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Edward Sweeney

Technological University Dublin, edward.sweeney@tudublin.ie

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Managing Information Flows

the key to effective supply chain integration

Edward Sweeney

Supply Chain Integration

An article in the last issue of *Logistics Solutions* (Sweeney, 2006) presented a discussion of both the historical evolution of supply chain management (SCM). From this it is evident that the concept of integration lies at the heart of SCM philosophy (see, for example, Christopher, 2005; New, 1996, 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; and,
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 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 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 worked 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 (New, 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). 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.

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 1.



Figure 1 – The Internal Supply Chain

Traditionally these functions have been managed in isolation, often working at cross purposes. 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 2.



Figure 2 –Integrating the Internal Supply Chain

This shift from 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 introduced in the earlier article (Sweeney, 2006). 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 pre-requisite 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. Organisations have long realised the need for company-wide approaches to organisation design and redesign. The development of systems engineering approaches to manufacturing system redesign in the 1970s and 1980s (see, for example: 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 a 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 who have generated significant improvements in competitive advantage as a result of the application of this “total systems” thinking (see, for example: Checkland and Scholes, 1999¹; Sweeney, 1999).

Finally, elements of two particular SCM definitions highlight some of the key organisational issues associated with internal integration. Monczka *et. al.* (1998) state that, ‘ SCM requires traditionally separate materials functions to report to an executive responsible for coordinating the entire materials process’. In a similar vein, Houlihan (1988) notes that, in an SCM environment, ‘responsibility for the various segments of the supply chain is not fragmented and relegated to functional areas such as manufacturing, purchasing, distribution and sales’.

¹ Peter Checkland is particularly associated with “Soft Systems Methodology” (SSM).

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 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.

The simplistic representation in Figure 3 (below) of an 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.

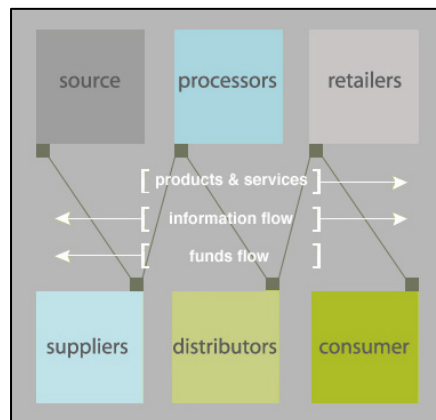


Figure 3 – The External Supply Chain

This issue is central to most 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').

Making Integration a Reality

Virtually all contemporary definitions place a strong emphasis on the needs 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 internal integration has implications for the design of organisational structures. Many 'leading edge' companies may well have adopted this philosophy to varying degrees but there is a need to understand its role and impact in the wider business community. 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. Information and communications technology (ICT) has a potentially pivotal role in this. To understand this, the manner in which the various "flows" in the supply chain should to be managed needs to be considered.

Supply Chain Flows

Forrester's pioneering article from almost half a century ago (Forrester, 1958) established a specific link between corporate success and the interactions between five flow systems:

- information;
- materials;
- money;
- manpower; and,
- capital equipment.

Since then, the concept of different flows interacting with each other, and the need to proactively manage these flows is a theme which has been the subject of much research and discussion. For example, Jones and Riley (1985) suggested that 'SCM is concerned with the total flow of materials from suppliers through end users'. Stevens (1989) suggested that the objective of SCM is 'to synchronize the requirements of the customer

with the flow of materials from suppliers'. Christopher and Ryals (1999) emphasise the importance of managing 'the flow of product and related information'.

In essence, for a supply chain to achieve its maximum level of effectiveness and efficiency, material flows, money flows and information flows throughout the entire chain must be managed in an integrated and holistic manner, driven by the overall service and cost objectives. The view of an external chain shown in Figure 3 (above) indicates the way in which material, money (funds) and information flow between the companies which participate in the chain. Similar flows typically occur between the functions which comprise the internal chain. The following sections provide an overview of some of the issues involved in managing these material, money and information flows, with a particular emphasis on the latter.

Managing Material Flows

Figure 3 (above) shows the flow of material ("products and services") from the source of materials forward (or upstream) to the final consumer in the external chain. It should be noted that there is also a backward (or downstream) flow of materials, mainly associated with product returns. The growing importance of reverse logistics in recent years has sharpened the focus on management of these flows. For example, "Return" is the process most recently incorporated into the SCOR model (Supply Chain Council, 2005)².

Much SCM theory has its origins in the well established field of materials management. The evolution of materials management in many ways mirrors the evolution of SCM as a whole. For example, the focus on manufacturing inventory reduction in the 1960s and 1970s became an integral part of the broader field of materials management in the 1980s and early 1990s (Sweeney, 2006). The need for more integrated approaches to materials management across the supply chain became a strong focus in the 1990s (see, for example: Hines, 1993). It could be argued that the whole field of logistics, with its origins in a military context, is fundamentally concerned with the efficient and effective management of the flow of materials through supply chains (see below). In any event,

² The SCOR model Version 8.0 was released by the Supply Chain Council in June 2006.

ensuring that the right materials are in the right part of the supply chain at the right time, remains an integral element of the SCM field.

Managing Money Flows

In a supply chain, money flows from the ultimate consumer of the product back down through the chain. The timing of these flows is critical in ensuring that supply chain companies maintain the ability to meet their ongoing operational expenditure commitments. The working capital cycle – a well known construct in the field of financial management (see, for example, Keown *et. al.*, 2004) – provides a useful representation of financial flows in a supply chain (see Figure 4).

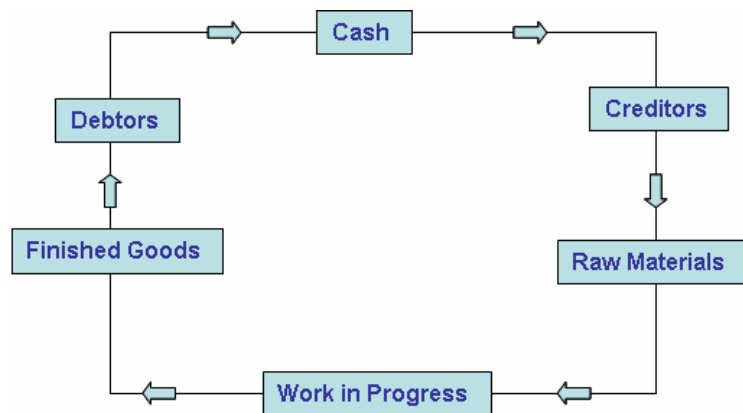


Figure 4 – The Working Capital Cycle

A performance metric used within the SCOR model is cash-to-cash cycle time (Supply Chain Council, 2005). This is defined by adding the number of days worth of inventory held to the number of days of receivables outstanding and then subtracting the number of days of payables outstanding. The result is a measure of the number of days of working capital that are tied up in managing the supply chain.

Managing Information Flows

As shown in Figure 4 (above) information flows in the supply chain are bidirectional. From an SCM perspective, it can be argued that managing the information flows is the most critical of the activities described in this article. This is because the flow or movement of materials or money is usually triggered by an associated information movement. Effective management of material and money flows is, therefore, predicated upon the effective management of the related information flows. It is not surprising, therefore, that recent years have seen a huge interest in this area in the literature (see, for example: Evans *et. al.*, 1993; Mason-Jones and Towill, 1998). The bullwhip effect to which Forrester (1958) referred is essentially the product of poor information management in the supply chain and leads to a requirement to hold excessive inventory levels. The corollary of this is that if levels of demand visibility are high throughout the supply chain then inventory levels can be reduced. As Christopher (2005) notes, good information effectively becomes a substitute for high levels of inventory.

Recent years have also seen rapid developments in ICT used to facilitate SCM. McDonnell *et. al.* (2004) proposed a taxonomy of supply chain ICT solutions which identifies four primary categories as follows:

1. Point solutions: used to support the execution of one link (or point) in the chain (e.g. warehouse management systems or WMS);
2. 'Best of breed' solutions: where two or more existing stand-alone solutions are integrated, usually using middleware technology;
3. Enterprise solutions: based on the logic of enterprise resource planning (ERP), these solutions attempt to integrate all departments and functions across a company into a single computer system that can serve all those different departments' particular needs; and,
4. Extended enterprise solutions (XES): refers to the collaborative sharing of information and processes between the partners along the supply chain using the technological underpinnings of ERP.

The move away from point towards enterprise solutions in many ways reflects the shift from internal and functional, to external and process, management orientations in recent

years (as highlighted earlier). Other technologies, in particular electronic data interchange (EDI) and the Internet, have enabled supply chain partners to use common data. As noted by Christopher (2000), this facilitates supply chain agility as companies can act based on ‘real demand, rather than be dependent upon the distorted and noisy picture that emerges when orders are transmitted from one step to another in an extended chain’.

Some Concluding Points

Effective management of supply chain flows provides the key to putting the philosophy of SCM, based around the concept of integration, into operational practice. It highlights the specific activities that need to take place, and places a strong emphasis on the need for an integrated and holistic approach to their management. A stepwise decomposition of the buy-make-store-move-sell model, as carried out in the SCOR model, identifies in more detail what these activities are and how they interact. Indeed, most of the activities typically seen by companies as being part of SCM relate to the planning and control of these elements of supply chain functionality (Fawcett and Magnan, 2002). In this context, “planning and control” is concerned with material, money and information throughout the supply chain.

The centrality of information management in effective supply chain design is a central theme in contemporary thinking. Recent years have seen the development and proliferation of a range potentially valuable ICT tools. The key is to view ICT as a tool which has the capability of enhancing supply chain integration levels. For this reason, technology has become a critical SCM enabler in that it enables or facilitates higher levels of both internal and external integration.

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The Author

Edward Sweeney was recently appointed Head of Lifelong Learning at the Institute of Technology, Carlow. In this capacity, he works with leading organisations in the South Leinster area and beyond. He was previously Director of Learning at NITL and Chief Editor of *Logistics Solutions*. His current research interests are in the area of competency development requirements for supply chain managers in the light of some of the developments described in this article. Edward's research is widely published, most recently in the *International Journal of Logistics Management* and the *International Journal of Logistics: Research and Applications*.