



2009-01-01

# Putting SCM Theory into Practice: Towards a Re-engineering Roadmap

Edward Sweeney

Dublin Institute of Technology, [edward.sweeney@dit.ie](mailto:edward.sweeney@dit.ie)

Follow this and additional works at: <http://arrow.dit.ie/nitlbc>

 Part of the [Business Administration, Management, and Operations Commons](#)

## Recommended Citation

Sweeney, E.: Putting SCM Theory into Practice: Towards a Re-engineering Roadmap. In *Supply Chain Management and Logistics in a Volatile Global Environment*, Dublin: Blackhall Publishers, 2009, Chap. 8, pp. 99-111

This Book Chapter is brought to you for free and open access by the National Institute for Transport and Logistics at ARROW@DIT. It has been accepted for inclusion in Books/Book chapters by an authorized administrator of ARROW@DIT. For more information, please contact [yvonne.desmond@dit.ie](mailto:yvonne.desmond@dit.ie), [arrow.admin@dit.ie](mailto:arrow.admin@dit.ie), [brian.widdis@dit.ie](mailto:brian.widdis@dit.ie).



This work is licensed under a [Creative Commons Attribution-NonCommercial-Share Alike 3.0 License](#)



## 8

## Putting SCM Theory into Practice: Towards a Re-Engineering Roadmap

EDWARD SWEENEY

### INTRODUCTION

The changing business environment has sharpened the focus on the need for robust approaches to supply chain improvement. This is particularly the case in Ireland, which has the natural disadvantage of a location peripheral to significant markets and sources of raw materials, which results in relatively high transport and distribution costs. This chapter outlines some of the key characteristics of supply chain management (SCM) excellence, based on the author's experience and on documented evidence in the literature. It goes on to review current levels of diffusion of SCM based on a large survey of firms in Ireland. The empirical results suggest that there is a need for more widespread adoption of SCM among Irish firms. This is particularly the case in relation to the four main elements of SCM excellence reported on in this chapter. The design of supply chain solutions is a highly skilled, knowledge-intensive and complex activity, reflected in a shift from 'box moving' to the design and implementation of customised supply chain solutions. Education and training needs to be addressed by stimulating the development of industry-relevant logistics and SCM resources and skills. Based on the performance of firms in relation to these key characteristics, a number of critical success factors (CSFs) for effective supply chain re-engineering are identified and the key elements of a roadmap are proposed. Finally, a number of research and managerial conclusions are drawn.

*Supply Chain Management and Logistics in a Volatile Global Environment*

## EXCELLENCE IN SUPPLY CHAIN MANAGEMENT

It is appropriate to refer to the widely cited article by Mentzer et al. (2001), in particular to two constructs proposed by the authors. Firstly, they suggest that many definitions of SCM are trying to define two interdependent but different concepts in one term. The first is referred to as 'supply chain orientation' (SCO) and is defined as 'the recognition by an organisation of the systemic, strategic implications of the tactical activities involved in managing the various flows in a supply chain' (Mentzer et al., 2001: 11). However, SCM requires that SCO exists in several linked companies across a supply chain. In other words, SCO is a prerequisite for SCM. Secondly, the definition of SCM proposed by the authors based on their analysis of the literature is:

The systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole. (Mentzer et al., 2001: 18)

This definition amalgamates a variety of concepts and philosophies into a single sentence. Its authors claim that their work 'should help practitioners as well as researchers to understand SCM, to give guidance to what SCM is, its prerequisites, and its potential effects on business and supply chain performance' (Mentzer et al., 2001: 19).

It is worth noting that SCM is not new. The term may be relatively new but supply chains have existed for a very long time – in fact they have probably always existed! For example, Forrester's often cited article from the *Harvard Business Review* in 1958 states that:

Management is on the verge of a major breakthrough in understanding how industrial company success depends on the interactions between the flows of information, materials, money, manpower, and capital equipment. The way these five flow systems interlock to amplify one another and to cause change and fluctuation will form the basis for anticipating the effects of decisions, policies, organisational forms, and investment choices. (Forrester, 1958: 37)

His article introduced the demand amplification concept using a computer simulation model. If, as Forrester suggested, management was on 'the verge of a major breakthrough' almost half a century ago, it seems pertinent to raise questions concerning how this breakthrough – mainly in relation to managing relationships between supply chain companies – has impacted on companies in reality. In fact over 40 years after Forrester's article first

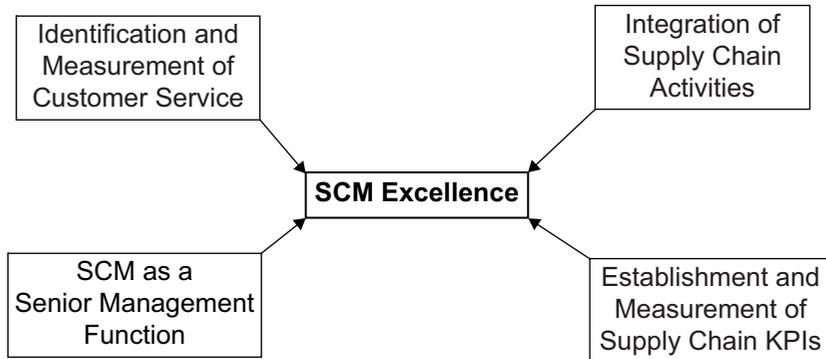
### Putting SCM Theory into Practice: Towards a Re-Engineering Roadmap

appeared, Mentzer et al., in concluding their paper, ask the specific question: 'How prevalent is SCM?' (2001: 20). This is a key question to which ongoing research needs to provide some answers. This chapter does so in the specific context of the adoption of 'World Class' SCM practices by firms in Ireland.

Identifying some of the characteristics in evidence in companies that might be regarded as world class provides a useful starting point for this discussion. 'World Class' in this context means companies that have been successful in tough, competitive international markets over a sustained period of time. By definition, it is impossible to develop an exhaustive list of the characteristics of SCM excellence but the following four elements appear to be of critical importance for most companies in most sectors (see Figure 8.1):

1. Identification and measurement of customer service: understanding customer service requirements in the market sets the specification for supply chain design (see, for example, Korpela et al., 2001).
2. Integration of supply chain activities: many supply chain non-value-adding activities (NVAs) are caused by fragmented supply chain configurations. In this context the author defines an NVA as 'any activity (or resource or asset) that adds cost (or time) to any supply chain process without adding value from a customer perspective' (based on Jones et al., 1997; Goldratt and Cox, 1992; Womack and Jones, 2003; and others).
3. SCM as a senior management function: SCM is becoming regarded more widely as a primarily strategic activity (see, for example, Gattorna et al., 2003).
4. Establishment and measurement of supply chain key performance indicators (KPIs): a robust performance measurement system provides a rational basis for continuous improvement (see, for example, Sweeney, 2007).

Customer service has long been recognised as an integral component of a firm's marketing strategy to increase sales and profits (Lambert, 1992). Furthermore, customer service is becoming a key source of differentiation or an order-winning criterion in many sectors (Christopher, 2005). In many sectors the importance of customer service relative to product quality (now largely an order qualifier) and price (largely determined by the dynamics of supply and demand in the market and subject to downward pressure in many sectors) has increased (Sweeney, 2004). In other words, the role of customer service as an element of the overall marketing mix of organisations has become more important. The key to the role of customer service in SCM lies in: (i) understanding customers' needs and requirements in

*Supply Chain Management and Logistics in a Volatile Global Environment***Figure 8.1: Elements of SCM Excellence**

targeted markets or segments; and then, (ii) meeting (or exceeding) these needs. To support this, the concept of an external and internal audit has been suggested (Sterling and Lambert, 1989). The title of the paper by Korpela et al. (2001) – ‘Customer Service Based Design of the Supply Chain’ – captures this approach very effectively.

From an examination of both the historical evolution and the many available definitions of SCM it is evident that the concept of integration lies at the heart of SCM philosophy (see, for example, Christopher, 1992; Lambert, 2004). Cooper et al. (1997) specifically described SCM as an integrative philosophy. The work of Fawcett and Magnan (2002) identified four levels of integration in practice:

1. Internal cross-functional integration
2. Backward integration with valued first-tier suppliers
3. Forward integration with valued first-tier customers
4. Complete backward and forward integration (“from the supplier’s supplier to the customer’s customer”)

The first of these relates to integration of activities and processes that are carried out within a single organisation. The others describe varying degrees of integration of activities that span the boundaries of organisations, with the last one being viewed as the theoretical ideal. The phrase ‘internal supply chain’ has appeared in the literature (Huin et al., 2002) to describe work aimed at breaking down the barriers between functions within organisations. This shift away from a functional orientation towards a more company-wide focus is in line with the SCO approach of Mentzer et al. (2001) in the sense that SCO at firm level, as manifested in high levels of internal integration, could be regarded as a prerequisite for SCM, as manifested in high levels of external integration. As noted earlier, the theoretical ideal is complete backward and forward integration (“from the supplier’s supplier to the customer’s customer”). The widely cited work of

## Putting SCM Theory into Practice: Towards a Re-Engineering Roadmap

Bowersox et al. (1999) describes a framework of six competencies (the *Supply Chain 2000 Framework*) that led to world-class performance in logistics and SCM. These competencies, all of which are concerned with integration, are grouped into three areas: operational, planning and relational. The work of Mollenkopf and Dapiran (2005) and Carranza et al. (2002) used this framework to assess logistics strategies in Australia/New Zealand and Argentina respectively.

The strategic role of SCM in achieving market differentiation, and the resultant need for senior management commitment to SCM, are widely referred to in the literature (see, for example, Lambert et al., 1998). Min and Mentzer (2004) specifically refer to top management support, including leadership and commitment to change, as an important SCM prerequisite. The strategic role of SCM is a strong theme in the work of Gattorna and his collaborators (see, for example, Gattorna et al., 2003). He argues that empirical evidence is mounting to suggest that if organisations are to achieve sustainable high levels of financial and operating performance, dynamic alignment of four key elements (the competitive environment, company strategy, culture and leadership style) must exist. As pointed out in Chapter 4, alignment in this context includes the development of a leadership style at the executive level to ensure the appropriate subcultures are in place as required.

The need for continuous innovation and improvement in all aspects of a company's supply chain has long been recognised. Standing still means falling behind in today's increasingly competitive marketplaces. Effective performance measurement provides companies with the only rational basis for continuous improvement (Gunasekaran et al., 2004). As world-class companies have experienced, external and internal supply chain performance measurement is the primary mechanism for organisational learning at all levels. Furthermore, *supply chain learning* – based on firm-to-firm exchange of knowledge – is based on leveraging the supply chain as a mechanism to enable learning and competence development (Bessant et al., 2003; Sweeney et al., 2005). A *Learning Organisation* is an organisation that recognises the importance of this type of learning, and which has developed practices that reflect this. Similarly, a *Learning Supply Chain* is a supply chain that takes learning seriously at all levels and bases its learning initiatives on its performance measurement system. The successful supply chains of the future will be those that are agile. A key ingredient of agility is the ability to learn and to respond quickly to changing markets and other requirements. In this context, the organisational learning that effective supply chain performance measurement delivers will become even more important (van Hoek, 1998). Finally, the importance of effective measurement is reflected in one of the six competencies incorporated into

*Supply Chain Management and Logistics in a Volatile Global Environment*

the *Supply Chain 2000 Framework* (Bowersox et al., 1999) – it is referred to as *measurement integration*.

## IRELAND AND SCM

Ireland is a small, open, trade-dependent economy and was one of the fastest growing economies in the developed world between 1995 and 2005. Over this decade, unprecedented economic growth saw the level of Irish real gross domestic product (GDP) almost double in size. Notwithstanding recent economic volatility, the Irish economy has been transformed from being agrarian and traditional manufacturing based to one increasingly based on the hi-tech and internationally traded services sectors.

In the context of supply chain management (SCM), the openness of the Irish economy is reflected both in the international mobility of its labour and capital and in high levels of foreign direct investment (FDI). However, in relation to manufacturing there is evidence that significant amounts of (mainly labour intensive) activity has in recent years migrated eastwards to lower labour cost locations, mainly in Eastern Europe and parts of Asia (Enterprise Strategy Group, 2004). There is also a growing realisation that in the medium term Ireland's ability to hold its position as the location of choice for FDI in Europe is under threat because of its high cost base.

A number of other issues combine to make logistics and SCM particularly critical from an Irish perspective. As noted earlier, the country's relatively peripheral location results in transportation costs for companies based in Ireland being higher than those in more favourable locations (Forfás, 1995). Furthermore, recent changes in the corporate taxation regime (in particular the introduction of a 12.5 per cent tax rate on service businesses) make the option of companies establishing business units (profit centres) in Ireland with responsibility for the management of supply chain activities more attractive. One of the necessary skills will therefore be the ability of Irish business to manage increasingly complex supply chains. Excellence in SCM can offset the physical disadvantage posed by Ireland's geographic location by securing improvements elsewhere in the wider supply chain.

## SCM PRACTICES IN IRISH FIRMS

This section is based on a recent survey that assessed the level of adoption of SCM practices in over 1,000 Irish firms in relation to a wide range of factors. These factors included demand forecasting, procurement and purchasing practices, warehouse management, inventory control, transport and distribution operations, production control and technology usage.

## Putting SCM Theory into Practice: Towards a Re-Engineering Roadmap

The results reported in this section relate specifically to the four characteristics of SCM excellence identified earlier. The responding firms are a mix of indigenous and foreign-owned multinationals, and represent a wide range of industry sectors.

### *Identification and Measurement of Customer Service*

The results revealed that less than 50 per cent of companies have not adopted KPIs for customer service to date. Furthermore, those firms that do measure customer service formally tend to use quite limited measures (see Figure 8.2).

**Figure 8.2: Main Indicators Used for Customer Service**



The ability of a firm's supply chain to perform consistently depends above all on its ability to continuously monitor market dynamics in terms of customer service requirements. This is particularly the case in the growing number of markets and market segments characterised by ever-increasing levels of competition. Lack of knowledge and understanding of changing market conditions clearly limits the ability of organisations to improve overall levels of supply chain capability and performance. As a result, the findings of this research in relation of the measurement of customer service requirements in Irish firms inevitably present serious systemic issues that need to be addressed.

### *Supply Chain Management and Logistics in a Volatile Global Environment*

Further analysis of the findings revealed significant differences across sectors and between firms of different sizes. This indicates that the need for improvement, and the scope of this potential improvement, is greatest in smaller firms and in sectors that have traditionally been later adopters of innovative techniques and systems.

#### ***Integration of Supply Chain Activities***

A fundamental principle of SCM is the development of collaborative and partnership relationships throughout the supply chain, including with customers and suppliers. The survey explored the extent to which respondents perceived various supply chain activities to be integrated internally. Whilst some activities (e.g. customer service and sales order processing) appear to be quite well integrated elements of overall SCM within the majority of firms, others (notably inbound transport, new product introduction and demand forecasting) are less well integrated.

Another indication of the degree of supply chain integration in firms relates to the extent of customer and supplier involvement in supply chain activities. The survey data indicates that this varies widely, with a small minority of respondents reporting 'very strong' involvement by customers and suppliers in any of the activities considered.

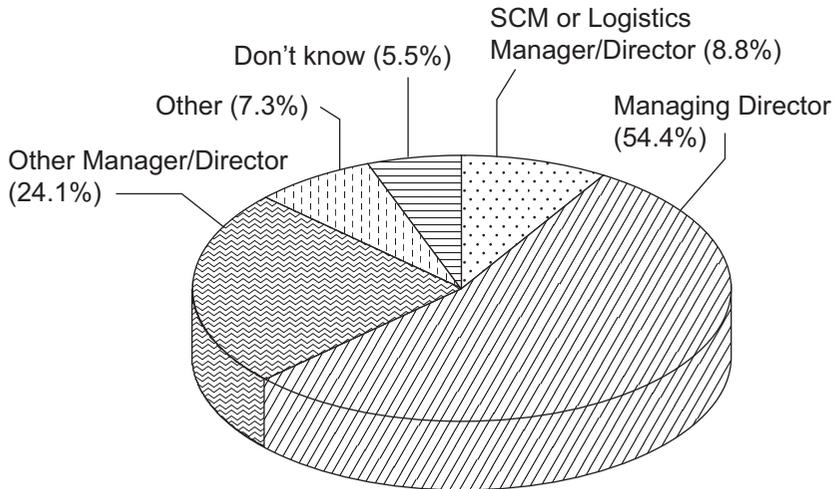
These findings suggest that moves towards higher levels of both internal and external supply chain integration have been carried out in, at best, a tactical and piecemeal fashion rather than as a matter of strategic priority. There is evidence from the findings of reasonably high levels of SCO in terms of recognition of the need for more holistic management of internal material and information flows. However, this does not appear to be translating widely into meaningful levels of systemic and strategic coordination of supply chain activities across businesses within the wider supply chain. For example, in relation to inventory management, less than a quarter of firms indicate that it is 'fully integrated' into overall firm SCM. In terms of external integration, only 3 per cent report a 'very strong' level of customer involvement in inventory management, with less than 10 per cent indicating a 'very strong' level of supplier involvement.

#### ***SCM as a Senior Management Function***

The survey assessed the organisation of SCM activities. In relation to overall responsibility for SCM activities, Figure 8.3 indicates that only 8.8 per cent of companies have a specialised SCM or logistics manager.

The author recognises that different approaches to supply chain organisation are appropriate in different firms and that the development of the

## Putting SCM Theory into Practice: Towards a Re-Engineering Roadmap

**Figure 8.3: Responsibility for Supply Chain Management**

optimum approach at any point in time depends on a wide variety of inter-related and interdependent factors. It would be inappropriate to propose an ideal organisational configuration irrespective of a company's products, processes and culture. Nonetheless, whilst recognising that every company has unique products, processes and culture, the increasing strategic importance of SCM across a range of sectors is not in dispute. The lack of specific SCM and logistics positions at a senior level within Irish firms is an indication that the strategic nature of the subject has not been embraced by the great majority of firms.

#### ***Establishment and Measurement of Supply Chain Key Performance Indicators (KPIs)***

The survey indicated that few companies have clearly defined supply chain KPIs. For example, as reported earlier, 46 per cent of companies do not have KPIs for customer service. Furthermore, 59 per cent of companies did not know their total supply chain costs. In relation to the measurement of performance of specific supply chain activities, 82 per cent of companies do not formally measure warehouse performance in terms of KPIs. There were similar findings in relation to the management of procurement, production and transportation activities.

As noted earlier, it is difficult to approach the task of supply chain improvement in any rational manner in the absence of information about current levels of performance. In other words, the generation of any meaningful improvements is predicated upon the very existence of robust and

*Supply Chain Management and Logistics in a Volatile Global Environment*

integrated systems of KPIs. The lack of such systems in Irish firms clearly compromises their ability to put such improvements into place.

**TOWARDS A SUPPLY CHAIN RE-ENGINEERING ROADMAP**

The foregoing raises fundamental questions about the extent to which companies understand and implement SCM concepts and practices. Overall, the empirical data appears to indicate that, whilst pockets of excellence undoubtedly do exist, there is significant room for improvement in these key areas. It is important, therefore, that any robust approach to supply chain improvement and re-engineering at least addresses these areas meaningfully. This section explores these areas in the context of a systematic and holistic approach to supply chain re-engineering. A number of possible barriers to SCM excellence have been identified and will be explored as part of the ongoing research and associated analysis. These include the facts that:

- Inefficiencies are often built into the supply chain.
- Communication structures are ineffective and exchange of information poor.
- Culture is inappropriate.
- There is an excessive reliance on forecasting and stockholding.
- Problems are often managed, rather than their causes eliminated.

Any robust approach to improving supply chain performance needs to address these barriers.

Improving supply chain performance through re-engineering involves analysis of internal and external parameters using relevant data which has been collected, the identification and evaluation of possible alternative improvements and their detailed planning, and the implementation of planned improvements, including the associated change management. In short,

**Re-engineering = Analysis + Planning + Implementation**

It is important to bear in mind that, in supply chain re-engineering, no panacea or 'magic solution' exists. Furthermore, as every company and every supply chain is unique in some respect, it is inappropriate to attempt to copy or imitate companies regarded as being exponents of good practice. The uniqueness could be with respect to products or services supplied, processes, customer expectations, people and cultural issues, systems or

## Putting SCM Theory into Practice: Towards a Re-Engineering Roadmap

any one of a number of other factors. However, there is a logical and systematic way of addressing the re-engineering challenge, based on the characteristics of supply chain excellence discussed earlier and shown in Figure 8.1.

It starts with a market-driven customer service strategy that provides the performance specification for integrated SCM. In relation to supply chain organisation it requires a focus on processes and effectiveness, with a strong emphasis on network arrangements and shared services. Information and communications technology (ICT) has the potential to facilitate integration between supply chain processes. However, for this potential to be realised, creative ICT strategies need to be developed and implemented. Again the focus needs to be on (value-adding) processes and on the people dimension. Finally, the integrated supply chain process KPIs provide organisations with a rational basis for continuous improvement. These measures feed back into the development of the customer service strategy, thus closing the loop. This roadmap provides the basis for logical and systematic approaches to supply chain re-engineering.

## CONCLUSIONS

The findings from the research reported earlier in this chapter indicate that, in general terms, while pockets of SCM undoubtedly exist (particularly in larger companies and in certain sectors), there is significant room for improvement in the great majority of firms. This is particularly the case in relation to the four main elements of SCM excellence reported on in this paper. The design of supply chain solutions is a highly skilled, knowledge-intensive and complex activity, reflected in a shift from 'box moving' to the design and implementation of customised supply chain solutions.

Re-engineering is, first and foremost, about change. The approach to re-engineering outlined in this chapter focuses on the four key aspects of service delivery based on clearly understood market requirements, integration of supply chain activities and data, supply chain organisation and the measurement of performance. The approach involves considering the whole supply chain and avoiding a situation where subsystems are optimised but the whole supply chain is suboptimal. Finally, the author's experience indicates that the real critical success factors in any re-engineering or change process relate to the people dimension, and specifically to the need for enhanced levels of knowledge and skills through supply chain learning.

## REFERENCES

- Bessant, J., Kaplinsky, R. and Lamming, R. (2003), 'Putting Supply Chain Learning into Practice', *International Journal of Operations & Production Management*, 23(2): 167–184.
- Bowersox, D.J., Closs, D.J. and Stank T.P. (1999), *21st Century Logistics: Making Supply Chain Integration a Reality*, Oak Brook, IL: CLM.
- Carranza, O., Maltz, A. and Antun, J.P. (2002), 'Linking Logistics to Strategy in Argentina', *International Journal of Physical Distribution & Logistics Management*, 32(6): 480–496.
- Christopher, M. (1992), *Logistics and Supply Chain Management: Strategies for Reducing Costs and Improving Service*, London: Pitman.
- Christopher, M. (2005), *Logistics and Supply Chain Management: Creating Value-Adding Networks*, London: FT Prentice Hall.
- Cooper, M.C., Ellram, L.M., Gardner, J.T. and Hanks, A.M. (1997), 'Meshing Multiple Alliances', *Journal of Business Logistics*, 18(1): 67–89.
- Enterprise Strategy Group (ESG) (2004), *Ahead of the Curve: Ireland's Place in the Global Economy*, Dublin: Forfás.
- Fawcett, S.E. and Magnan, G.M. (2002), 'The Rhetoric and Reality of Supply Chain Integration', *International Journal of Physical Distribution and Logistics Management*, 32(5): 339–361.
- Forfás (1995), *World Class to Serve the World*, Dublin: Forfás.
- Forrester, J.W. (1958), 'Industrial Dynamics: A Major Breakthrough for Decision Makers', *Harvard Business Review*, 36 (Jul–Aug): 37–66.
- Gattorna, J., Ogluin, R. and Reynolds, M.W. (2003), *Handbook of Supply Chain Management*, fifth edition, London: Gower.
- Goldratt, E.M. and Cox, J. (1992), *The Goal: A Process of Ongoing Improvement*, New York, NY: North River Books.
- Gunasekaran, A., Patel, C. and McGaughey, R.E. (2004), 'A Framework for Supply Chain Performance Measurement', *International Journal of Production Economics*, 87(3): 333–347.
- Huin, S.F., Luong, L.H.S. and Abhary, K. (2002), 'Internal Supply Chain Planning Determinants in Small and Medium-Sized Manufacturers', *International Journal of Physical Distribution & Logistics Management*, 32(9): 771–782.
- Jones, D.T., Hines, P. and Rich, N. (1997), 'Lean Logistics', *International Journal of Physical Distribution & Logistics Management*, 27(3–4): 153–173.
- Korpela, J., Lehmusvaara, A. and Tuominen, M. (2001), 'Customer Service Based Design of the Supply Chain', *International Journal of Production Economics*, 69(2): 193–204.

## Putting SCM Theory into Practice: Towards a Re-Engineering Roadmap

- Lambert, D. (1992), 'Developing a Customer-Focused Logistics Strategy', *International Journal of Physical Distribution & Logistics Management*, 22(6): 12-19.
- Lambert, D.M. (2004), 'Supply Chain Management' in D.M. Lambert (ed.), *Supply Chain Management: Processes, Partnerships, Performance*, Sarasota, FL: Supply Chain Management Institute, 1-23.
- Lambert, D.M., Cooper, M.C. and Pagh, J.D. (1998), 'Supply Chain Management: Implementation Issues and Research Opportunities', *International Journal of Logistics Management*, 9(2): 1-19.
- Mentzer, J.T., DeWitt, W., Keebler, J.S., Min, S., Nix, N.W., Smith, C.D. and Zacharia, Z.G. (2001), 'Defining Supply Chain Management', *Journal of Business Logistics*, 22(2): 1-25.
- Min, S. and Mentzer, J.T. (2004), 'Developing and Measuring Supply Chain Management Concepts', *Journal of Business Logistics*, 25(1): 63-99.
- Mollenkopf, D. and Dapiran, G.P. (2005), 'The Importance of Developing Logistics Competencies: A Study of Australian and New Zealand Firms', *International Journal of Logistics: Research & Applications*, 8(1): 1-14.
- Sterling, J. and Lambert, D. (1989), 'Customer Service Research: Past, Present and Future', *International Journal of Physical Distribution & Materials Management*, 19(2): 1-23.
- Sweeney, E. (2004), 'Making Supply Chain Management Work for You!', *Logistics Solutions*, 7(4): 21-25.
- Sweeney, E. (2007), 'Supply Chain Benchmarking and Performance Measurement: Towards the Learning Supply Chain' in E. Sweeney (ed.), *Perspectives on Supply Chain Management and Logistics: Creating Competitive Organisations in the 21st Century*, Dublin: Blackhall Publishing, 283-294.
- Sweeney, E., Evangelista, P. and Passaro, R. (2005), 'Putting Supply Chain Learning Theory into Practice: Lessons from an Irish Case', *International Journal of Knowledge and Learning*, 1(4): 357-372.
- van Hoek, R.I. (1998), 'Measuring the Unmeasurable: Measuring and Improving Performance in the Supply Chain', *Supply Chain Management: An International Journal*, 3(4): 187-192.
- Womack, J.P. and Jones, D.T. (2003), *Lean Thinking: Banish Waste and Create Wealth in Your Corporation*, second edition, London: Free Press.