

Can the SME survive the supply chain challenges?

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Abstract

Purpose – The purpose of this paper is to focus on small and medium sized enterprises (SMEs) and the extent to which they are prepared to meet SCM challenges through the use of modern planning and control methods.

Design/methodology/approach – The study is based on a cross-sectional survey of 200 Norwegian companies with informants mainly related to the SCM function and from top management.

Findings – The findings clearly indicate that SMEs give less attention to planning and control methods than LEs. SMEs are less satisfied with the methods applied; less concerned with methods supporting SCM on product quality, rationalisation of operations and capital cost rationalisation; less focused on system integration with other actors in the supply chain; and less focused on EDI and e-based solutions.

Research limitations/implications – The study focuses primarily on managerial components and excluded logistics structures and business processes that are more or less inter-related.

Practical implications – Horizontal cooperation or vertical integration can reduce the information technology gap by sharing planning and control systems. The suppliers of support systems should consider delivering complete “turn-key” solutions for revitalising the supply chain functions, specifically targeted towards SMEs.

Originality/value – The strength of this study is that it has been able to identify systematic differences between LEs and SMEs across sectors with respect to how SCM challenges are met.

Keywords Small to medium-sized enterprises, Distribution management, Electronic commerce, Business planning, Production planning and control, Norway

Paper type Research paper

Introduction

Supply chain management (SCM) has increasingly become an important way to enhance competitive strength, and it is commonly argued that present day competition is between integrated supply chains rather than individual organisations. Studies of companies exploiting the benefits of SCM have indicated improvements in individual supply chain functions ranging from 10 to 80 percent (Wagner *et al.*, 2003). Reduced software costs, industry-wide learning of best practices and increased probability of having to compete against rivals enjoying the advantages of SCM are driving forces behind adoption of the SCM concept (Trebilcock, 2002; Arend and Wisner, 2005). The integration of key business processes among the partners in a supply chain aims at adding value for the customers. This integration is achieved by connecting suppliers, through manufacturing and assembly companies, to distributors, retailers and end-customers to make the process

more efficient and the product and services more differentiated (Arend and Wisner, 2005; Wisner, 2002; Tan, 2001).

The potential benefits of SCM include product and delivery process quality such as shorter delivery times, more reliable delivery promises, fewer schedule disruptions, cost savings (for example, significant reductions in inventories) and risk reductions (Christopher, 1998; Bask and Juga, 2001). Furthermore, integration of processes in the supply chain can also enhance the ability to leverage its scalable competences, for example, the enforcement of innovative product design and radical process innovation, and to access complementary partner assets (Arend and Wisner, 2005).

Despite the fact that there is no generally agreed definition, supply chain management (SCM) is generally intended to cover all business processes between vertically linked organisations (Bowersox *et al.*, 1999; Cooper *et al.*, 1997; Lambert *et al.*, 1998; Bask and Juga, 2001). Persson (2002) suggests three groups of SCM definitions:

- 1 *actor-oriented* definitions (e.g. Lamey, 1996) focus on how to organise and manage the flow of materials from “point of origin” to “end user” as the point of departure;

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- 2 *relation-oriented* definitions (e.g. Aitken, 1998) focuses on the relationships between the actors in the supply chain, and how co-operation and mutual interest can lead to improvements; and
- 3 *process-oriented* definitions focus on activities and processes in the supply chain and typically define SCM as “the integration of key business processes from end user to original suppliers that provide products & services and information that add value to customers and other stakeholders” (Lambert *et al.*, 1998).

Our understanding of SCM as discussed in this paper is based on the process-oriented definition.

The ability to develop and maintain sound business relationships across company boundaries is an important issue when managing a supply chain. It is therefore essential to recognize the power structures that exist between buyer and seller (Cox, 1999), or what Cox *et al.* (2004) refer to as the “power resources” in the transactions. Only by understanding the existing power regime can buyers and suppliers manage relationships in an appropriate manner (Cox, 2004). It has been suggested that most Western suppliers are basically opportunistic rather than deferential, and have little incentive to tie themselves to one customer unless they are forced (Cox, 1999). This implies that a buyer is able to achieve improved performance from suppliers in situations of buyer dominance or interdependence (Cox *et al.*, 2004) and *vice versa*. Dominant players are able to direct, or obtain access to all crucial resources in a supply chain structure of dominance and dependency (Cox, 1999).

A supply chain includes several focal organisations. In other words, the customer (with the exception of the end-user) is also supplier, and any supplier (except for the very first link in the chain) is also a customer. Every focal organisation has its own supply chain, and hence represents rather a complex network rather than a conventional chain. In this perspective, it is highly relevant to focus on co-operation between several parties embedded in the network. We therefore find the model of Lambert *et al.* (1998) useful, where they suggest a combination of three closely related elements when studying supply chains. The first, the supply chain *structure*, is determined by the network of participants involved in the supply chain and the relations between those. Secondly, business *processes* are defined by the activities that produce a certain output of value for the customer. Finally, the *management components* describe how business processes and structures are integrated. The management components will be discussed and investigated in this paper.

The SME and supply chain adoption

Despite the substantial benefits of SCM, it is also evident that SCM implementation has its costs, hazards and challenges. Furthermore, there are indications that small and medium-sized enterprises (SMEs) are less able to harness the benefits of SCM or encounter greater obstacles when trying to introduce SCM practices. Recent studies have indicated that SMEs and large enterprises (LEs) differ in performance after the introduction of SCM. Some studies have identified problems of such a magnitude that SCM implementation is negatively correlated with SME performance (see Arend and Wisner, 2005).

Lack of performance among SMEs after the introduction of SCM, as compared with larger companies, can be related to several reasons. Studies focusing on the *processes* suggest that SMEs and LEs implement SCM differently, and apparently this difference in implementation is significantly associated with SME performance (Arend and Wisner, 2005). Differences in implementation were also identified in a study of 288 UK small to medium-sized industrial enterprises (Quayle, 2003), which pointed towards lack of effective adoption of SCM techniques. Issues such as new technology, R&D and e-commerce, which are normally associated with innovations in a supply chain context, were regarded as low priority items. These findings were generally supported by the study of Wagner *et al.* (2003), although the latter study also identified considerable diversity among SMEs with regards to technological adoption. In other words, SMEs do not appear to implement SCM as deeply as LEs, and consequently receive fewer advantages from other actors in the supply chain.

The reasons for lack of implementation can also be related to *structures* in the supply chain. This includes resource structures and how various assets are linked and shared between collaborating actors. Effective resource structures are crucial when developing virtual companies and virtually integrated supply chains (Skjoett-Larsen, 2000). Reduction of inventories is a second example of structural issues. These reductions easily impose significant changes in activity structures with implications for the logistics structures and the physical flow throughout the supply chain (Lee and Billington, 1993; Sullivan, 1997; Das and Tyagi, 1997; Christopher, 1998).

A last group of studies focuses on how processes and structures are combined in terms of the *management components* of the supply chain (Lambert *et al.*, 1998). One of the management components is related to the *behavioural side* of management including the power aspect between companies and risk and reward structures. One study claims, for example, that if a key partner forces a less powerful SME supplier to implement SCM, the performance in the chain will increase (Arend and Wisner, 2005). The literature also indicates that SMEs in general are not able to implement SCM to its full extent, mainly because they are managed at arm's length by larger customers and have to follow the norms stipulated by the buyer (Arend and Wisner, 2005). Other findings suggest that since larger companies consider SMEs as being easy to replace, buyers are reluctant to form partnerships with SMEs (Arend and Wisner, 2005). Systems, tools and methods also represent significant differences between SMEs and larger companies, for example in relation to adoption of electronic interfaces between actors in the supply chain. Whereas larger companies have the resources and technical budgets to implement e-business and e-supply strategies, SMEs will continue to be challenged by resource limitations (Wagner *et al.*, 2003).

The tools for improving SCM and overall competitiveness include more than e-business and e-supply. Prior studies indicate a significant gap between the “big” company and the SME with respect to implementing various tools and ideas included in supply chain management concept (see Quayle, 2003). Studies also indicate a considerable gap between what is normally considered as important SCM tools and ideas and the reality that SMEs operate in. This implies that some of the crucial tools and concepts that enhance supply chain competitiveness do not receive the necessary degree of attention among SME business managers.

The SME and e-commerce

Several studies have specifically scrutinised the diffusion of electronic markets, electronic data interchange and internet commerce among SMEs (e.g. Wagner *et al.*, 2003; Quayle, 2003; Smyth and Ibbotson, 2001; Drew, 2003; Grandon and Pearson, 2004; Tiessen *et al.*, 2001). The exploratory study by Wagner *et al.* (2003), based on in-depth interviews with 21 senior managers of Scottish SMEs revealed that the propensity for introduction of e-commerce varies by industry and sector factors. Not surprisingly, firms with entrepreneurial orientation and high technology content in their products exhibit significantly higher e-business adoption rates (Wagner *et al.*, 2003). Other SMEs with limited technology content suffer from lack of funding and expertise, thus reducing their ability to exploit technology available beyond the initial web page design (Wagner *et al.*, 2003). These barriers were also investigated in a study of SMEs adoption of e-commerce in internationalization processes. Lack of familiarity with the technology and its benefits, and barriers related to high costs and security concerns were found to be significant (Tiessen *et al.*, 2001). Furthermore, few firms had any kind of strategic plan or vision for their e-strategy. Two other studies were more optimistic. The first, based on companies in the east of England, found that notwithstanding a slower adoption among SMEs compared to LEs, the significance of the barriers to introduce e-commerce was considered weak (Drew, 2003). Faced with the risk of losing competitive strength in relation to larger companies combined with awareness of the new opportunities for growth, e-commerce was likely to be a central part of SMEs business strategies in the coming years (Drew, 2003). The second study, based on US informants, supports some of this optimism by suggesting that lack of financial and technological resources to adopt e-commerce was not found to be a significant factor (Grandon and Pearson, 2004). Willingness and ability to adopt e-commerce among SMEs were determined by perceived usefulness, perceived ease of use, compatibility, and external pressure (Grandon and Pearson, 2004).

While we acknowledge the importance of logistics processes and structures in creating sustainable supply chains, this paper will focus on methods supporting the management of supply chains. The basic rationale behind this choice is that prior studies (e.g. Wagner *et al.*, 2003) indicate a significant gap between SMEs and LEs with respect to implementation of state-of-the-art tools and systems supporting effective and competitive supply chains. In the following section the management components, and particularly the planning and control methods, will be further outlined.

The management components of SCM

Physical and technical management components represent one sub-group of the management components, and include planning and information management systems. A study by Lambert *et al.* (1998) clearly indicates that supply chain actors understand physical and technical management components better than the other group of management components. Hence, the physical and technical management components are indeed relevant for comparison of companies, and will be emphasised in this study.

The group of physical and technical components includes the most visible, tangible, measurable, and easy-to-change

components (Lambert *et al.*, 1998). The *work flow/activity structure* is the first component, and describes how activities in the supply chain are carried out. *Organisational structure* indicates how functional areas are integrated within and between the focal companies, and the *product flow facility structure* reveals the managerial complexity. The fourth component, the *structure of the communication and information flow*, describes how effective information is made available throughout the chain. The fifth component, *planning and control methods*, will be addressed in this paper.

Planning and control methods include collection, processing and distribution of information, both within the focal company and across company boundaries. The methods are either functional, for example in keeping track of transportation operations, or cross functional, for example when handling the order process, inventories, sourcing and invoicing. Planning and control methods are crucial for enhancing SCM competitiveness for several reasons. First, these methods may reduce transaction costs considerably, for example, by retrieving and processing data electronically. Secondly, the level of locked up capital can be diminished simply because a smooth and speedy flow of relevant information reduces the uncertainty of the demand patterns in the flow. But even more importantly, modern management methods open up for new business opportunities and radical improvements in the supply chain. For example, electronic commerce is assumed to be one of the most important forces shaping business today (Wagner *et al.*, 2003).

The purpose of this study is to identify company perceptions on key aspects related to the planning and control methods that *support* supply chain management, and to compare small and medium-sized enterprises with larger enterprises. More specifically, the aim of our study is to examine the possibility of systematic differences between the two groups of companies with regards to the following research questions:

- To what extent are planning and control methods (supporting SCM) important for maintaining competitiveness?
- To what extent are the methods in balance with current and future requirements?
- For which type of SCM tasks do the management systems have greatest influence?
- Which methods are most important when integrating with external actors?
- Which order processing methods are currently employed and what changes are expected in the future?
- For which assessments regarding planning and control methods, does company size matter the most?

The paper is organised in seven sections continuing with methodology followed by presentations and discussions of the findings. Finally, a discussion on the limitations of the study and further research is presented made, before the implications of our findings are highlighted in the concluding section.

Methodology

To examine the research questions stated above, the following research approach was applied: as input for developing a survey of Norwegian based companies, structured in-depth interviews were conducted in a total 16 firms. The

interviewees were top-level managers responsible for the supply chain management strategy in their respective companies, and included CEOs, logistics directors and financial directors.

The first selection criteria for the interview sample was that the companies should represent a broad range of industries and markets. Thus, the 16 companies came from different industries, such as piping supplies, maritime and offshore, electrical equipment, telecom, machinery, pharmaceuticals, paper and packaging, print works, lighting supplies, furniture, food products and tobacco. Secondly, the companies should be able to articulate key issues for their respective line of business. In our view the selected companies fit these criteria in the sense that they are all central actors, cover a broad range of products and operate in different markets.

The main purpose of the interviews was to identify the SCM issues that are considered as important by various types of industries and provide guidance for the design of the larger survey, including the construction of the survey questionnaire. A draft outline of the questionnaire had been prepared in advance and was discussed during the interviews. The main advice from the interviewees was to keep the questionnaire focused on SCM issues of general interest and tone down the use of specified questions, particularly if these were relevant or fully understood by only some of the likely respondents. Inventory management and logistical costs are examples of areas where the questionnaire was substantially changed as a result of the interviews.

The questionnaire was pre-tested internally (on colleagues who were not affiliated with the study) and externally (on selected companies) before being distributed. In addition, two SCM experts provided independent assessments of the questionnaire as part of the quality assurance procedure.

Survey sample

The survey sample frame was based on four sources: The company databases of two firms (DHL and KPMG), commercial directories of Norwegian companies and the membership directory of the Norwegian Purchasing Association. Questionnaires were distributed to a total of 838 companies. Completed questionnaires were received from 182 companies, which represent a response rate of 21.7 percent. In addition, all member companies of the Norwegian Purchasing Association were invited to reply, using the web-based version of the questionnaire. This resulted in 20 additional responses. Two of the questionnaires were incomplete and therefore excluded from further analysis. Thus, our findings are based on analysis of data from a total of 200 companies. Descriptive data of the sample are presented in Appendix 1.

Respondents were asked to report their job titles and also the names of their companies to ensure that only one response was received from each company. The majority of respondents (74 percent) reported job titles specifically related to the SCM function (supply chain manager, director of procurement, director of distribution, etc.). The second largest group (15 percent of respondents) came from top management (CEOs, general managers, etc.). The third group (11 percent) consisted of respondents with administrative positions that were not specifically related to SCM (such as controller, head of administration and finance manager). As could be expected, job titles among large company respondents generally signalled senior level positions

and a higher degree of specialization (for example, “Vice President Procurement” in a large company compared to job titles like “Operations and Logistics Manager” in smaller firms).

The geographical distribution of the 200 companies corresponds with the economic demographics of Norway, with the largest proportion of companies in the Eastern part (mainly in the capital Oslo and surrounding counties) and in Western Norway. The majority of the companies operate within trade and manufacturing, just as expected. The sample includes both fully Norwegian-owned companies and companies that are partly or fully owned by foreign interests. Two-thirds of companies with foreign ownership are divisions or subsidiaries of a foreign company.

Employment (number of man-years) was used as a measure for company size. Quayle (2003) and Wagner *et al.* (2003) define SMEs as companies with less than 200 employees, and the same cut-off point was used in our study. Sixty-three percent of the companies in the sample have less than 200 employees, while the remaining 37 percent have more than 200 employees. The group of larger companies include the major enterprises in Norway and it is worth mentioning that the 200 companies combined have annual sales of NOK 210bn (approximately US\$33bn), which represents a substantial part of the private sector value creation in Norway. The questionnaire was fairly extensive and some of the data collected in the survey is not relevant for this paper. In Appendix 2 we present the respective research areas addressed and the corresponding measurements.

Findings

Below we report the main findings from our analyses. The six research questions presented earlier are examined and the results are presented in Tables I–VI. The aspects that were rated are found in Appendix 2, and the Tables include all significant differences that were found between LEs and SMEs regarding the research questions. Tables I–VI present the mean ratings of the SMEs and the LEs, respectively, as well as the difference between the two groups, *t*-values and significance levels. As shown in Appendix 2, all assessments were done using the same rating scale, with alternatives from 1 = low importance to 4 = high importance.

Research question 1: To what extent are planning and control methods (supporting SCM) important for maintaining competitiveness?

Appendix 2 shows that the respondents were asked to rate the importance of ten different planning and control methods. The LEs and SMEs revealed significantly different assessments regarding the importance of four of these methods. The differences were in the same direction, i.e. that the LEs considered the methods to be more important than the SMEs did.

As presented in Table I, within the various planning and control methods, the SMEs consider the *financial control and budgeting system* as being most important for maintaining competitiveness (3.53). The *production management system* (2.71) and *e-solutions with suppliers* (2.68) are assessed to be of medium importance. *Simulation and scenario analysis systems* are generally designed to reduce uncertainty in a supply chain, with implications for the critical balance between safety stock and delivery reliability. The importance of this type of system

Table I To what extent are methods (supporting SCM) important for maintaining competitiveness?

	SME mean	LE mean	t	Mean difference
Production management system	2.71	3.31	-3.518	-0.60**
Simulation and scenario analysis systems	2.12	2.63	-3.594	-0.51**
E-solutions with suppliers	2.68	3.01	-2.414	-0.33*
Financial control and budgeting system	3.53	3.70	-2.321	-0.17*

Notes: * $p < 0.05$; ** $p < 0.01$. Rating scale used: 1 (low importance) to 4 (high importance). This applies to all tables in the paper

Table II To what extent are the systems in balance with current and future requirements?

	SME mean	LE mean	t	Mean difference
Currently, production management system	2.47	3.14	-4.131**	-0.67
Currently, simulation and scenario analysis systems	2.02	2.41	-2.919**	-0.39
Currently, competence management systems	2.36	2.66	-2.390*	-0.30
Future, production management system	2.85	3.47	-3.950**	-0.62
Future, simulation and scenario analysis systems	2.91	3.44	-4.002**	-0.53
Future, e-solutions with suppliers	3.52	3.84	-3.761**	-0.32
Future, competence management systems	3.25	3.53	-2.681**	-0.28
Future, transportation management systems	3.18	3.45	-2.177*	-0.27
Future, purchasing/sourcing systems	3.50	3.72	-2.452*	-0.22
Future, E-solutions with customers	3.60	3.79	-2.400*	-0.19

Notes: * $p < 0.05$; ** $p < 0.01$

Table III For what type of SCM tasks do the management systems have most significant influence?

	SME mean	LE mean	t	Mean difference
Management system current influence on product quality	3.08	3.37	-2.098*	-0.29
Management system current influence on rationalisation of operations	3.59	3.79	-2.349*	-0.20
Management system future influence on product quality	3.16	3.45	-2.599**	-0.29
Management system future influence on rationalisation of operations	3.58	3.79	-2.782**	-0.21
Management system future influence on capital costs	3.52	3.69	-2.290*	-0.17

Notes: * $p < 0.05$; ** $p < 0.01$

Table IV Which systems are most important when integrating with external actors?

	SME mean	LE mean	t	Mean difference
Production management systems	2.40	2.99	-3.536**	-0.59
Simulation and scenario analysis systems	2.36	2.87	-3.193**	-0.51
E-solutions with suppliers	3.19	3.68	-4.229**	-0.49
Purchasing/sourcing systems	3.20	3.60	-3.441**	-0.40
Transportation management systems	3.01	3.35	-2.516**	-0.34
E-solutions with customers	3.30	3.63	-2.658**	-0.33
Competence management systems	2.47	2.79	-2.371*	-0.32
Warehouse management systems	3.07	3.33	-2.026*	-0.26
Customer order systems	3.31	3.57	-2.034*	-0.26

Notes: * $p < 0.05$; ** $p < 0.01$

is rated as comparatively low from the perspective of the SMEs.

How does these priorities compare with the ratings of the LEs? The most apparent differences apply to systems related to production management (2.71 versus 3.31) and simulation and scenario analysis (2.12 versus 2.63). For production

management the difference in mean rating is -0.60 (2.71 - 3.31). A subsequent *t*-test reveals that this difference is highly significant, $t(178) = -3.518$, $p < 0.01$. Regarding simulation and scenario analysis the difference in mean ratings is -0.51 (2.12 - 2.63), which is also highly significant, $t(125) = -3.594$, $p < 0.01$.

Table V Which order processing modes are currently employed, and expected in the future?

	SME mean	LE mean	t	Mean difference
Currently, vendor managed inventories	1.66	2.29	-5.543 **	-0.63
Currently, conventional EDI	2.09	2.65	-4.151 **	-0.56
Currently, e-purchase solutions	2.09	2.54	-3.547 **	-0.45
Currently, EDI/XML	1.75	2.13	-3.623 **	-0.38
Currently, other order methods	1.68	2.04	-2.505 **	-0.36
Future, vendor managed inventories	2.85	3.34	-3.165 **	-0.49
Future, EDI/XML	2.88	3.31	-2.738 **	-0.43
Future, e-mail	3.55	3.20	2.769 **	0.35
Future, conventional EDI	2.84	3.11	-1.961 *	-0.27
Future, e-purchase solutions	3.57	3.83	-2.725 **	-0.26

Notes: * $p < 0.05$; ** $p < 0.01$

Table VI Association between the assessments of the various planning and control methods and company size – results of regression analyses

	β^a	t-value
Dependent variable		
Company size (number of man-years)		
Significant independent variables		
Production management system (in balance with future requirements; Table II)	0.316	4.293 **
Vendor managed inventories (current order processing methods; Table V)	0.229	2.981 **
Simulation and scenario analysis system (balance with future requirements; Table II)	0.162	2.305 *
Purchasing/sourcing system (importance when integrated with external actors; Table IV)	0.160	2.295 *
E-mail (future order processing methods; Table V)	-0.156	-2.245 *
E-purchase solutions (current order processing methods; Table V)	0.154	2.067 *
F-value (df 6, 145)	12.248 **	
Adjusted R^2	0.318	

Notes: ^aStandardized coefficients; * $p < 0.05$; ** $p < 0.01$

These findings could indicate that LEs demand formalised systems for handling production, and that they require advanced simulation and scenario analysis systems for reducing uncertainties. But the difference could also indicate an efficiency gap for SMEs in terms of higher production costs, higher inventories, and even less quality in delivery processes due to lack of formal risk and scenario analysis. The remaining methods, – *e-solutions with suppliers* and *financial control and budgeting system* – have differences that are less apparent. In total, however, all four systems are considered significantly less important by SMEs as compared to LEs. In other words, SMEs have significantly weaker attitudes towards supportive methods to sustain SCM competitiveness than is the case for LEs.

Research question 2: To what extent are the methods in balance with current and future requirements?

The second research question was addressed by requesting the companies to assess the system capabilities in terms of

servicing their purpose now and in the future. Table II shows the methods/systems where assessments by the two groups of companies differed significantly.

As presented in Table II, the SMEs consider the *production management system* to be moderately balanced with current requirements (2.47) followed by *competence management system* (2.36). The *simulation and scenario analysis systems* (2.02) are not considered to be in balance with the needs of the SMEs. The LEs seem to be more satisfied with all three systems. This is most apparent for production systems where the difference in ratings is particularly profound, (2.47 versus 3.14), followed by the *simulation and scenario analysis system* (2.02 versus 2.41). In a nutshell, SMEs appear to be less satisfied with the methods applied today than the larger companies are.

What about the perspective on the fit between requirements and the systems in the next three years? The findings reveal an interesting aspect with regard to the future capabilities of the various systems. The gaps in the current situation are higher than the anticipated gaps in the future. In other words, the systems are expected to be more in balance with the requirements in the near future than they are at present. Both SMEs and LEs share this opinion. One possible explanation might be that current systems do have functions and potential that are still underutilised. *E-solutions with suppliers and customers* are rated fairly similar by SMEs and LEs. The differences are mainly found with regard to production management systems and risk-reducing analysis systems. Clearly, SME are less satisfied with their systems both in the current situation and in a three-year perspective.

Research question 3: For which type of SCM tasks do the management systems have greatest influence?

As shown in Table III, the findings indicate that the current influence of systems for product quality and rationalisation of operations are relatively high for the SMEs, although significantly lower than the LEs.

The same picture applies to the future with the addition of systems for handling capital costs, to mention, reduction of inventories. The most significant difference between SMEs and LEs is found in methods related to product quality, both today and in the future, in the sense that the SMEs put less emphasis on systems as tools for improving product quality.

Integration is a key word in a competitive supply chain, which leads us to the next research question.

Research question 4: Which methods are most important when integrating with external actors?

As indicated in Table IV, customer order systems and e-solutions, both upstream and downstream, are regarded as most important for both SMEs and LEs. However, the most significant differences between SMEs and LEs are found for methods with lower importance, such as production management and simulations. What is particularly interesting is that SMEs place considerably little emphasis on methods aimed at integrating the supplier side. For example, the mean ratings for *e-solutions with suppliers* are 3.19 for the SMEs versus 3.68 for the LEs. The same pattern applies to the item *purchasing/sourcing systems* (3.20 versus 3.60). In other words, the LEs appear to be more aware of the importance of having effective methods for integration with the supplier side.

Our fifth research question is related to the management of orders.

Research question 5: Which order processing methods are currently employed and what changes are expected in the future?

Table V shows that order-processing methods based on EDI and e-purchase are considered moderately important for SMEs in the current situation. This view is shared by LEs, but again SMEs are lagging behind. Today, LEs appear to be significantly ahead of SMEs in adopting new information technology. In the next three years, electronic solutions are expected to grow in importance. Also here, we notice that LEs indicate a significantly more proactive attitude compared to SMEs. The largest difference between SMEs and LEs is related to *vendor-managed inventories*. Vendor-managed inventories have a marginal interest for SMEs, (1.66 versus 2.29 for LEs). The importance of this type of inventory is anticipated to grow in the future and also in the SME perspective (from 1.66 to 2.85). However, the SME interest is still far behind that of LEs (2.85 versus 3.34). Readers should note that the item “the importance of e-mail as an ordering method in the next three years” is the only aspect out of a total of 37 where SMEs have a higher mean rating than the LEs.

The findings presented in Tables I-V clearly demonstrate that are significant differences between SMEs and LEs in the way that the companies assess the importance of various planning and control methods. Our last research question deals with the association between the different methods and company size.

Research question 6: For which assessments regarding planning and control methods, does company size matter the most?

To examine the degree of association between the various assessments in Tables I-V and company size, regression analyses were performed. These analyses used the various assessments as independent variables and company size as the dependent variable. For maximum utilisation of the details in the data, company size (number of man-years) was included as a numerical scale variable instead of the dichotomous (SME/LE) categorical variable.

Table VI presents the significant independent variables and shows that the assessments of the *production management system* (the extent to which the system is in balance with future requirements) and *vendor managed inventories* (current order processing methods) have strong associations with company size. This implies that these are the most significant

explanatory variables in terms of discrimination between smaller and larger companies. The systems for *simulation and scenario analysis* (the extent to which the system is in balance with future requirements), *purchasing/sourcing* (importance when integrating with external actors) and *e-purchase solutions* (current order processing methods) are other significant explanatory variables. As shown in Tables I-V, LEs rate all of these aspects as more important than SMEs (hence the positive β s). As explained earlier, “the importance of e-mail as an ordering method in the next three years” was the only aspect where SMEs had a higher mean rating than LEs. This is reflected in the negative β in Table VI (i.e. negative association between this variable and company size).

Discussion

Related to our research questions, the findings suggest that:

- SMEs in general rate the requirements and utility of formalized planning and control systems lower than is the case for LEs;
- SMEs are less satisfied with their current systems;
- SMEs see less potential in these systems as tools for improving product quality;
- while both LEs and SMEs acknowledge the importance of customer order and e-solutions, SMEs place considerably less emphasis on upstream integration;
- vendor-managed inventories have marginal interest for the SMEs, although the importance of this type of inventory is anticipated to grow in the future; and
- production management system (the extent to which the system is in balance with future requirements) and vendor managed inventories (as current order processing methods) are the two variables with strongest associations with company size (i.e. where the views of SMEs and LEs differ most sharply).

As discussed earlier, the findings indicate that the SMEs and the LEs generally agree on which of the various planning and control methods that are most relevant for developing and maintaining competitive supply chains. The pertinent issue is that size matters when assessing the importance of the methods for planning and control. As indicated above, out of a total of 37 items related to the five research questions, only one item has a higher mean rating for the SMEs than the LEs.

In our opinion, it is useful to compare our findings with results from previous studies of SMEs in the UK. Quayle's (2003) study indicated that SMEs in Wales lack focus on issues such as new technology, research and development and e-commerce. Wagner *et al.* (2003) found that except for a subgroup of hi-tech companies, SMEs in Scotland generally adopt a “wait and see” attitude towards e-based SCM methods, especially if there is no pressure by customers. Our findings support to a considerable extent the conclusions of the UK studies. Thus, it is fair to assume that the identified lack of focus on technology-based SCM methods is a phenomenon that characterises SMEs across national boundaries. However, it is worth noting that the UK studies did not include larger companies in their samples and were therefore not able to scrutinise systematic differences between SMEs and LEs.

In our opinion, the findings reflect a considerable technology gap between large and small companies, since virtually all methods for planning and control are electronically based. The

indifference of SMEs with regard to technological issues may provide a competitive advantage to LEs, which tend to give higher priority to employing technology-based methods to reduce transactional costs and introduce new and more effective material and process technologies. The result might be that SMEs will lose competitive strength. SMEs may be more flexible than larger companies, but can easily be outdistanced by larger companies with efficient transaction systems (e.g. e-business) and state of the art production technology. A company's willingness to integrate advances in information and communication technologies will largely determine, for example, its ability to develop direct deliveries or to apply time compression principles (Zografos and Giannouli, 2001). Larger companies are currently completely reshaping their distribution concept by transferring business processes from customers to retailers – for example “home shopping”, and electronic purchasing in the business-to-business market (Skjoett-Larsen, 2000). Consequently, it is difficult to see how SMEs can survive if they continue to underestimate the importance of e-commerce.

Notwithstanding the above observations, it is possible to overstate the importance of technology for SMEs. A trading company or non-manufacturing SME can enhance competitive power by improving the “human factor” in terms of an extensive focus on building and maintaining business relationships. Several scholars (e.g. Cox, 1996; Cox and Lamming, 1997) emphasize the importance of relational competence in order to develop sustainable supply chains. Some even argue that supply chains are really about talent, not technology, especially as the marketplace grows even more complex (Bromberger and Hoover, 2003). A final point on the question of the importance of technology is that stressing the need for technological awareness does not necessarily imply that SMEs must control or own access to that technology. By means of network collaboration, and sharing of resources, the cost of acquiring new technology can be minimised.

Managerial implications

Our findings clearly indicate that the SMEs give less attention to planning and control methods than is the case for the LEs. One possible explanation might be that larger enterprises in general have organisational structures that allow for higher degree of specialisation including separately organised supply chain management functions. It may be argued that this type of specialisation is required to develop, operate and maintain adequate planning and control systems. SMEs on the other hand often have their strength in being fast-moving and less bureaucratic. Because of the entrepreneurial orientation and flexible organisational structure that characterise many SMEs, it was anticipated that these companies would have a proactive attitude towards e-business solutions. However, the findings indicate that the SMEs also lack focus with regards to electronically based methods.

Since integration of actors and transaction efficiency are fundamental for developing and maintaining a competitive supply chain, we are concerned that SMEs will face substantial challenges without adoption of technology-based *planning and control methods*. The question that arises is how SMEs can proceed to implement such methods when they often lack the necessary organisational, financial and human resources.

One possible solution can be to cooperate horizontally with other SMEs to share competence and other resources that are necessary to reduce the information technology gap, without taking the entire risk and financial burden alone. A second possibility is to develop vertical partnerships in the supply chain in order to implement shared planning and control systems and thereby limit the resources spent on slow moving and costly information flows. This also includes the possibility of using application service providers to run both systems and applications. The third alternative is related to the providers of IT solutions. The suppliers of products such as barcodes/scanners, electronic data interchange, computer aided-ordering, ECR-efficient consumer response systems, etc., should expand their product range to include implementation and managerial support. In other words to deliver complete “turn-key” solutions for revitalising the supply chain functions, specifically targeted towards SMEs.

Directions for further research

This cross-sectional study provides a “snapshot” on how companies view the situation today and what changes they anticipate in the coming three years. There are plans to repeat the SCM survey every second year to determine in what way the identified differences between SMEs and LEs regarding managerial components of SCM will change over time. The survey should also be complemented by longitudinal studies to examine possible dynamic aspects in greater detail.

In our opinion, the strength of this study is that it has been able to identify systematic differences between LEs and SMEs across sectors. However, it is important to bear in mind that SMEs represent a fairly heterogeneous group of companies ranging from traditional producers of goods and services to high-tech niche providers. Further studies should be conducted to investigate multi-sectoral aspects in greater detail. In our view, in-depth studies of a limited number of companies will be more suitable in this regard than large cross-sectional surveys.

Our study complements earlier studies in the UK. To further strengthen the external validity of the conclusions, similar studies should be conducted in other European and non-European countries. Finally, *planning and control methods* are not the only way to effectively implement supply chain management. Other aspects of SCM such as structures and business processes would be relevant to study more closely with regards to possible differences between SMEs and larger enterprises.

Limitations

Competitiveness is sustained by planning and control systems, but represents only one piece of the total picture. We acknowledge that other management components can also play a significant role. Furthermore, we have primarily focused on managerial components and excluded logistics structures and business processes that are more or less interrelated. The similar findings from studies in the UK imply that our conclusions are not restricted to the Norwegian context, although a broader selection of countries would be an advantage to eliminate possible geographical biases. As mentioned earlier, the cross-sectional approach employed in our study should be complemented by in-depth studies of a limited number of companies to explore differences among SMEs in greater detail.

Conclusion

Based on the earlier studies, we did expect to find a weaker focus on tools and systems for strengthening SCM and transaction efficiency among SMEs as compared with LEs. What is surprising, though, is the considerable gap between the two groups of companies on nearly all aspects of current and future SCM-related methods. If this gap is not reduced, SMEs are likely to lose transaction efficiency *vis-à-vis* their larger counterparts. Compared with LEs, SMEs are:

- less satisfied with the methods applied today and less optimistic about the future requirement fit;
- less concerned with methods supporting SCM on product quality, rationalisation of operations and capital cost rationalisation;
- less focused on system integration with other actors in the supply chain; and
- less focused on EDI and e-based solutions both upstream and downstream the supply chain.

Generally, the larger companies expect their business to be more technology driven in the years to come, while SMEs expect less change. In conclusion, SMEs appear to be far behind in the technology and system adoption that is considered vital to sustain SCM implementation. Thus, SMEs face a significant risk of losing competitive power. To address the question raised in the title, SMEs seem to be lagging far behind larger companies in terms of competing by means of effective supply chains. The remaining question is: how important is SCM as a competitive tool? For the sake of the SME, let us hope there are other options.

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Appendix 1. Descriptive data of the sample

Table AI Geographical distribution of companies

Region of Norway	Percentage
Capital region (Oslo, Østfold and Akershus counties)	28
North-East region (Hedmark and Oppland)	7
South-East region (Vestfold, Buskerud, Telemark Aust-Agder and Vest-Agder)	12
Western region (Rogaland, Hordaland, Sogn og Fjordane and Møre og Romsdal)	28
Middle region (Sør-Trøndelag and Nord-Trøndelag)	18
Northern region (Nordland, Troms and Finnmark)	7
Total	100

Table AII Type of industry

Type of industry ^a	Percentage
Wholesale and retail trade	34
Miscellaneous manufacturing	25
Electrical products and telecom	14
Oil and gas	9
Food and beverage	9
Construction	8
Transport and communication	8
Mining	8
Machinery	7
Miscellaneous services	6
Paper and pulp	5
Pharmaceutical/health products	5
Ship building	5
Electricity and water	4
Fishing and fish farming	3
Agriculture and forestry	3
Defense industry	1

Note: ^aSeveral companies offer a number of products and services, which implies that the categories in the table are not mutually exclusive

Table AIII Ownership structure

Ownership structure	Percentage
Less than 10% foreign ownership	29
10-29%	1
30-49%	3
50-69%	5
70-89%	3
90-100%	59
Total	100

Table AIV Company size

Employment (number of man-years)	Percentage
1-19	18
20-49	17
50-199	28
Total SMEs	63
200-499	17
500-1,000	11
1,000 +	9
Total larger enterprises	37
Total	100

Appendix 2

Table AV Research areas and corresponding measurements

Area	Measurements
Background information about the company	Location Type of industry Annual sales Annual total costs Annual logistical costs Annual total procurement costs Company size (employment) Proportion of company owned by foreign interests Is the company a subsidiary/division of a foreign company?
Importance of various planning and control methods	The respondents were asked to rate ^a the importance of the following systems for maintaining competitiveness: Financial control and budgeting system Production management system Customer order system Purchasing/sourcing system Transportation management system Competence management system E-solutions with suppliers E-solutions with customers Simulation and scenario analysis system Warehouse management systems
Extent to which the planning and control systems cover current and future requirements	The respondents were asked to rate ^a to what extent each of the above-mentioned systems cover current and future (anticipated) requirements
Integration with external actors – importance of various systems	The respondents were asked to rate ^a the importance of the above-mentioned systems with regards to integration with external actors
Importance of management methods for various SCM areas	The respondents were asked to rate ^a the importance of management methods for the following SCM areas: Customer satisfaction/loyalty Relationship with suppliers Capital costs Product quality Rationalization of operations Logistical costs
Current and future importance of various order processing methods	The respondents were asked to rate ^a the importance of the following order processing methods in the current situation and in the next three years: Letters, telephone, fax Personal sales E-mail E-commerce (internet based) E-supplier Conventional EDI EDI/XML Vendor managed inventories Other ordering methods

Note: ^aResponses for the various areas were given on one-item scales ranging from 1 = low importance to 4 = high importance

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