Developing a Sustainable Supply Chain Management Framework

Assoc. Prof. Ruth Banomyong, Mr. Paitoon Varadejsatitwong
and Mr. Kavin Kitcharoen

Centre for Logistics Research, Thammasat University

Abstract

Some of the key management approaches to SCM today include outsourcing of procurement processes, collaborative planning and partnerships between customers and suppliers, and Integrated Supply Chain (ISC) design, involving all areas of the organisation. These approaches are closely linked to the latest advances in manufacturing technology including agile manufacturing and postponement technology.

Organisations with long and complex supply chains, whether they are at the beginning (such as chemicals), in the middle (such as logistics companies), or at the end (retail businesses) of the supply chain, need to understand the sustainability aspects of their supply chains. Supply chain sustainability issues can range from child labour and exploitation of workers on the one hand to ozone depletion, deforestation and global warming on the other. These issues can be broken down according to environmental, social, and economic aspects. Some of the tools used in sustainable supply chain management (SSCM) include written policies and communications materials, pre-qualification of suppliers (using environmental and/or social/economic criteria), purchasing guidelines and supplier partnerships, and development.

Companies are now realising that the value they provide to their customers is the sum of all the 'value added' along the supply chain. In the same way, the sustainability of the goods and services an organization provides is also the sum of all the social, economic and environmental impacts of these goods and services along the supply chain. Therefore, organisations are beginning to recognise that they have to identify, understand, and manage sustainability issues within their organisation, but also co-operate with other organisations in the supply chain to ensure that these issues are successfully managed throughout the supply chain.

The aim of this study is to develop a sustainable supply chain management framework that can assess the related sustainable dimensions. The authors will try to define the concept of "sustainable supply chain management" and identify sustainable metrics.

Introduction

Organisations with long and complex supply chains, whether they are at the beginning (such as chemicals), in the middle (such as logistics companies), or at the end (retail businesses) of the supply chain, need to understand the sustainability aspects of their supply chains. Supply chain sustainability issues can range from child labour and exploitation of workers on the one hand to ozone depletion, deforestation and global warming on the other. These issues can be broken down according to environmental, social, and economic aspects. Some of the tools used in sustainable supply chain management (SSCM) include written policies and communications materials, pre-qualification of suppliers (using environmental and/or social/economic criteria), purchasing guidelines and supplier partnerships, and development.

Objective

The purpose of this research is to provide an overview of the advanced techniques in SCM and SSCM, and an overview of the application of SSCM. The initial conclusions from discussion are aimed at providing stimulus for discussion and to provide a baseline for the remainder of the Supply Chain Performance Evaluation research stream. The results of the research will then act as an input into the overall research that aims to examine the feasibility of developing a sustainable supply chain management system for public and private organisations.

On a more detailed level, the objectives of this research are defining SSCM and developing the metrics to measure SSCM performance.

Literature Review

This section looks at the terminology used in the field of SCM and SSCM, including its definitions, scope and level of acceptance. 'Supply Chain Management' (SCM) is a relatively new term for a concept that is still evolving. Consequently, there still exists a certain lack of common understanding in organisations about what SCM means and how it differs from other similar terms, such as 'demand chain', 'value chain' and 'logistics', which are sometimes used interchangeably. This lack of clarity is carried over into the concept of 'sustainable supply chain management' (SSCM), which at the moment is seldom used and as a term is subject to considerable misunderstanding. This misunderstanding is complicated by the general lack of a clear definition of 'sustainable'.

Supply Chain

It was found in the literature and through the interviews that various terms are used interchangeably for 'supply chain', such as 'demand chain' and 'value chain'. However, these terms convey slightly different conceptual meanings. For example, the Massachusetts Institute of Technology (MIT), a leading US institute researching supply chain issues defines 'supply chain' as the flow of materials, information and funds between different parties or organisational functions (Metz, 1998).

This relatively generic definition of a supply chain differentiates the term slightly from related terms, such as 'value chain' and 'demand chain' in that the latter two terms imply a customer focus, while the former concentrates on the operational flows. For instance, value chain, a term coined by Professor Michael Porter at the Harvard Business School in the US, is used to describe all the strategically relevant activities, such as inbound logistics, operations, outbound logistics, marketing and sales, service, etc., that an organization performs to 'add value' to its products or services for its customers (Kennedy, 1993). While this concept includes many of the same organisational functions as the MIT supply chain definition, the emphasis is clearly on the customer and the customers' needs, rather than on a description of the operational flows.

Similarly, demand chain is a way of looking at the steps involved in the creation of products and services from a customer viewpoint. From an organisational perspective, the concepts of value chain and demand chain are conceptually important as they stress the need to focus material, financial and informational flows (the MIT definition of supply chain) from the perspective of customer(s), without whom the supply chain would not exist.

However, the MIT view of the 'supply chain' is not the only definition. Others, such as the UK-based Institute of Logistics (IOL) highlight a multitude of definitions of

supply chain, from the process of supplying customers from the factory 'to the total process from raw materials to the customer'. However, both points out that supply chains are intended to satisfy customers. This definition is much more closely related to the concepts of value chain and demand chain described above; the initial desk research, it seems that at present, there is no one agreed definition of supply chain.

This conclusion is reinforced by the interviews e.g. supply chain definitions vary considerably. For instance, most interviewees defined their supply chains as only representing their immediate 1st or 2nd tier suppliers. Others saw their supply chains as representing only the process of distributing and delivering products and services to their customers. Only a few of the most proactive organisations (in terms of supply chain issues) defined their supply chains as stretching from their most distant suppliers to the end-user, and everything in between.

These differences demonstrate a significant lack of consensus in the scope and understanding of the term 'supply chain' in many organisations, across all sectors. Often the difference related to the position of the interviewee in the organisation and his/her particular perspective. In other words, people in the purchasing department most often defined supply chain exclusively in terms of the organisation's upstream suppliers, while those in other functions had different perspectives and different definitions. Taking the broadest definition of the supply chain as representing all activities from resource extraction to the customer (and back again), this indicates a significant lack of integrated supply chain thinking within many organisations.

SCM

Given the lack of consensus on the meaning and scope of 'supply chain', it is not surprisingly that the definition and understanding of the term 'supply chain management' (SCM) also differs considerably. SCM denoted the management of that part of the supply chain which they recognised.

Again, this was very much based on the position and perspective of the particular person interviewed. For purchasers, it meant the management of suppliers, for those in distribution, it meant the management of distribution and delivery. Only in the most integrated supply chain organisations, such as Dell Computer, Walmart, Tesco and Volkswagen, does SCM appear to mean the integrated management of materials, information and financial flows from raw material extraction to end-user.

In some organisations, notably governmental bodies, the term 'SCM' is not considered relevant, i.e. not part of the terminology used. In these organisations procurement is the term used to denote the relationship between the organisation, its direct suppliers (vendors, contractors) and its customers (various departments and agencies). Rather than managing their 'supply chain,' they manage the 'procurement process'.

Another term that is commonly used interchangeably with SCM is logistics. However, some undertaking research in this area do see a difference. For instance, according to Professor Martin Christopher of Cranfield School of Management in the UK, logistics is more focused on the planning and synchronisation of material movements within an organisation and to the customer, while SCM is a more holistic term referring to the management of information, materials, funds and relationships outside and through the organisation, from the "supplier's supplier to the customer's customer."

From these definitions it can be seen that the definitions of SCM and logistics are still evolving (as are the processes they define) and therefore, there is no universally agreed definition at this time.

SSCM

Given the uncertainties and lack of clarity involved in defining 'supply chain' and 'SCM', it is not surprising to find a considerable amount of confusion over 'sustainable SCM'. In addition to the differences already mentioned above, the definition of 'sustainable supply chain management' (SSCM) is further confused by a lack of understanding and clarity regarding the term 'sustainable'. Many of the interviewees had to ask what we meant by the term sustainable before they could answer questions about it.

Some interviewees saw 'sustainable' from a purely economic perspective, i.e. that SSCM meant the long term profitability, or at least solvency, of the supply chain over time. Of those that saw 'sustainability' from the perspective of 'sustainable development', i.e. in the sense of "[development that] meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987), the vast majority define this in terms of 'environmental sustainability' or more specifically environmental management. Most efforts to integrate social, ethical, and environmental issues into SCM have so focused on environmental issues. From this has developed terms such as supply chain environmental management (US-AEP, 2000) and green procurement, both of which focus on the environmental aspects of managing supplier/customer relationships, with the former taking a broader approach and definition of 'supply chain' and the latter being more concerned with the incorporation of environmental issues into the purchasing process with 1st tier suppliers. Many interviewees claimed to have environmental programmes and not 'sustainability programmes'. Many interviewees were aware that there were other issues involved in sustainability and that they were not addressing them as thoroughly as environmental issues.

As for social and ethical issues, a few organisations, such as B&Q, Co-operative Bank and The Body Shop in the UK, and Ben & Jerry's Ice Cream (now part of Unilever) in the US, are looking at social and ethical issues in their supply chains, alongside environmental issues. For these organisations, SSCM does mean the integration and management of social, ethical, environmental and economic issues in their supply chains.

Framework and Methodology

A new framework for performance measurement is described. It is based on quantitative and qualitative measurements. Some performances are simply quantitative and can be observed easily. This means that they are easily understood as they are usually represented numerically, such as cost represented by money. It is no doubt understood that a lower cost would be preferred in most cases. Other common criteria are cost and resource utilisation, which are the first and are believed to be the most important measures for most people. Qualitative criteria, such as trust and visibility, which are more conceptual, also have an influence on the performance.

Quantitative measurements, such as cost and resource utilization are direct concepts which can be immediately related to how they are judged. Cost should be kept as low as possible, and resources should be kept to an optimum amount for effective use.

Some other factors are recognised and understood to be important for performance; however, it is difficult to quantify them. Many quality assurance systems have been launched to approve products or services as meeting the above standard. The measurements should be quantified as time and accuracy. Details of these measurements will be discussed in the following section.

In the environment of supply chains, the involvement of different companies has also relied on their trust and visibility. These two concepts have not been discussed in detail in previous work. They are also qualitative, but can be measured. Two other concepts are also the current issue in any business, they are the flexibility and innovativeness. They are still new issues and can be investigated for the development of a good supply chain.

Key Finding

This section explores supply chain sustainability issues facing organisations and examples of the advanced strategies and management practices being used. This section also looks at some the organisations that are currently involved in projects, programmes and activities on various aspects of SSCM.

Current trends towards the increasing globalisation of consumption patterns, global sourcing, outsourcing and specialisation are both causing and the result of increasingly long and complex supply chains. In parallel, 24 hour CNN style news reporting and the explosive growth of the Internet are increasingly exposing the unsustainable practices 'hidden' in some supply chains e.g. use of child labour. Organisations with long and complex supply chains, whether they are at the beginning (e.g. chemicals), in the middle (e.g. logistics companies), or at the end (e.g. consumer electronics, automotive, retail, government, etc.), are increasingly having to come to terms with the sustainability aspects (particularly environmental) of their supply chains and are needing to find ways of managing them.

Supply chain sustainability issues can range from child labour and exploitation of workers on the one hand to ozone depletion, deforestation and global warming on the other. These issues can be broken down according to environmental, social, and economics aspects.

Despite the list, organisations implementing SSCM activities are still focused on environmental issues. This is partly due to significant external pressures to address these issues, in the form of standards, regulations and business-to-business pressures, and partly as a result of environmental issues receiving increasing attention in the media. For most of the organisations interviewed in this report, environmental issues were already part of the corporate agenda with clear lines of responsibility within organizations and an increasingly focus on supply chains.

Social and ethical issues were seen as less tangible and more difficult to address, the notable exception was the retail sector where a number of initiatives have started. Some interviewees saw these issues as too political (as meaning party political) and others indicated that social and ethical issues were not in the lexicon of their organisations.

Specific Supply Chain Indicator

According to the previous section, the customer satisfaction is one of the effective SCM performance measures. To understand more about the customer satisfaction, the definition of satisfaction must be defined.

In 1987, Kotler and Clarke defined the satisfaction as the state felt by a person who has experienced a performance (or outcome) that has fulfilled his or her expectations. Satisfaction is thus a function of relative levels of expectation and perceived performance…Expectations are formed on the basis of past experiences with the same or similar situations, statements made by friends and other associates, and statements made by the supplying organization.

Satisfaction was defined by Oliver (1997) as the consumer's fulfillment response. It is a judgment that a product or service feature, or the product or service itself, provided (or is providing) a pleasurable level of consumption-related fulfillment, including levels of under- or over-fulfillment.

From the above definitions, it can conclude as customer satisfaction considers the fulfillment response. This satisfaction fulfillment should be the performance of the order management process from the time the order is taken through to the time the product is delivered to the customer. Then, the **Delivery In Full and On Time (DIFOT)** will be recommended as the supply chain performance measurement.

Specific Social Indicator

The transparency, companies are facing increased demands for transparency and growing expectations that they measure, report, and continuously improve their social, environmental and economic performance. Companies are expected to provide access to information on impacts of their operations, to engage stakeholders in meaningful dialogue about issues of concern that are relevant to either party and to be responsive to particular concerns not covered in standard reporting and communication practice. Leadership companies are also investigating various types of audit and verification as a further means of increasing the credibility of their transparency and reporting efforts. Increasingly, demands for greater transparency also encompass public policy; stakeholders want to know that the way companies use their ability to influence public policy is consistent with stated social and environmental goals. As part of this move toward greater disclosure, many companies are putting increasingly detailed information about their social and environmental performance -- even when it may be negative -- onto their publicly accessible websites.

Specific Economic Indicator

The key metric driving the performance improvements, **C2C or cash conversion cycle**, is a composite metric. It has been described as "the average days required to turn a dollar invested in raw material into a dollar collected from a customer" (Stewart, 1995). Dell's cash management has resulted in a negative cash conversion cycle that has improved from four days in 1997 to 30 days in 2001. It is argued that with a negative C2C, the Dell model will generate cash, even if the company was to report no profit whatever (Gurley, 2001).

Existing definitions of C2C are not always consistent. Definitions can range from a general statement, such as "C2C is a composite metric describing the average days required to turn a dollar invested in raw material into a dollar collected from a customer" to the simple description that C2C reflects "the length of the time between cash payment for purchase of resalable goods and collection of accounts receivable generated by sale of these goods" (Moss and Stine, 1993). A later definition uses the operating cycle as the primary criteria stating, "the cash conversion cycle measures the number of days the firm's operating cycle requires costly financing to support it. You

can think of the operating cycle as the number of days sales (are) invested in inventories and receivables" (Gallinger, 1997).

Specific Environmental Indicator

Product stewardship and life-cycle assessment is increasingly being used as a way of ensuring supplier and buyer organisations and the sourcing of raw materials are meeting ethical guidelines. The Body Shop, for example, undertakes a life-cycle assessment for all suppliers of raw materials. The focus of the assessment is on origins of feedstocks, methods of extraction and cultivation, processing, resource consumption, waste generation, and distribution.[1] Unilever has also conducted life-cycle assessments for several of its key products: tea, frozen vegetables, ice-cream, margarine and tomato-based sauces.[2]

The extent to which environmental factors are *integrated into management decisions* varies. For example, all the large banks have implemented a number of internal environmental policies and programs, including: efficient energy and water management, recycling and sponsoring community-based environmental initiatives. However, many of these are ad hoc and do not appear to form part of an overall business strategy. The recent PriceWaterhouseCoopers UNEP (2000) Financial Initiatives survey found that it was difficult to establish managerial accountability for these programs, their objectives, targets and performance.

Moreover, an increasing number of companies are beginning to *'green' their supply chain* by working on environmental initiatives with their suppliers. Examples of supplier environmental management include screening suppliers for environmental performance, working collaboratively with suppliers on green design initiatives and providing training and information to build suppliers' environmental management capacity. It is becoming more common for companies to include ISO 14001 compliance as a minimum standard in their procurement policies.

Several multinational companies, such as Ford, now require that all suppliers with manufacturing facilities become ISO 14001 certified. Other companies adopting this approach include SouthCorp (a wine producer), which has committed to reject grapes from growers who by 2005 have not implemented 'worlds best practice' salinity controls and water quality measures, and Unilever, which has committed to sourcing all its fish from sustainable sources by 2005.

Then this research, the **waste management and environmental standard policy** will be used as a performance measurement.

Conclusion

This research investigated the environmental, social and economic impacts in supply chain management (SCM), and how different organisations are addressing the issues of sustainable development. The main finding of the research is a lack of clarity in the definitions and scope of the terminology used in SCM and sustainable SCM. The definitions of 'supply chain', 'demand chain' and 'value chain' are sometimes used interchangeably, although there are differences. Similarly, 'logistics' is often substituted for 'SCM '. The term 'sustainable supply chain management' (SSCM) is not in

[1] The Body Shop (2000). *The New Bottom Line*.

[2] Unilever (2000). *How Can We Care for the Environment: Unilever Environmental Performance 2000*.

common usage and there is considerable lack of clarity due to misunderstandings on the meaning and scope of the term ‘sustainable’.

Another finding is most organisations have concentrated their SCM efforts on environmental issues e.g. ‘environmental SCM’, ‘supply chain environmental management’ or ‘green procurement’. These definitions depend on the scope of the organisation’s understanding of the term ‘supply chain’. The most common tools for SSCM have been environmentally based, especially where the environmental drivers have been linked to business risk.

On the other hand, social and economical management strategies have appeared most commonly in the retail sector, where customers consist of the general public and social and economical issues are more salient due to the physical association of the product with the supply source.

Key factors that have influenced successful SSCM have been the power of companies over the supply chain and the role of business risk drivers in forcing companies to manage risk more effectively into their supply chains. However, the key measure of the success of SSCM tools appears to be the amount of buy-in from senior management. The further research is needed to determine a more thorough understanding of SSCM practices and tools of performance measurement.

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