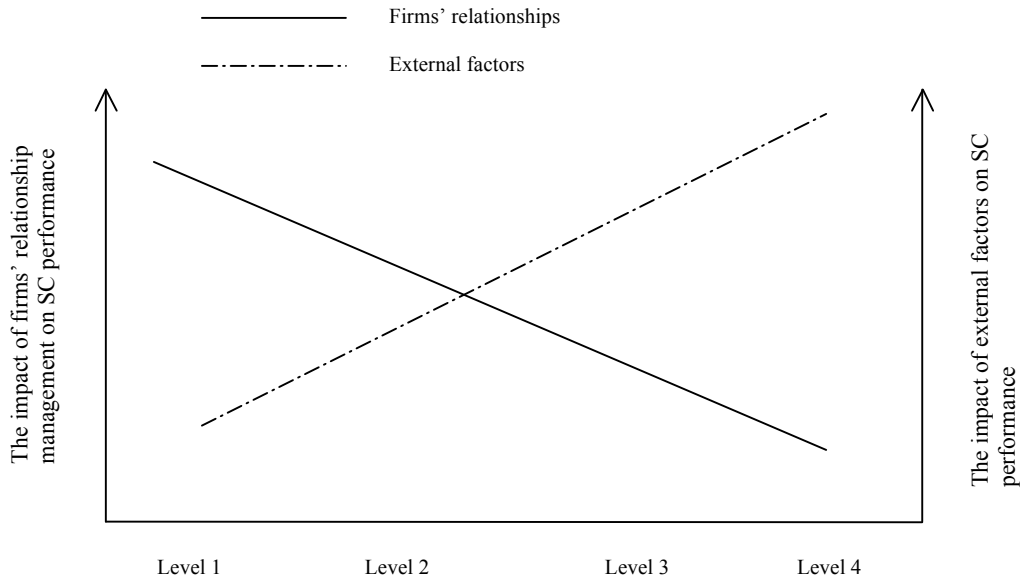

Fig 3: The impact of relationship management and external environment on SC performance at different levels

When managing chain relationships at the higher levels of integration, uncertainty and risk can increase significantly because relationship management involves more than a firm's immediate partners and because of the impact of the external environment. External factors are less easily controlled by individual firms so chain stability at the high levels of integration could be affected negatively (as shown in Fig 4). We argue that systems thinking is needed in firms' relationship management at higher levels of chain integration.

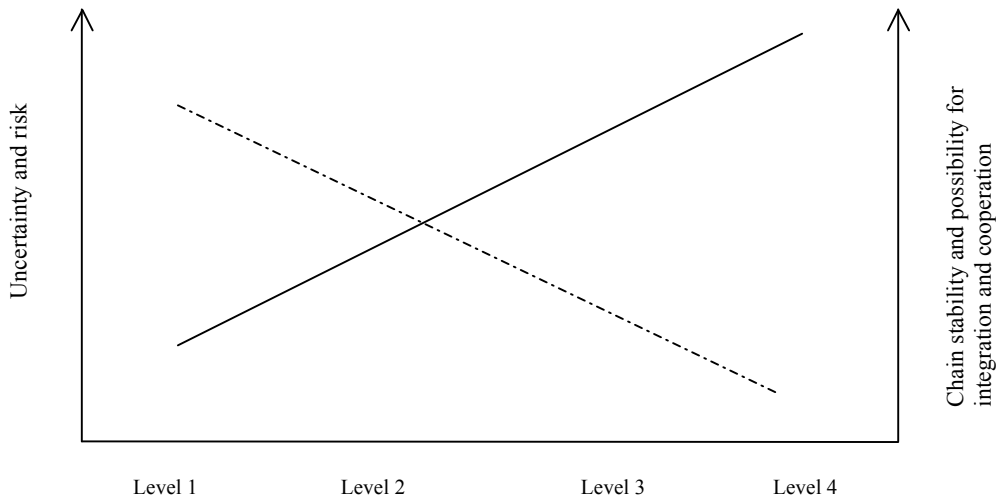

Fig 4: Uncertainty, risk, stability and possibility of integration at different chain levels

RELATIONSHIP MANAGEMENT: A SUBSYSTEM IN A COMPLEX SYSTEM

Relationship management can be seen as a subsystem of supply chain management which takes place in a complex social, political and economic setting, as shown in fig 4. Cross- border supply chains face even more complex settings, where relationship management on its own may not achieve the desired levels of chain performance. Seeing the chain as a system in a particular setting is the precursor for managing successfully in such an environment.

There is evidence that social, cultural, political and economic systems can impact on relationship management in the supply chain. In research on cross-border trade with developing countries, Roekel et al., (2002) revealed that social and cultural differences between the chain partners, as well as hidden agendas, can lead to a slow down of chain performance, even when trust, commitment and transparency among the chain partners are present. Other studies have shown that regional culture can negatively affect supply chain practices and performance (Money *et al.*, 1998; Park and Krishnan, 2001; Zhang and Goffin, 2001).

In the case of China, research has shown that its massive size, inefficient information systems, poor logistics and unreliable distribution systems make it difficult to implement supply chain management principles (Longo, 2004; Bin, 2002; Li and Fung, 2006). A lack of coherent business laws and the presence of strong government control over limited resources have also been reported as affecting relationship management within supply chains (Nee, 1992; Xin and Pearce, 1996). Arias (1998) even argued that the concept of business relationships in China can be quite different to western countries. Chinese business relationships are rooted in tradition and culture, and have little to do with service and the management of the service delivery process, a very important component of relationship marketing (Grönroos, 1996).

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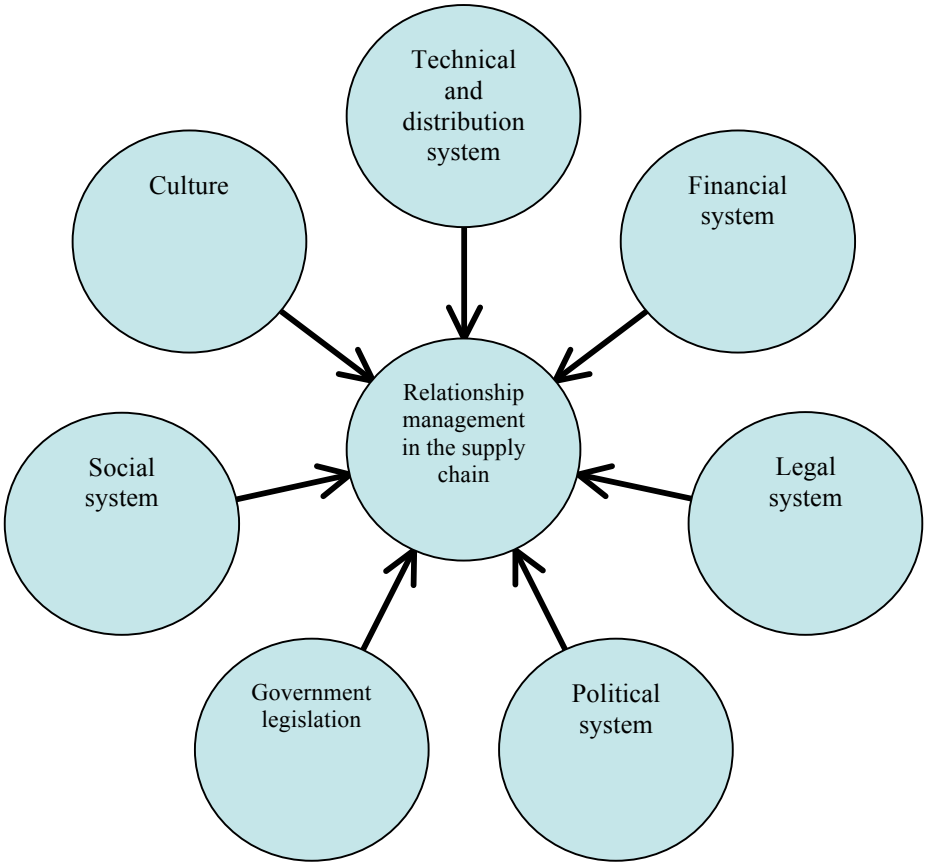

The concept of relationship management in supply chains may benefit from a more systems perspective. While many studies have focused on the relationships themselves, little attention has been paid to the interactions between these relationships and the external environment of the system within which they operate.

When performance is measured on the basis of individual firms' rather than by whole chain performance or end user satisfaction, it is very difficult for firms to adopt a systems perspective. Hald (2007) pointed out several reasons for the difficulty of adoption of system thinking in a firm, its employees, planners and boundary spanning mangers:

- external management and control are more often considered less important than management and control of internal activities and processes;
- it is natural to focus on those activities and processes that are visible and inside management reach;
- it is also natural to focus on those activities that are controlled100% by the company. Managers are most often interested in reducing complexity, and focusing internally will reduce complexity considerably;
- boundary spanning managers have less incentive to adopt a wider SCM view in their performance management thinking if their performance is measured by internal activities that reduce purchasing spend and production cost, or volume of sales.

During the past decade, competitive forces are putting firms under pressure to adopt supply chain management strategies to improve quality, delivery performance, and

responsiveness while simultaneously reducing costs (Kannan and Tan, 2006). Competition between firms in a chain has given away to the competition between chains. The quip that "the best supply chain wins" is a biting reality for companies that do not adapt (Shub and Stonebraker, 2009). Firms seeking to integrate at the whole chain level need to understand the complexity of the system and the uncertainties arising from its external environment. Cross-border integration multiplies this complexity considerably. It is particularly true for managing global chain. Skjott-Larsen *et al.,* (2007) proposed that using system thinking was essential in measuring the performance of global chain. Several principles in system thinking (Maani and Cavana, 2000) can be used to help firms understand how to manage their relationships with their business partners under such complex and uncertain conditions:

- The structure of a system determines its behaviour and performance
- There is more to reality that what can be seen. The intangibles are powerful indicators of performance
- Reality is not either/or. There are often multiple possibilities
- Our assumptions, values, beliefs and worldviews confound understanding of problems and create unintended consequences of our decisions

Systems thinking could reduce ambiguity and bring hidden assumptions to the surface. It could also help to avoid miscommunication in complex and dynamic circumstances. For firms seeking to enhance their competitiveness through improving whole of chain performance by relationship management with their suppliers, customers, and other chain members, systems thinking could transform the known benefits of relationship management at low levels of supply chain integration to benefits at the higher levels.

CONCLUSION

Although relationship management in supply chains has four apparently sequential levels of integration, the relationships between the four levels is complex. Relationship strength at one level of the chain may not be reflected at the next level due to the external environment in which the chain is operating. The impact of external factors could dominate chain performance at the whole chain or network level. In these circumstances, relationship management may be a less effective way of improving chain performance. Given the complexity and interdependent nature of supply chains at higher levels of integration, systems thinking could offer managers a perspective capable of encompassing relationships and the external environment. This study reports one case study and it leaves many unanswered questions. More research across a range of settings is needed to establish the dynamics of within chain relationships and the influence of the external environment.

REFERENCE

Anderson, E. and Weitz, B. (1992). The use of pledges to build and sustain commitment in distribution channels, *Journal of Marketing Research*, 29, Feb, pp. 18-34.

Anderson, J. and Narus, J. (1990). A model of distributor firm and manufacturing firm working relationships, *Journal of Marketing*, 54, Jan, pp. 42-58.

B. J. Angerhofer, B.J and M.C. Angelides (2000). System Dynamics Modelling in Supply Chain Management: research Review, J. A. Joines, R. R. Barton, K.

Kang, and P. A. Fishwick, eds in *Proceedings of the 2000 Winter Simulation Conference*

Arias José Tomás Gómez (1998). A relationship marketing approach to guanxi, *European Journal of Marketing,* 32(1/2): 145-156.

Athaide, G., Meyers, P. and Wilemon, D. (1996). Seller-buyer interactions during the commercialisation of technological process innovations, *Journal of Production Innovation Management,* 13(5): 405-421.

Bin, J. (2002). How international firms are coping with supply chain issues in China, *Supply Chain Management, An international Journal,* 7(4):184-188.Child, J (1969), *British Management Thought*, Allen and Unwin, London.Christopher, M (1992). *Logistics and Supply Chain Management*, Financial Times/Pitman Publishing, London.

Christopher, M., Magrill, L., Wills, G.1998). Educational development for marketing logistics, *International Journal of Physical Distribution and Logistics Management* 28 (4), 234-241.

Corsten, D. and Felde, J. (2004). Exploring the performance effects of key supplier collaboration: an empirical investigation into Swiss buyer-supplier relationships, *International Journal of Physical Distribution and Logistics Management,* 35(6): 445-61.

Rigby, C., Day, R.C.;, M., Forrester, P and Burnett, J. (2000). Agile supply: rethinking systems thinking, *systems practice International Journal of Agile Management Systems.,* 2(3):178-186.

Doney, P. and Cannon, J. (1997). An examination of the nature of trust in buyer-seller relationships, *Journal of Marketing*, 61 (April):35-51.

Ellram, L.M. (1995). Partnering pitfalls and success factors, *International Journal of Purchasing and Materials Management,* 31(2): 36-44.

Farmer, D., (1997). Purchasing myopia revisited, *European Journal of Purchasing and Supply Management* 3 (1): 1-8.

Forrester, J. W (1961), *Industrial Dynamics*. Portland (OR):Productivity Press.

Frazier, G.., Gill, J. and Kale, S. (1989). Dealer dependence levels and reciprocal actions in a channel of distribution in a developing country, *Journal of Marketing*, 53(January):50-69.

Ganesan, S. (1994). Determinants of long-term orientation in buyer-seller relationships, *Journal of Marketing*, 58(April):1-19.

Grönroos, C. (1996). Relationship marketing: strategic and tactical implications, *Management Decision*, 34(3):5-14.

Gundlach, G., Achrol, R. and Mentzer, J. (1995). The structure of commitment in exchange, *Journal of Marketing*, 59(January): 78-92.

Hald, K.S. (2007). *Inter-organizational Performance Measurement and Management in Action – an Ethnography on the Construction of Management, Identity and Relationships,* PhD School of Technologies of Managing, PhD Series 6.2007, Copenhagen Business School.

Harland, C.M. (1996). Supply chain management: relationships, chains, and networks", *British Journal of Management*, 7(1): S63-S80.

Harland, C.M., Lamming, R.C. and Cousins, P.D. (1999). Developing the concept of supply strategy, *International Journal of Operations and Production Management*, 19(7): 650-673.

Harwick, T., (1997), Optimal decision-making for the supply chain, *APICS-The Performance Advantage* 7 (1), 42--44.

K. ambiz Maani and B. Cavana (2000). *Systems Thinking and Modeling—Understanding Change and Complexity*, Prentice Hall.

Kannan, V.R and Tan, K.C (2006). Buyer-supplier relationships: The impact of supplier selection and buyer-supplier engagement on relationship and firm performance, *International Journal of Physical Distribution & Logistics Management,* 36(10): 755-775.

Lamming, R., (1996). Squaring lean supply with supply chain management, *International Journal of Operations and Production Management* 16 (2): 183-196.

Lamming, R., Hampson, J., (1996). The environment as a supply chain management, *British Journal of Management,* 7 (Special Issue), S45-S62.

Lertpattarapong, C (2002). *Applying system dynamics approach to the supply chain management problem*, Thesis (S.M.) Massachusetts Institute of Technology.

Li and Fung (2006). *The wholesale Markets in China*, Li & Fung Research Centre. www.lifunggroup.com.

Longo, D. (2004). In China, local and multinational retailers share similar problems, *Progressive Grocer*; Dec 1, 2004; 83, 18; pp 8, ABI/INFORM Trade & Industry.

Money, R.B., Gilly, M.C., Graham, J.L. (1998). Explorations of national culture and word-of-mouth referral behaviour in the purchase of industrial services in the United States and Japan, *Journal of Marketing*, 62:76-87.

Morgan, J., Monczka, R.M., (1996). Supplier integration: a new level of supply chain management, *Purchasing* 120 (1), 110-113.

Morgan, R. and Hunt, S. (1994). The Commitment-Trust theory of relationship marketing, *Journal of Marketing*, 58: 20-38.

Morris, M., Brunyee, J. and Page, M. (1998). Relationship marketing in practice: Myths and reality, *Industrial Marketing Management*. 27(5):359-371.

Nee, V. (1992). Organizational dynamics of marketing transition: hybrid firms, property rights, and mixed economy in China, *Administrative Science Quarterly*, 31(March): 1-27.

New, S.J., Payne, P., (1995). Research frameworks in logistics: three models, seven dinners and a survey, *International Journal of Physical Distribution and Logistics Management* 25 (10), 60--77.

Park, D., Krishnan, H.A. (2001). Understanding supplier selection practices: differences between U.S. and Korean executives, *Thunderbird International Business Review*, 43(2): 243-55.

Reck, R.F., Landeros, R., Lyth, D.M., (1992). Integrated supply management: the basis for professional development, *International Journal of Purchasing and Materials Management* 28 (3), 12--18.

Roekel, V.J., Sabine Willems, Dave M. Boselie (2002). To Stimulate Cross-Border Trade in Developing Countries and Emerging Economies, *World Bank Paper Cross-Border Agri Supply Chain Management,* 's-Hertogenbosch, 19 August 2002.

Sako, M (1992). *Prices, Quality and Trust: Inter-Firm Relations in Britain and Japan*, Cambridge University Press, Cambridge.

Scannell, T.V., Vickery, S.K. and Dro¨ge, C.L. (2000), "Upstream supply chain management and competitive performance the automotive supply industry", Journal of Business Logistics, Vol. 21 No. 1, pp. 23-48.

Scott, C., Westbrook, R., (1991). New strategic tools for supply chain management, *International Journal of Physical Distribution and Logistics* 21 (1), 23-33.

Shub, A.N. and P.W. Stonebraker (2009). The human impact on supply chains: evaluating the importance of "soft" areas on integration and performance, *Supply Chain Management: An International Journal Volume*, 14 (1): 31 – 40.

Sterman, J. D. (1989). Modeling Managerial Behavior: Misperceptions of Feedback in a Dynamic Decision Making Experiment, *Management Science* 35 (3):321-339.

Subramanian, K (2001). System approach to supply chain management, *Manufacturing Engineering,* May.

Tage Skjott-Larsen, Philip B. Schary, Juliana, R.M. (2007). *Managing the global supply chain*, Liber Copenhagen Business school Press.

Tan, K.C (2001). A framework of supply chain management literature, *European Journal of Purchasing & Supply Management* 7: 39-48.

Vaaland, T. I and Heide, M (2007). Can the SME survive the supply chain challenges?, *An international Journal of Supply Chain Management*, 12(1):20-31.

Xin, K R and Pearce, J L (1996). Guanxi: Connections as Substitutes for Formal Institutional Support, *Academy of Management Journal*, 39(6):1641-1658.

Zhang, L., Goffin, K. (2001). Managing the transition – supplier management in international joint ventures in China, *International Journal of Physical Distribution & Logistics Management*, 31(2): 74-95.