

Chapter 1

Supply Chain Integration: Challenges and Solutions

Edward Sweeney
Dublin Institute of Technology, Ireland

ABSTRACT

Since its introduction by management consultants in the early 1980s, supply chain management (SCM) has been primarily concerned with the integration of processes and activities both within and between organisations. The concept of supply chain integration (SCI) is based on documented evidence that suggests that much of the waste throughout businesses is a consequence of fragmented supply chain configurations. However, there is also evidence to suggest that the achievement of higher levels of intra- and inter-firm integration presents an array of managerial challenges. The need for innovation in all aspects of SCM is widely recognised. Given the pivotal role of the integration paradigm within SCM, any meaningful innovation in this area must focus heavily on this issue. This chapter outlines some of the challenges by exploring the evolving SCM business context. It goes on to relate SCM theory to the widely cited Porter value chain concept. The core of the chapter provides a detailed description of SCI based on a wide variety of literature. It does so with particular reference to the challenges inherent in implementing an integrated business paradigm with a view to identifying a range of possible innovative solutions. The adoption of more integrated supply chain structures raises questions regarding the nature of both internal and external customer/supplier relationships. The effective management of such relationships is, therefore, given particular focus.

INTRODUCTION

Since its introduction in the early 1980s, supply chain management (SCM) has attracted a lot of attention in both business and academic circles. Recent years have seen a proliferation of literature with its origins in a range of academic disciplines and industry sectors. This has prompted scholars to classify the literature in various ways. For example, Tan (2001) illustrates the evolution of SCM from both a purchasing and supply perspective, as well as a transportation and logistics perspective. However, one theme that is a characteristic of much of the scholarly work in the field is that of integration.

Integration in this context refers to the extent to which various supply chain activities and processes work together in as seamless a manner as possible. It has long been recognised that traditionally managed businesses and supply chains, often characterized by high levels of fragmentation, have failed to achieve their true potential in terms of profitably meeting customer expectations. Supply chain integration (SCI) is, to a great extent, concerned with the development of more integrated approaches that hold out the prospect of eliminating many of the inefficiencies directly attributable to supply chain fragmentation. A plethora of supply chain management (SCM) definitions have been developed in recent years. There is evidence of differences in emphasis and approach between different industrial sectors, geographical areas and functional backgrounds. Furthermore, a variety of associated terminologies have also been developed which has added to the complexity. As noted by Ross (1998), this can limit management's understanding of the SCM concept and the practical effectiveness of its application, particularly in relation to the implementation of more integrated supply chain configurations.

The overall aim of this chapter is to provide the reader with insights into the essence of SCI, with a view to identifying both challenges and possible innovative solutions. Following this introduction,

a overview of the evolving SCM business context is set out. This points to some of the challenges that need to be addressed in putting SCI concepts into practice. This theme is developed by relating SCM theory to one widely used approach to the formulation of business strategy—the value chain concept and value chain analysis. The core of the chapter then provides a detailed description of SCI based on a wide variety of literature. It does so with particular reference to the challenges inherent in implementing an integrated business paradigm with a view to identifying a range of possible innovative solutions. The adoption of more integrated supply chain structures raises questions regarding the nature of both internal and external customer/supplier relationships. The effective management of such relationships is, therefore, given particular focus. Based on the foregoing some future research directions are proposed and a number of conclusions drawn.

THE EVOLVING SUPPLY CHAIN MANAGEMENT ENVIRONMENT

The literature suggests that a number of key issues are changing the supply chain management (SCM) and logistics strategic landscape. Arguably, the three most significant such issues are:

1. Internationalisation (or globalisation) of supply chains
2. Vertical disintegration
3. The changing role of the supply chain as a source of strategic leverage

This is in line with much of the published work (Sweeney, 2007). For example, Storey et al. (2006) point out that their work “concurred with the literature in identifying globalisation, outsourcing and fragmentation as three major drivers”. Vertical disintegration is largely a consequence of outsourcing and fragmentation in this context refers to strategic leverage, particularly in

the context of product strategy. More specifically, fragmentation refers to issues such as proliferation of stock keeping units (SKUs), shortening product life cycles and the requirement for increased customisation. Internationalisation is being driven by changing structures in the international economic and business environment. Vertical disintegration and the changing strategic view of the supply chain are both parts of the strategic response of firms to competitive pressures in the marketplace. The author recognises that these three issues are in many ways interrelated and interdependent: for example, outsourcing of manufacturing to lower labour cost economies is facilitated by economic liberalisation in these countries. Nonetheless, the following sections discuss each of these issues in detail.

Internationalisation

The structure of the international economic and business environment has changed significantly in recent years. The growth of trade blocs throughout the world has resulted in increasing global economic integration. This evolution, largely based on the reduction of barriers to the movement of capital, goods, services, people and information internationally, has facilitated increased international trade and foreign direct investment (FDI). The value of world merchandise trade reached about US\$13.6 trillion in 2007. In 1990 it was less than US\$2.85 trillion (UNCTAD, 2008). According to the World Trade Organisation (WTO), international trade flows multiplied by a factor of 25 between 1950 and 2003 (WTO, 2004). Annual foreign direct investment (FDI) expanded over 19-fold between 1973 and 2004, that is from US\$21.5 billion to over US\$410 billion (UNCTAD 2004). These trends have resulted in the increasing internationalisation of supply chains. This can be related to the 'buy–make–move–sell' model of product supply chains (New 1997; NITL 2000).

Buy

Global sourcing of raw materials and other inputs has now become a reality for many organisations as the structure of the international economic and business environment has evolved (Fagan, 1991; Trent and Monczka, 2003). The WTO provides an interesting example in its 1998 annual report (WTO, 1998). In the production of an 'American' car, 30 per cent of the car's value originates in Korea, 17.5 per cent in Japan, 7.5 per cent in Germany, 4 per cent in Taiwan and Singapore, 2.5 per cent in the United Kingdom and 1.5 per cent in Ireland and Barbados. That is, "... only 37 per cent of the production value ... is generated in the United States". This phenomenon is large enough to be noticed in aggregate statistics. Feenstra and Hanson (1996) used US input–output tables to infer US imports of intermediate inputs. They found that the share of imported intermediates increased from 5.3 per cent of total US intermediate purchases in 1972 to 11.6 per cent in 1990. Campa and Goldberg (1997) found similar evidence for Canada and the UK.

Make

Access to lower cost manufacturing worldwide is now possible. For example, the expansion of China in recent years, based to a large extent on outsourcing (or 'offshoring') of labour-intensive manufacturing by companies from developed countries, is indicative of this. No other country has attracted as much FDI as China. In 2004, approximately US\$60 billion of FDI was absorbed; between 1979 and 2004, the total was approximately US\$560 billion (UNCTAD 2004). As a result China is growing rapidly and attaining pre-eminence in global manufacturing in certain sectors. For example, by early in the last decade the country already produced 50 per cent of the world's cameras, 30 per cent of air conditioners and televisions, 25 per cent of washing machines and

20 per cent of refrigerators (Pinto, 2005). Similar trends have occurred in central and eastern Europe as the European Union (EU) expanded eastwards.

Move

The above has implications for the logistics and distribution strategies of companies (Waters, 2004). Increased trade volumes globally have created the need for new logistics pipelines. The growth in the international 3PL sector is a reflection of this. The large number of mergers and acquisitions in the sector has been driven significantly by the desire of companies to have a stronger global presence (Eyefortansport 2001). With specific reference to the European freight industry, Peters (2000) notes that growth in the 1990s has offered a lesson that “the country-by-country model for logistics is no longer valid; companies have begun to reorganize themselves into continental operations based on integration and rationalisation”.

Sell

Furthermore, as markets have opened up internationally for a range of products and services, international (and in some cases global) selling has become the reality. The cases of China and India are worthy of particular comment. As pointed out in a survey in *The Economist* (2005), the two countries are home to nearly two-fifths of the world’s population and are two of the world’s fastest-growing economies. A recent report by America’s National Intelligence Council (2004) likened their emergence in the early 21st century to the rise of Germany in the 19th and America in the 20th century, with impacts potentially as dramatic. The liberalisation of markets has sharpened the focus on the need for more robust approaches to international marketing strategy (Bradley, 2004; Cateora and Graham, 2004). For example, the term ‘glocalisation’ (from ‘global’ and ‘localisation’) has been used to refer to the creation of the local

(country or regional) market presence of a global enterprise (Fan and Huang, 2002).

In short, as economic and business globalisation has happened, supply chain architectures have become more global. The resulting challenges in terms of SCM and SCI have been the subject of significant research, debate and discussion (e.g., Arntzen et al., 1995; Gourdin, 2000; Simchi-Levi et al., 2002; Bolstorff and Rosenbaum, 2003; Ayers, 2003).

Vertical Disintegration

Companies are increasingly focusing on what they regard as their core activities or competencies. Oates (1998) defines core competencies as the central things that organisations do well. The corollary of this is that activities regarded as ‘non-core’ are often being outsourced. Greaver (1999) states that “non-core competencies take up time, energy and workspace, and help management lose sight of what is important in an organisation”. Furthermore, the trend towards economic and business globalisation has facilitated the outsourcing of various activities to overseas locations (offshoring – see above). Key supply chain activities are increasingly being outsourced to third-party organisations. This can again be related to the ‘buy–make–move–sell’ model of product supply chains.

Buy

Purchasing and procurement activities have generally not been outsourced in the traditional sense but the development of purchasing consortia has meant some sharing of responsibility for this activity between companies. Hendrick (1997) defines a purchasing consortium as:

A formal or informal arrangement, where two or more organisations, who are separate legal entities, collaborate among themselves, or through a third party, to combine their individual needs for

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products from suppliers and to gain the increased pricing, quality and service advantages associated with volume buying.

Essig (1999) notes that a purchasing consortium is often just one element of an overall supply strategy.

Make

The classic 'make versus buy' decision has been a central theme in the field of manufacturing strategy for decades (e.g. Hayes and Wheelwright, 1984). The traditional focus was largely on the financial and economic analysis of in-house versus outsourced options for particular processes within a manufacturing operation. Manufacturing outsourcing decision-making processes now tend to take a broader and more strategic view (e.g. Hill, 1999). Many large manufacturers have outsourced significant parts of their production activity to third parties (e.g. Edwards and Edwards, 2000; Hassey and Lai, 2003). For example, in the electronics sector, the trend is one of original equipment manufacturers (OEMs) outsourcing significant amounts of manufacturing to contract manufacturing companies. Companies in the electronic manufacturing services (EMS) sector, such as Flextronics, Foxconn and Celestica, have grown rapidly as a result.

Move

Transport and a range of other logistics activities are increasingly being outsourced by manufacturers and retailers (Scott and Westbrook, 1991; McKinnon, 1999). The 3PL sector has developed rapidly as it has responded to its customers' requirements for the supply of tailor-made services (Razzaque and Sheng, 1998; Skjoett-Larsen, 2000). The European Union PROTRANS project (PROTRANS, 2003) developed a definition of 3PL based on a wide number of definitions which have appeared in the literature:

Third-party logistics are activities carried out by an external company on behalf of a shipper and consisting of at least the provision of management of multiple logistics services. These activities are offered in an integrated way, not on a stand-alone basis. The co-operation between the shipper and the external company is an intended continuous relationship.

This definition reflects the manner in which shippers' requirements have evolved in recent years. The emphasis now is on the provision of integrated multiple services and the development of relationships.

Sell

Selling as a process has generally not been outsourced in the traditional sense. Nonetheless, many of the individual activities which comprise sales channels may be owned by other companies. The actual selling of products to consumers may be carried out by retailers, who may in turn obtain the products from wholesalers; third-party owned and managed call centres may be an integral part of the selling process; third-party agents, franchisees or distributors may also have some responsibility (e.g. Friedman and Furey, 1999).

The above has resulted in a shift away from the traditional model of 'control through ownership' towards models which are based on management and control through effective supply chain relationship management. The former is based on the strategic logic of vertical integration. Vertical integration is the degree to which a firm owns its upstream suppliers and its downstream buyers (Greaver, 1999). Harrigan (1999) provides a good description of the logic underpinning this approach to strategic development. The latter, effectively a process of vertical disintegration, has taken place as a result of the trends outlined above (Mpoyi, 1999; Langlois, 2001). Recent developments in information and communications technology (ICT), in particular Internet

technologies, have facilitated this process and laid the foundations for the 'network economy model' (Reddy and Reddy, 2001). According to Hugos (2002) traditional supply chain models have "given way to virtual integration of companies". In short, as outsourcing of various elements of supply chain functionality takes place, supply chain architectures are becoming more virtual. The traditional *fully vertically integrated* approaches are being replaced by contemporary *fully virtually integrated* approaches - a new FVI is evolving.

Strategic Leverage

Classically in the field of strategic management, the generic approaches of cost leadership, differentiation, and focus have been identified (Porter, 1985). Porter's classic text described these alternatives, as follows:

- A cost leadership strategy requires a company to be a low cost supplier, and to sell either at below average industry prices to gain market share, or at industry average prices to earn a profit higher than that of rivals.
- A differentiation strategy requires a product or services that offers unique attributes that are valued by customers, thereby allow premium pricing.
- A focus strategy concentrates on a narrow segment and within that segment attempts to achieve advantage through either cost leadership or differentiation.

A significant proportion of the overall cost base of companies is in the supply chain. In the automotive industry, for example, A.T. Kearney (1999) report that typically component (30 per cent), manufacturing and assembly (28 per cent) and distribution (four per cent) costs together represent 62 per cent of sales price. Hence, any worthwhile cost leadership approach needs to focus on the optimisation of total supply chain

costs and the elimination of non-value-adding activities (NVAs). The author's definition of an NVA - based on Jones et al. (1997), Goldrat and Cox (1992), Womack and Jones (2003) and others is: *any activity (or resource or asset) that adds cost (or time) to any supply chain process without adding value from a customer perspective*. Much of this lean thinking has its origins in the Japanese automotive industry, in particular in the Toyota Production System (TPS) and the just in time (JIT) paradigm (Ohno, 1988; Womack and Jones, 2003). The main objective of this thinking was the elimination of waste (or 'muda' in Japanese).

Customer service is becoming a key source of differentiation or an order winning criterion in many sectors (Christopher, 2005). An order winning criterion (or 'order winner') is a feature of the product or service offering which differentiates it from the competition and is, therefore, likely to be a source of increased market share; an order qualifier, on the other hand, is a feature which must exist to ensure that a product or service gets into the market in the first instance and stays there (Hill, 1999). The latter tend to have order losing rather than order winning characteristics. 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). Customer service is delivered by the supply chain. In this way, the supply chain itself has become a key factor in the development of a differentiation strategy.

As pointed out earlier, a focus strategy concentrates on a narrow segment and within that segment attempts to achieve advantage through either cost leadership or differentiation. The points made above in relation to the role of SCM in strategy formulation and implementation are, therefore, equally relevant in the context of a focus approach.

In short, a company pursuing a cost leadership, a differentiation or a focus strategy can leverage the supply chain as a fundamental element of

its effort to improve competitive performance. The role of SCM in strategy formulation and implementation is given extensive treatment in the literature (e.g. van Hoek and Harrison, 2004; Simchi-Levi and Kaminsky, 2003; Cohen and Roussel, 2004). Two approaches are worthy of particular mention.

Firstly, Christopher and Ryals (1999) argue that SCM has a central position in the creation of shareholder value. In this context, shareholder value is defined as the financial value created for shareholders in the companies in which they invest. The four basic drivers of enhanced shareholder value (i.e. revenue growth, operating cost reduction, fixed and working capital efficiency) are “directly and indirectly affected by logistics management and supply chain strategy”. The framework of value-based management (VBM) plays a potentially important role in achieving these improvements in practice. The paper concludes by noting that: “By seeking out opportunities for partnership in the supply chain combined with an emphasis on the reduction of non-value-adding time, the evidence suggests,

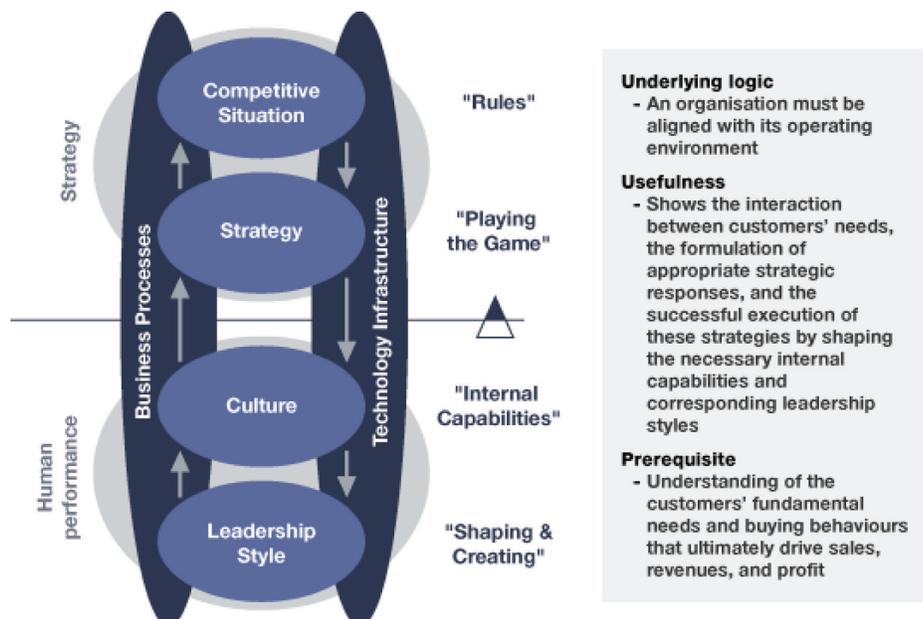
enduring improvement in shareholder value can be achieved” (Christopher and Ryals, 1999). The emphasis on time compression is important as it has the potential to reduce cost and improve customer service.

Secondly, a graphical representation of Gattorna’s ‘Strategic Alignment Model’ is shown in Figure 1 (Gattorna et al., 2003). He argues that empirical evidence is mounting to suggest that if organisations are to achieve sustained high levels of financial and operating performance, the four elements shown in the diagram must be dynamically aligned.

Alignment in this context means:

- An understanding of customers’ buying behaviour;
- Corresponding value propositions to align with the dominant buying behaviours;
- The appropriate capabilities (or cultural capability) embedded in the organisation to underpin the delivery of these specific value propositions; and,

Figure 1. The strategic alignment model



- A composite leadership style at the executive level to ensure the appropriate sub-cultures are in place as required.

Organisations seeking superior performance must be both very aware of their customers' expectations and of their own internal capability. If these two dimensions are addressed adequately, then an organisation is fully aligned with its marketplace. This is in line with classical approaches to strategy formulation – for example, Porter (1985) points out that the essence of formulating a competitive strategy is relating the company to its environment – but with a strong focus on the role of SCM in ensuring that strategic plans are realised in practice.

Key Challenges from the Evolving Environment

Economic and business globalisation is happening. Companies are increasingly focussing on their core competencies and as a result, vertical disintegration is happening. Finally, more and more companies are coming to regard the supply chain as a source of strategic leverage. In short, supply chains have become more global and more virtual (and, therefore, their management has become more complex) and SCM – with the concept of integration at its core - is becoming a more integral and integrated part of overall corporate strategy. Simultaneously, customers have become more discerning and are demanding better quality products, higher levels of service and reduced prices. This increasingly competitive business environment has sharpened the focus on the need for more robust approaches to supply chain design and management.

SCM AND THE VALUE CHAIN

One well-known approach to strategic thinking and strategy formulation, based on the concept of the

value chain, was introduced a quarter of a century ago by Michael Porter (Porter, 1985). The idea of the value chain is based on the process view of organisations, the idea of seeing a manufacturing (or service) organisation as a system, made up of subsystems each with inputs, transformation processes and outputs. Inputs, transformation processes and outputs involve the acquisition and consumption of resources, such as money, labour, materials, equipment, buildings, land, administration and management. How value chain activities are carried out determines costs and affects profits.

Most organisations engage in hundreds, even thousands, of activities in the process of converting inputs to outputs. These activities can be classified generally as either primary or support activities that all businesses must undertake in some form. According to Porter (1985), the *primary* activities are:

1. **Inbound Logistics**, which involve relationships with suppliers and include all the activities required to receive, store and disseminate inputs.
2. **Operations** are all the activities required to transform inputs into outputs (products and services).
3. **Outbound Logistics**, which involve relationships with customers and include all the activities required to collect, store and distribute the output.
4. **Marketing and Sales** are activities that inform buyers about products and services, induce buyers to purchase them and facilitate their purchase.
5. **Service** includes all the activities required to keep the product or service working effectively for the buyer after it is sold and delivered.

The *support* activities are procurement, human resource management (HRM), technological development and infrastructure. A graphical

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representation of Porter's value chain is shown in Figure 2.

Jacobs (2003) notes that:

The value chain disaggregates a firm into its strategically relevant activities in order to understand the behaviour of costs and the existing and potential sources of differentiation. A firm gains competitive advantage by performing these strategically important activities more cheaply or better than its competitors.

One implication of Porter's thesis is that firms need to examine each activity in their value chains to determine whether or not they have a real competitive advantage in the activity. One consequence of this is that activities which are not a source of real competitive advantage are often being outsourced (see above) thus creating more virtual supply chain architectures.

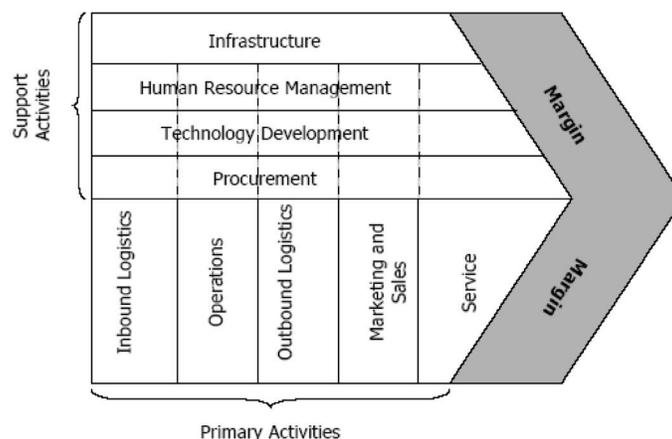
The relationship between this chain and SCM has been the subject of discussion in several papers (e.g. Barney, 1997; Lazzarini et al., 2001). As noted earlier, supply chains are sets of activities representing successive stages of value creation. The literature on SCM suggests that vertical interdependencies require a systemic approach to the management of material and information

flows between firms engaged in the chain. On the other hand, Porter's original value chain analysis was primarily an approach that described a set of sequential activities creating value *within* firms. However, outsourcing of supply chain functionality and the resulting creation of more virtual configurations has had the effect of extending the value chain beyond the boundaries of individual firms. As noted by Christopher (2005, p. 14), 'the supply chain becomes the value chain'. In other words, the distinction often traditionally espoused between the *value chain* and the *supply chain* has become inconsequential. As succinctly suggested by Christopher (2004): "Now the focus has widened as the move to outsourcing non-core activities in the value chain accelerates. Thus, we are seeing, in effect, the supply chain become the value chain."

THE ROLE OF INTEGRATION IN SCM

It is evident that the concept of integration lies at the heart of SCM philosophy (see, e.g. Christopher, 1992; New, 1996; Lambert, 2004). Cooper et al. (1997) specifically describe SCM as "an integrative philosophy". Storey et al. (2006) in their discussion of the interlocking ideas and propositions

Figure 2. Porter's value chain



of SCM declare that, “the central underpinning ideas relate to alignment and integration” (p. 758). Perhaps most tellingly, Pagell (2004) declares that “in its essence the entire concept of SCM is really predicated on integration” (p. 460). If, as Mentzer et al. (2001) suggested, SCM can be regarded as a management philosophy then this philosophy is concerned first and foremost with integration. The widely cited work of Bowersox and his collaborators at Michigan State University (see, for example, Bowersox et al., 1999), which describes a framework of six competencies (the *Supply Chain 2000 Framework*) that lead to world class performance in logistics and SCM, supports this view. The six competencies, grouped into three areas (operational, planning and relational) are all concerned with integration.

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’).

Furthermore, and as noted earlier, Harland et al. (1999) classifies research in this area according to the level of integration between supply chain activities. The four levels are:

1. Internal level, which considers only on those activities which are entirely internal to the focal company.
2. Dyadic level, which considers single two-party relationships (between, for example, supplier and manufacturer or manufacturer and distributor/retailer).
3. Chain level, which encompasses a set of dyadic relationships including a supplier,

a supplier’s supplier, a customer and a customer’s customer.

4. Network level, which concerns a wider network of operations.

In each of these cases, the first level relates to integration of activities and processes which are carried out within a single organisation (i.e. *internal* or *micro-* or *intra-firm* supply chain integration). The others describe varying degrees of integration of activities which span the boundaries of organisations (i.e. *external* or *macro-* or *inter-firm* supply chain integration), with the last one of Fawcett and Magnan (2002) often being viewed as the theoretical ideal. The following sections discuss internal and external integration in more detail.

Internal Chain Integration

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. To establish a framework for describing the key functions of a typical internal supply chain, New’s comment (1997) that SCM “revolves around the buying, making, moving and selling of ‘stuff’ ” is quite instructive. It is in line with the ‘buy–make–move–sell’ model of product supply chains (NITL 2000) introduced earlier. For the purposes of this section the author has added a fifth element, namely the ‘store’ activity. This has been done to ensure that all activities associated with the design and management of warehouses and other storage locations is given due recognition in the framework. Warehouse management has long been regarded as an integral element of the logistics activity of firms (see below) and a significant amount of specialist knowledge and expertise in this area has been developed over the years. Essentially, ‘move’ has been disaggregated into separate ‘move’ and ‘store’ elements, reflecting the specific characteristics of each of these activities.

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Most businesses – certainly manufacturing-based business – can be described in terms of the five functions: buy, make, store, move and sell. This is what is referred to as the internal (or micro- or intra-firm) supply chain as shown in Figure 3.

Traditionally these functions have often been measured, and therefore managed, in isolation, often working at cross purposes. As succinctly noted by Storey et al. (2006) this traditional approach is analogous to a relay race with responsibility being passed from one function to another. SCM means thinking beyond the established boundaries, strengthening the linkages between the functions, and finding ways for them to pull together. A recognition that the ‘whole is greater than the sum of the parts’ calls for more effective integration between purchasing and procurement (buy), production planning and control (make), warehouse management (store), transport management (move) and customer relationship management (sell), as illustrated in Figure 4.

This shift, away from a functional orientation towards a more company-wide focus, is in line with the early stages of the various models of SCM historical evolution. It is also analogous to the supply chain orientation (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. Nonetheless, the desirability of achieving seamless integration is not something which is unique to SCM. As noted earlier, or-

ganisations have long realised the need for company-wide approaches to organisational design and redesign. The development of systems engineering approaches to manufacturing system redesign in the 1970s and 1980s (see, e.g. Hitomi, 1996) was followed by the focus on organisational re-engineering, often based on business processes, in the 1980s and 1990s (Hammer and Champy, 1993). A common feature of these approaches was recognition that ‘the whole is greater than the sum of the parts’. In other words, optimising subsystems (whether those subsystems are functional departments, production sites or individual processes in the manufacturing cycle) can result in a sub-optimised total system. Lack of efficiency and/or effectiveness is often a result of the poorly designed interfaces between subsystems rather than any inherent subsystem weaknesses. There are numerous examples of companies which have generated significant improvements in competitive advantage as a result of the application of this ‘total systems’ thinking (see, e.g. Checkland and Scholes, 1999; Sweeney, 1999).

External Chain Integration

Every product or service is delivered to the final consumer (the only source of ‘real’ money in the chain) through a series of often complex movements between companies which comprise the complete chain. An inefficiency anywhere in the chain will result in the chain as a whole failing to achieve its true competitive potential. In other

Figure 3. The internal supply chain



Figure 4. Integrating the internal supply chain



words, supply chains are increasingly competing with other supply chains rather than, in the more traditional axiom, companies simply competing with other companies. The phrase ‘supply chain’ is used to indicate that the chain is only as strong as its weakest link. Lambert et al. (1998) suggested that “much friction, and thus waste of valuable resources results when supply chains are not integrated, appropriately streamlined and managed”. (p. 14). This concept of inter-company ‘friction’ is useful in conceptualising the need to replace fragmentation with integration.

The simplistic representation in Figure 5 of the external (or macro- or inter-firm) supply chain shows materials flowing from the raw material source through the various stages in the chain to the final consumer. Money (i.e. funds) then flows back down the chain. The point is that every link matters and that value is added, and profit generated, at each link along the way.

This aspect is central to most widely cited definitions of SCM. As Houlihan (1988) notes, “the supply chain is viewed as a single process”. In other words, the various links in the chain need to function in as seamless a manner as possible. Monczka et al. (1998) refer to the use of “a total systems perspective across multiple functions and multiple tiers of suppliers”. The reference to ‘multiple functions’ alludes to internal integration;

extending this to ‘multiple tiers of suppliers’ introduces the external integration concept, albeit in the rather limited sense of backward integration with suppliers. As noted earlier, the theoretical ideal is complete backward and forward integration (‘from the supplier’s supplier to the customer’s customer’).

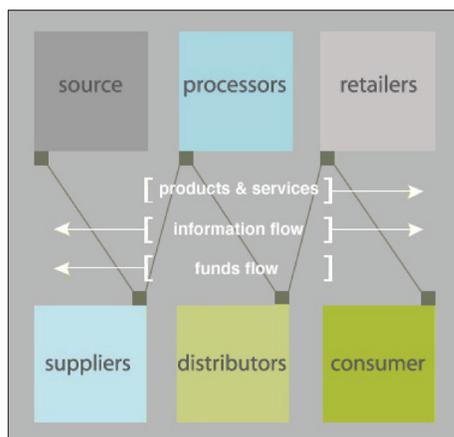
It is important to note that the representation in Figure 5 corresponds to the ‘chain level’ in the classification of Harland (1996). In reality most ‘chains’ are more like the ‘network level’ with multiple suppliers and customers across the various tiers in the ‘chain’. Lambert et al. (1998) made reference to:

- **Horizontal structure:** this refers to the number of tiers across the supply chain
- **Vertical structure:** this refers to the number of suppliers/customers represented within each tier
- **Horizontal position:** this refers to where the focal company is positioned within the chain (e.g. close to the initial source of supply or nearer to the ultimate customer)

Thus, most ‘supply chains’ are in reality three dimensional networks of organisations. In view of this, Lambert and Cooper (2000) suggest that “the ultimate success of the single business will depend on management’s ability to integrate the company’s intricate network of business relationships” (p. 65).

It was noted earlier that ‘complete backward and forward integration’ as postulated by Fawcett and Magnan (2002) might be viewed as the theoretical ideal. However, in reality various degrees of integration between upstream and downstream organisations will exist. In this context, Frohlich and Westbrook (2001) proposed the concepts of ‘arcs of integration’ with the direction of the arc referring to the direction of integration (i.e. upstream or downstream) while the degree of the arc indicates the level or extent of integration (from ‘no integration’ to ‘extensive integration’).

Figure 5. The external supply chain



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Similarly, Bask and Juga (2001) proposed the concept of ‘semi-integrated’ supply chains. They suggest that “a fully integrated supply chain sounds impressive but says little” (p. 150). By way of illustration they note that:

The relationships between organisations are subtle and complex and no one recipe exists on how the supply chains achieve best performance. For some companies, tight integration is the answer under regimes like efficient consumer response, quick response, etc. For others, intensive integration may be the goal in selected areas of SCM, while in other areas it can be beneficial to strive for limited integration. Simultaneous properties of tight and loose control are needed as is suggested in the notion of semi-integrated supply chains. (p. 149)

The work of Fabbe-Costes and Jahre (2007) is in line with this concept. They identify a “differentiated” approach to supply chain integration which “can help companies to identify and then to focus on a limited number of integration factors” (p. 847).

Performance Measurement

It was noted earlier that traditionally supply chain activities have often been measured, and therefore managed, in isolation. The contention implicit in this statement is that fragmented approaches to measurement result in fragmented approaches to management. This is in line with the “what gets measured gets done” axiom. In relation to internal integration, Ellinger (2002) reinforces this point by contending that:

If functions are very interdependent in their work, it is counterproductive to base evaluation and reward systems on individual performance. The nature of such work demands compatible systems such as team-based pay and compensation, performance appraisal and accountability at the team level, and recognition for team results. (p. 87)

One of the case companies studied by Storey et al. (2006) provides a good illustration of this point in relation to external integration. The company in question had measures in place that showed that they consistently achieved their three-day delivery target. However, the large majority of orders were delivered after the date the customer had originally requested, and on average they were 16 days late. The problem was that only that part of the supply chain over which they had control was being measured. As Brewer and Speh (2000) noted, performance metrics ‘are not always focused on measuring, motivating, and optimising inter-firm and intra-firm performance’ (p. 82). Gunasekaran et al. (2004) capture the challenge very effectively by noting that:

Many companies have not succeeded in maximizing their supply chain’s potential because they have often failed to develop the performance measures and metrics needed to fully integrate their supply chain to maximize effectiveness and efficiency. (p. 335)

Business performance measurement generally, and supply chain performance measurement specifically, are subjects which have been the subject of extensive discussion in the literature for many years. The amount of work in the area of supply chain performance measurement specifically is illustrated by Fabbe-Costes and Jahre (2007) who note that a search in EBSCO-Business Source Complete identified over 700 peer-reviewed articles with a combination of ‘performance’ and ‘supply chain management’ in the title, abstract and/or keywords. An examination of the historical development of this domain over time suggests that the general trend has involved a shift away from the use of purely financial metrics with the importance of the supply network emerging in the final and current phase. This recognises that customer satisfaction can only come from the supply chain functioning effectively in totality (both processes and process interfaces).

Several authors have pointed out some of the challenges associated with effective supply chain performance measurement and some of the weaknesses inherent in current approaches. Chow et al. (1994) discuss how logistics performance has been and could be conceptualised. Van Hoek (1998) suggested that vertical disintegration has resulted in a new scenario as much of a firm's competitive capability is no longer under its direct operational control. Beamon (1999) notes that "current supply chain performance measurement systems are inadequate because they rely heavily on the use of cost as a primary (if not sole) measure" (p. 280). Gunasekaran et al. (2001) note the lack of a "balanced approach" and the lack of a "clear distinction between metrics at strategic, tactical and operational levels" (p.72). Lambert and Pohlen (2001) suggest that "in most companies, the metrics that management refer to as supply chain metrics are primarily internally focused logistics measures' and that 'these metrics do not capture how the overall supply chain has performed" (p. 1).

In 1994, Caplice and Sheffi (1994) presented a taxonomy of logistics performance metrics, organized by process rather than by function, with the metrics evaluated using established criteria. Since then, a number of frameworks have been proposed which aim to address fragmentation in supply chain performance measurement, as well as some of the other weaknesses noted above. Three such approaches provide some useful foundations for effective measurement in a SCM context.

Balanced Scorecard

Brewer and Speh (2000) demonstrated how the balanced scorecard framework developed originally by Kaplan and Norton (1996) could be adopted in a SCM context. The balanced scorecard is an attempt to balance the inclination to overemphasise purely cost and other financial metrics with measures related to other drivers of long-term profitability. It does this by using

customer satisfaction, innovation and learning and business process metrics, along with purely financial metrics. Brewer and Speh (2000) propose that the supply chain perspective can be embedded within the internal business process dimension of the scorecard through the use of both 'integrated' and 'non-integrated' measures. They cite cash-to-cash cycle time as an example of the former in that it embraces several functions across several organisations. The latter, in contrast, provide diagnostics on where problems are occurring within individual functions and firms.

Lambert and Pohlen Framework

Lambert and Pohlen (2001) proposed a framework that aligns performance at each dyadic link (i.e. supplier-customer pair) within the supply chain. The framework begins with the linkages at the focal company and moves outward a link at a time. The link-by-link approach provides a means for aligning performance downstream and upstream "with the overall objective of maximizing shareholder value for the total supply chain as well as for each company" (p. 8). The framework comprises seven steps:

1. Map the supply chain from point-of-origin to point-of-consumption to identify where key linkages exist.
2. Use the customer relationship management (CRM) and supplier relationship management (SRM) processes to analyse each link (customer-supplier pair) and determine where additional value can be created for the supply chain.
3. Develop customer and supplier profit and loss (P&L) statements to assess the effect of the relationship on profitability and shareholder value of the two firms.
4. Realign supply chain processes and activities to achieve performance objectives.
5. Establish non-financial performance measures that align individual behaviour with

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- supply chain process objectives and financial goals.
6. Compare shareholder value and market capitalisation across firms with supply chain objectives and revise process and performance measures as necessary.
 7. Replicate steps at each link in the supply chain.
 8. This framework represents a methodology for overall supply chain improvement with a novel approach to performance measurement at its core.

Gunasekaran et al Framework

Gunasekaran et al (2004) proposed a measurement framework by considering strategic, tactical and operational measures for the four supply chain activities/processes of plan, source, make/assemble and deliver. The authors suggest that this framework provides “a starting point for an assessment of the need for supply chain performance measurement” (p. 344). In other words, the framework does not provide a usable tool but rather provides a foundation which can be developed and built upon. In this context, Beamon (1999) presented four characteristics of effective performance measurement systems, which should be: inclusive (i.e. measure all pertinent aspects); universal (i.e. allow for comparison under various operating conditions); measurable (i.e. data is available); and, consistent (i.e. measures used should reflect organisational goals).

Integrating The Supply Chain: Challenges And Solutions

Virtually all contemporary definitions of SCM place a strong emphasis on the need for a shift from traditional supply chain architectures, which were often characterised by fragmentation, to more effective configurations, which need to replace fragmentation with integration. This is true both in relation to internal and external chains.

The achievement of high levels of integration has implications for the design of organisational structures and supply chain architectures. Kempainen and Vepsalainen (2003) suggest that in the future this is “expected to result in a new structure of demand-supply networks, in this paper called the encapsulated network, with shared technology and systems, extended decision rights and non-territorial services” (p. 716). While ‘leading edge’ companies may well have adopted this philosophy to varying degrees, there is a need to understand its role and impact in the wider business community. For example, the recent work of Fabbe-Costes and Jahre (2008) concludes that:

In going behind the rhetoric of “integration is always best”, we have shown that “evidence” cannot be taken for granted and that much more research is needed in particular with regard to the impact of extended inter-organisational SCI on supply chain performance. (p. 145)

Finally, moving from fragmented to more integrated approaches inevitably requires changes to the ways in which both internal and external customer and supplier relationships are created and managed.

SUPPLY CHAIN RELATIONSHIP MANAGEMENT

The need to replace fragmentation with integration and the holistic approach to flow management requires a re-appraisal of the way in which both internal and external customer/supplier relationships are created and managed. As noted by Sweeney (2005): “SCM is not a ‘zero-sum’ game based on adversarial relationships. Rather, it needs to be a ‘win-win’ game based on partnership approaches”. This point is relevant to the interactions between the key *internal* supply chain functions of buy, make, store, move and sell, as well as to relationships between an organisation

and its external customers and suppliers. Several of the SCM definitions in the literature highlight the importance of relationship management. For example, Monczka et al. (1998) refer to the requirement for “joint relationships with suppliers across multiple tiers”. La Londe and Masters (1994) suggest that supply chain strategy includes, “... two or more firms in a supply chain entering into a long-term agreement; ... the development of trust and commitment to the relationship; ... the integration of logistics activities involving the sharing of demand and sales data”. The CSCMP definition of SCM (CSCMP 2009) specifically embraces the concept of “co-ordination and collaboration with channel partners”. Lambert et al. (1998) go even further by suggesting that: “Increasingly the management of relationships across the supply chain is being referred to as supply chain management (SCM)”.

Types of Relationships

Lamming (1993) highlights the need to move from ‘zero-sum’ to ‘win-win’ games; from competitive to collaborative approaches; and, from adversarial to partnership relationships (and beyond - as suggested in the title of his book *Beyond Partnership: Strategies for Innovation and Lean Supply*). As noted above, various degrees of integration between upstream and downstream organisations exist depending upon a range of factors. It is not

surprising, therefore, that in reality many different possible relationship types exist. Quinn and Hilmer (1994) categorised relationships based on the trade-off between the need for flexibility and the need for control, as shown in Figure 6. Choosing the appropriate relationship model is a key issue in any given situation.

Croom et al. (2000) identify ten variables which influence the nature of relationships between actors in a network. These include the attitude and commitment to collaborative improvement programmes, legal issues and the degree of power and influence of each party. It is widely recognised that, as noted by Lambert and Cooper (2000), “the closeness of the relationship at different points in the supply chain will differ” (p. 69). In other words, it is not a case of ‘one size fits all’. A key management decision involves determination of the appropriate relationship that best suits a particular set of circumstances.

The Impact of Vertical Disintegration

As noted earlier, companies are increasingly focusing on what they regard as their core activities or competencies. The corollary of this is that activities regarded as ‘non-core’ are being outsourced. Key supply chain activities such as transportation, warehousing and manufacturing are increasingly being outsourced to third-party organisations. This has resulted in a shift away

Figure 6. Categories of customer/supplier relationship



from the traditional model of ‘control through ownership’ towards models which are based on management and control through effective supply chain relationship management (Christopher, 2005). In short, as this process of vertical disintegration has taken place, supply chain architectures have become more virtual. As noted earlier, the traditional *fully vertically integrated* approaches are being replaced by contemporary *fully virtually integrated* approaches. This has sharpened the focus on the need for the creation of appropriate relationship forms throughout the supply chain, as well as on their effective management.

Strategic Partnering

Much of the literature presents the partnership approach as an ideal. For example, Harland et al. (1999) argue that: “The search for closer co-operation and integration is evident not only with customers; suppliers are increasingly being viewed as partners, becoming more deeply involved in co-operative problem solving”. In a truly strategic partnership approach a number of features should be evident (Rothery and Robertson 1995), as follows:

- Senior management from both firms meet regularly.
- Payments relate to specified business outcomes or pre-agreed levels of performance rather than fixed work volumes.
- Outsourcing contracts usually last for five years or longer.
- Disclosure takes place of costs and margins between both the parties.
- Each is involved in the other partner’s strategic planning.
- Partner is not chosen on the basis of a competitive tendering process.
- Each partner searches for ways to reduce total costs of the partnership.
- Each partner must genuinely add value.

However, as noted by Stone (2002): “In reality, few partnerships are arrangements between equal parties”. Fernie (1998) goes further by noting that, “there is an impression that companies enter some form of partnership but in many cases lip service is being paid to the idea”. Lamming (1993) also referred to the ‘lip service’ trap in relation to customer/supplier partnerships by noting that, if companies talk about it for long enough, they begin to believe they are doing it.

The People Dimension

It is important to note that relationships are in essence about people. For example, Grieco (1989) recognised that effective SCM “rests on the twin pillars of trust and communication”. Ellinger (2000) identifies the role of “predominantly informal processes based on trust, mutual respect and information sharing, the joint ownership of decisions, and collective responsibility for outcomes” (p. 86). Lambert et al. (1998) proposed that the fundamental management components of SCM can be classified into ‘physical & technical management components’ and ‘managerial and behavioral management components’; the former might be characterised as the ‘hard-wiring’ of the supply chain while the latter relate to the ‘soft-wiring’. The latter components are all concerned with the people dimension of SCM and the model indicates their important role in the overall SCM paradigm and to SCI particularly.

Another important aspect of the people dimension relates to the role of management in supply chains. As noted by Lee (2004) in the *Harvard Business Review*, “there are no technologies that can do those things; only managers can make them happen” (p. 11). Mangan and Christopher (2005) suggest that contemporary SCM requires managers with a ‘T-shaped’ profile. This recognises the need for in-depth expertise in one discipline combined with sufficient breadth of understanding to facilitate interactions with others. In line with this and with specific reference to future skill

requirements for supply managers, Giunipero et al (2006) suggest that communication skills, as well as technical and financial skills, will be important.

A number of authors have proposed the concept of supply chain learning (Bessant et al, 2003, Sweeney et al, 2005). This involves leveraging the supply chain as a mechanism for inter-firm competency development. Bessant et al (2003) outline several possible benefits of this type of approach but recognise that inter-firm learning is not necessarily a natural feature of business networks.

The people dimension in SCM is important from many perspectives (including relationships, management development of the potential role of supply chain learning). However, Storey et al. (2006, p. 754) acknowledge the “crucial importance of the behavioural and people dimension but the relative neglect of this in any substantive form”. In relation to supply chain learning specifically, Bessant et al (2003) acknowledge that “it is still at an early stage and being made with faltering steps” (p. 182). Similarly, Mangan and Christopher (2005) recognise that “there is still some way to go” in building the required SCM skills and competencies (p. 189).

Supply Chain Relationship Management: The Key to Effective SCI

Based on the foregoing, the creation and management of partnerships with all customers and suppliers (internally and externally) is not what SCM is about. As stated earlier, it is about recognising that putting SCM philosophy into practice requires a reappraisal of such relationships. There is no ‘one size fits all’ approach to this. There are many possible relationship forms and choosing the right ones in specific situations is the key. Nonetheless, one of the biggest manifestations of the application of SCM in recent years has involved the move away from adversarial relationships with key external suppliers towards relationships which are based

on mutual trust and benefits, openness and shared goals and objectives. As noted by Harland et al. (1999), “there has been an observed shift away from multi-sourced adversarial trading with suppliers, towards single or dual sourcing, resulting in a reduction (or ‘rationalisation’) of supplier bases used by firms”.

SOLUTIONS AND RECOMMENDATIONS FOR SUPPLY CHAIN INNOVATION

The foregoing sections suggest that the concept of integration lies at the heart of the contemporary SCM paradigm. Any worthwhile attempt to improve supply chain capability and performance must, therefore, focus on innovation in this area. As noted earlier, the evidence in relation to experience at firm and supply chain levels indicates that there are many barriers and challenges that must be addressed. It is important to recognise that no panacea exists when it comes to being innovative in achieving higher levels of integration. However, there is a logical and systematic way of addressing the challenges in holistic manner in line with the underpinning principles and concepts of SCM. What is required above all is the commitment of senior management teams to developing and implementing the required strategies.

As noted throughout this chapter, integration can be considered on at least two levels – i.e. intra-firm and inter-firm – and it is essential that both dimensions are considered. The author’s experience suggests that without relatively high levels of internal integration any attempt at innovation externally is likely to be difficult. This is in line with the SCO/SCM 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. Approaching the issue in a logical and systematic manner is likely, therefore, to begin with address-

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ing issues of fragmentation within organisations. This requires a multi-disciplinary approach with an emphasis on the identification of NVAs in a cross-functional manner. Once improvement has been achieved internally by supply chains firms then efforts at inter-organisation collaboration are more likely to succeed.

Recent years have seen rapid developments in ICT thus providing the technological basis for improvement. There can be little doubt that the effective implementation of technology has the potential to radically enhance SCI through better management of information both within and between firms. However, for the real potential of technology to be realised its potential must be considered as an integral part of the overall innovation process of organisations. Other chapters in this book deal with some of these technological issues in more detail. What is arguably more important and more difficult is the ‘soft wiring’ dimension of SCI, in particular issues related to relationship management.

Innovation in SCI is most of all about improving the manner in which individual components within the overall supply chain architecture interact with each other. This often requires that existing mindsets are challenged and that innovative approaches to communication are adopted. This issue is about the people dimension of SCM with innovative models, particularly in the area of supply chain learning, likely to play a more pivotal role in the coming years. This in turn raises issues in relation to education and training – it is only with the right competencies in place throughout the supply chain that sustainable innovation can be achieved.

FUTURE RESEARCH DIRECTIONS

SCM, and its core philosophy of integration, 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 (Forrester, 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. (p. 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” over half a century ago, it seems pertinent to raise questions concerning how this breakthrough – mainly in relation to integration and managing relationships between supply chain companies – has impacted on companies in reality. In fact over 40 years after Forrester’s article first appeared, Mentzer et al. (2001), in concluding their paper, ask the specific question: “How prevalent is SCM?” This is a key question to which ongoing research needs provide some answers.

A number of authors have raised serious questions about the real impact of SCM in practice. Cousins et al (2006) suggest that:

SCM still appears to suffer from an underlying frustration or perception of being largely ignored; practitioners feel they have a great deal of value to add, but the organisation is not concerned with them. (p. 699)

Storey et al (2006) raise doubts about the “more full-blown claims of many of the advocates (of SCM)” and suggest that “the pretence that SCM is a discipline which is effectively grappling with these forces is an exaggeration” (p. 771). They also

state that the SCM literature tends “move rather imperceptibly between description, prescription and trend identification”. This results in what New (1997) referred to as ‘normative tension’ between the *is* and the *ought*:

The rhetoric of managerial folklore tells managers to feel that they should take a broad, integrative approach and “manage the whole chain”, and this often clouds practitioner reports, with both overstatement and yet profound cynicism. (p. 16)

He goes on to suggest that “academics too are often guilty of perpetuating a type of breathless hyperbole” and to note that “researchers must grapple with the fact that (SCM) exists in the netherworld of the imperative and the actual” (p. 16).

Empirical research is needed to disentangle the rhetoric from the reality, with particular reference to SCI concepts and principles. Much of the earlier empirical research in this field has focussed on specific elements of the overall SCM concept rather than on wider cross-functional and inter-organisational integration. A key aspect of this research involves moving beyond these specific foci and examining SCI in a more *holistic* manner. Current research being undertaken by the author is attempting to address these issues by adopting an integrated research design based on the principles of triangulation.

CONCLUSION

There is significant evidence that the effective implementation of integrated SCM has the potential to generate significant improvements in the performance of firms. For example, on the basis of a study of 196 firms Li et al., (2006) concluded that higher levels of SCM practice “can lead to enhanced competitive advantage and improved organizational performance” (p. 107). Similarly, the work of Frohlich and Westbrook (2001) based on a survey of 322 global manufacturers strongly

supported the hypothesis that “the companies with the greatest arcs of supplier and customer integration will have the largest rates of performance improvement” (p. 193). This is significant given the centrality of integration in SCM philosophy. This chapter has discussed the role of integration as part of the overall SCM paradigm.

However, the adoption of SCI concepts and principles is not without its challenges. For example, Fabbe-Costes and Jahre (2008), based on a systematic review of 38 papers on the subject of SCI note that:

Even though half of the papers of our total sample conclude that SCI has a positive effect on performance, the variety of empirical bases and the research design of the studies suggest that caution is advisable. (p. 140)

In a similar vein, Storey et al (2006) assert that, “while there is an emerging body of theory which ostensibly offers a relatively coherent and compelling prescriptive narrative, predominant practice is at considerable odds with this conceptualisation” (p. 755). Future research needs to address this conundrum if the true potential of the integrated SCM narrative is to be realised in practice.

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