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Current Practice and Concerns of the Small- and Medium-Sized Construction Enterprises towards Supply Chain Management

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Abstract
Small- to medium-sized enterprises (SMEs) constitute the majority of firms in the construction industry and are therefore of prime importance in the construction supply chain. Despite this fact, little attention has been paid to SMEs with respect to supply chain management (SCM). SMEs in Australia were surveyed (via a postal questionnaire) to identify business strategies, current SCM practices, the concerns and the barriers which SMEs encountered in developing an integrated supply chain. Amongst the research outcomes it was found that the SMEs' business strategies are mainly focused on improving profit growth, providing a high quality product and lowering total deliver costs. The SCM practice by the SMEs typically aims to reduce the delivery time of materials, as well as determine customers' future needs. At the same time SMEs are concerned with the lack of interest among suppliers and customers, lack of sophisticated information systems and competition from other supply chains. SMEs do not seem to be concerned with a lack of trust and cooperation among supply chain members as this is usually covered by contractual relationships. Despite the above provisos the findings reflected that supply chain integration is an important issue for construction SMEs.

Keywords:
Small- and medium-sized construction enterprises, construction supply chain management

1. Introduction

A supply chain is "a network of connected and interdependent organisations mutually and cooperatively working together to control, manage and improve the flow of materials and information from suppliers to end users" (Aitken 1999). For a construction project, the supply chain includes the owner (client), planner, designer, architect, engineer, construction manager, general contractor, subcontractors, material/equipment suppliers, distributors, and manufacturer. Supply chain management (SCM) is the management of such network and it takes a systems approach to view the whole supply chain as a single entity, unifying intra-organisation and inter-organisation operational and strategic capabilities, emphasizing on improving value leading to customer satisfaction. The focus of SCM is on the integration and management of key business processes across the supply chain (Lambert et al. 1998), the

improvement of the total process efficiency and effectiveness across members of the supply chain and the cooperation and trust and the recognition that, properly managed, 'the whole can be greater than the sum of its parts' (Christopher and Ryals, 1999). SCM aims at improved productivity and competitiveness, value-added and profitability for the company as well as the whole supply chain network. In fact, SCM creates a virtual organisation composed of several independent entities with the common goal of efficiently and effectively managing all of its entities and operations. Fredendall and Hill (2001) identified two forces driving the supply chain management. First, there is the new information and communication technology available now that allows managers to actively manage a supply chain. Secondly, customers are demanding lower prices and better products and services. In the construction industry, the client often acts as a customer in a construction supply chain and the main contractors see themselves as customers to the subcontractors and material suppliers.

The construction industry is generally characterised as being fragmented and adversarial in nature, due to its complex structure which involves many different parties over a short project duration. This fragmentation has led to poor communication and inefficient information practices that have developed into a contractual and confrontational culture affecting the construction supply chain (Cheng et al., 2001; Dainty et al., 2001). In view of such fragmented but interdependent nature of the construction supply chain, SCM is being seen as a necessity and an opportunity for the construction industry to better improve its overall effectiveness and efficiency (Vrijihoef and Koskela, 2000). Furthermore, the structure of the construction industry is consider to be diverse, with a small number of large firms engaging in major contracts/projects at one end of the spectrum, and a large number of small firms at the other end carrying out a substantial proportion of the total workload (Cox and Townsend, 1998). For example, in Australia, there are more than 190,000 construction firms with an average number of employees less than five and this accounts for approximately 94% of all businesses in the construction industry (ABS, 1999). However, in the construction industry, the adoption of SCM has been scattered and partial, and the task of managing the construction supply chain is often left to the main contractors with little involvement from subcontractors and suppliers (Vrijhoef and Koskela, 2000; Dainty et al., 2001) and the focuses on the supply relationship between the main contractor and the subcontractors and material suppliers (i.e., SMEs), and the development of partnerships between such companies in pursuance of performance improvement are less common (Dainty et al., 2001, Briscoe et al., 2001). The lack of attention paid to them reflects the lack of recognition of the importance of SMEs (Notman, 1998). To improve the overall performance of the construction supply chain, there is a need to address the importance of SMEs in deriving greater benefits from true supply chain integration and involvement.

2. Research Objectives, Methods and Sampling

This paper focuses on the current practice and concerns of construction SMEs in relation to the SCM and presents their views on SCM integration. The paper also identifies the barriers that SMEs are facing towards supply chain integration and provide recommendations which could be adopted to improve supply chain management from an SME perspective.

A postal questionnaire survey was administered with particular care being taken in the composition of the survey sample. By definition, a population contains all the items conforming to a given set of criteria and a sample is a limited number of items selected from a population (Holt, 1998). In this research, the population comprises the contractors, subcontractors and materials suppliers which is, of course, a very large and diverse population. The nature of the industry, is such that it comprises o a large number of different companies working together to produce a 'one-off' product. The decision was therefore taken to conduct the survey on just one typical building construction project since every project involves many different entities and these entities may have also worked together on other past projects, and may also be working on other projects concurrently. In this way, the results can be drawn from a variety of businesses, which represent the industry as a whole. In addition, in view of the increasing demand/pressure for faster project completion from clients, many main contractors are adopting fast-tracking project delivery

methods to remain competitive. The decision was therefore made to select a fast-track project for this study. The selected sample was taken from one typical design-and-construct project and in total of 60 sets of questionnaires were posted to main contractors, subcontractors and material suppliers (include different entities such as bricklayer, steel fabricator, plumber, pre-castor etc). Pre-paid self-addressed return envelopes were provided with the questionnaire sets to encourage participation and early return of results.

3. Survey Results and Discussions

Out of these 60 sets of questionnaires sent, a total of 27 were received. However, three questionnaires were un-answered and returned, and two questionnaires were unusable due to missing information on some parts of the questionnaires. This gives an overall effective response rate of 40% (22/55). The survey cannot be considered biased following Moser and Kalton (1993), who held that the results of a postal survey are biased if the return rate is lower than the range 30-40%.

3.1 Organisational Characteristics of Respondents

The section of the construction industry targeted was construction professionals (project managers, purchasing managers and other managerial personnel) that were directly involved with the management of their supply chains. The nature of their business was broadly classified under 4 categories, namely, (a) Building Construction/Civil Engineering, (b) Manufacturer/Suppliers, (c) Building Trade Services, and (d) Others (hiring, administrative services etc). Out of the 22 respondents, 5 were from building construction/civil engineering (structural elements), 7 from manufacturers/suppliers (building elements), 8 from building trade services, and 2 from others (hiring, remedial works). The majority of the respondents were manufacturers/suppliers (36%) and building trade services (32%) which account to a total of 68%. In terms of the size of businesses, small businesses (less than 100 employees) form the majority of the respondents with a total of 68.2%, (9.1% has less than 4 people and 13.6% employ 5-19 staff), as compared to medium-sized businesses (13.6%) and large businesses (18.2%).

3.2 Business Strategies

The survey is set out to determine which business strategies are aligned with the respondents' supply chain (regardless of business sizes). As shown in Figure 1, out of the 10 possible choices, two business strategies, namely profit growth and high quality, scored equally high among the majority of the respondents, capturing 77.3% of the votes. Two other strategies which are lowest total delivered cost and low cost, hovered in the 64% to 59%, while the remaining strategies sank considerably in the polling, all coming in below 37%.

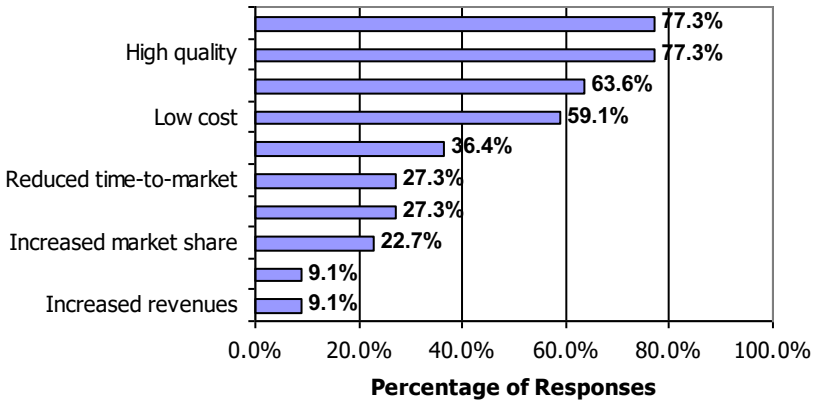

Figure 1: Perceived Strategic Alignment of Business Strategies and Supply Chain

Based on the results, it is obvious that the respondents' supply chain focus is targeting at 4 main business strategies, namely, profitable growth, high quality, lowest total delivered cost and low cost. Putting them together, it is apparent that the majority of the respondents' supply chain efforts are targeting at providing quality products and services at a reduced cost in order and gain profitable growth. Therefore, profitable growth may be seen as the only business strategy that showed a strong correlation with their supply chain practices. However, it is interesting to point out that 'Time' (reduced time-to-market in this case), being one of the key objectives of project performance, scored low (27.3%) as compared to quality and cost.

3.3 SCM Practices

In identifying the current SCM practices, respondents were asked to indicate the importance of 13 selected practices, based around 4 key factors: supply chain characteristics, supply chain integration, information sharing and customer service management. The findings are presented in Table 1.

Table 1 SCM Practices

To what extent are the following practices important to your firm's SCM efforts? (Scale: 1 to 4; 1=Low, 4=High)	Overall (Mean)	SMEs (Mean)
(k) On-time delivery directly to customers' points of use	3.59	3.56
(c) Reducing response time across the supply chain	3.32	3.39
(l) On-time delivery directly to your firm's point of use	3.32	3.33
(h) Determining customers' future needs	3.14	3.33
(b) Establishing more frequent contact with supply chain members	3.05	3.11
(d) Communication of future strategic needs within supply chain	3.05	3.00
(e) Creating a greater level of trust among supply chain members	3.05	3.06
(a) Improving integration of activities across your supply chain	2.95	2.94
(g) Creating a compatible information system	2.73	2.67
(m) Contacting the end users to get feedback	2.73	2.83
(j) Use of informal/formal information sharing	2.68	2.83
(f) Extending supply chain beyond immediate suppliers/customers	2.64	2.72
(i) Participating in the marketing efforts of customers	2.55	2.56
Factor Analysis:		
Customer Service Management (Items k, l, m)	3.21	3.24
Supply Chain Integration (Items a, b, c)	3.11	3.15
Supply Chain Characteristics (Items d, e, f, g)	2.87	2.86
Information Sharing (Items h, i, j)	2.79	2.91

The overall mean responses for the 13 SCM practices are ranged from 2.55 to 3.59, with a median of 3.05 (Overall). From the survey results, the perceived highest-ranked practices (above median) were on-time delivery directly to point of use, reducing response time, and determining customers' future needs. At the other end, the lower-ranked practices include creating compatible information system, information sharing, extending supply chain beyond immediate suppliers or customers, and participation in customers' marketing efforts. Whereas, practices like establishing frequent contact (such as contacting end users to get feedbacks), communication of future strategic needs, improving level of trust, and integration of activities were ranked around the median. In comparison, the SMEs responses were more or less ranked similarly with the overall results in terms of order of importance. Taking a broader view through the factor analysis, the current SCM practices are more focused towards customer service management and supply chain integration as compared to information sharing and other supply chain characteristics (trust, communication of strategic needs etc). Although establishing frequent contact, improving integration of activities, receiving feedbacks and other characteristics of SCM were ranked below the median, the overall responses supported the objectives and principles of SCM, i.e. customer satisfaction and process integration.

However, it was observed that the use of formal/informal information sharing (2.68) was not found to be as critical as other practices, though it is an essential component of SCM especially in determining customers' future needs and for better communications. One reason for this may be due to the aggressive business mentality of the industry and the non-trusting climate, which limit the sharing of information, since many businesses see information (e.g. trade secrets) as an important value to their success. Consequently, as argued by many authors (Egan, 1998; Briscoe et al., 2001), this may lead to insufficient or incorrect information to complete work due to lack of coordination. Nevertheless, the survey results did reflect the industry's attempt in creating a greater level of trust among supply chain members (3.05). Similarly, even with the current advances in information technology and the potential of B2B (business to business) e-commerce, creating compatible information system (2.73) was also ranked below the median. This may be due to the complexity of creating compatible information system to accommodate all users, and the nature and culture in which construction business is conducted (Johnson, 2002).

One interesting observation which is in conflict with information in the literature, that is the importance to extending the supply chain beyond immediate suppliers and customers. Based on the mean values, this was ranked nearly at the bottom (2.64), while in the literature, the theoretical SCM concept involves the integration of business processes from raw materials to the end user, and addresses the importance of materials, services and information flow, among all organisations. Though it may be too complex to achieve full integration within the entire supply chain, the results suggest that most businesses are just focused on immediate suppliers and customers. Thus, the industry is still ignorant about the importance of total involvement and neglecting the total cost reduction opportunities of SCM. Nevertheless, the results reflected the importance of supply chain integration (3.11) within the construction industry, especially the SMEs.

3.5 SCM Concerns

Respondents were asked to indicate the likelihood of 5 identified issues that may have prevented their companies from achieving the full potential of SCM. The overall mean responses to the question on SCM concerns ranged from 2.05 to 2.41, with a median of 2.18 (Table 2). The results reflected that lack of interest among supply chain members received the highest mean score as compared to the others. This was supported by the literature in terms of the views of supply chain members who are only interested in their own activities and have little consideration on its impact on others. As such, the barriers between the interfaces of different project participants has led to poor communication and inefficient information practices within the construction supply chain (Vrijhoef and Koskela, 2000; Cheng et al., 2001). Therefore there is a need for all supply chain members to realise the interdependency of their businesses and the importance of efficient and effective communication and coordination within the construction supply chain. In addition, the concern over lack of sophisticated information systems may also be attributed to the lack of interest among supply chain members. There is no doubt that the industry is concerned over the lack of a flow of information and other resources among supply chain members, which has been a problem within the construction supply chain (Cheng et al., 2001; Dainty et al., 2001; Anumba and Ruikar, 2002; Tan, 2002). It is suggested that e-commerce should be used as a means to improve project communication and coordination, and encourage the mutual sharing of inter-organisational resources and competencies.

Interestingly, the concern over lack of trust and cooperation among supply chain members was ranked the lowest as compared to other concerns. This may be due to the contractual nature of the industry where all parties are contractually obligated to complete their works as dictated in their contracts. Since all parties are bounded by contracts, lack of trust and cooperation may not have much impact in preventing them from achieving the full potential of SCM as compared to the other issues. In addition, the low concern over lack of trust may also be interpreted in another manner, that is the industry may have put much effort in creating a certain level of trust among supply chain members (ranked median in Table 2) where it no longer becomes a threat for better performance. However, it must be noted that trust and cooperation are

still a major requirement for successful implementation of SCM, and therefore should not be neglected. It has also been argued by many authors (Akintoye et al., 2000; Dainty et al., 2001; Kale and Arditi, 2001) that failure to manage the issues of trust and communication will abandon any attempt to manage the construction supply chain effectively. Another interesting observation is the awareness of competition from other supply chains (ranked around the median). It is apparent that individual businesses no longer compete as an independent entity, but as supply chains. The competition from other supply chains will definitely have an impact on the success of their businesses. As such, more and more businesses are beginning to be aware of the performance level of other supply chains in order to take necessary measures to improve their supply chains to gain competitive edge over them (Spekman et al., 1998; Cox, 1999).

Table 2 SCM Concerns

To what extent have the following issues prevented your firm from achieving the full potential of SCM? (Scale: 1 to 4; 1=Low, 4=High)	Overall (Mean)	SMEs (Mean)
(c) Lack of interest among your suppliers and customers	2.41	2.44
(e) Lack of sophisticated information system	2.32	2.22
(a) Competition from other supply chain	2.18	2.11
(d) Difficulty in managing supply chain inventories	2.09	2.06
(b) Lack of trust and cooperation among supply chain members	2.05	2.11

4. Conclusions and Recommendations

Through the questionnaire survey, this research has identified that

- The construction SMEs direct their business strategies towards gaining profitable growth by providing quality products and services at the lowest possible cost.
- The current SCM practices are focused at improving customer service management in terms of reducing delivery in time; and supply chain integration in terms of reducing response time across the supply chain and establish more frequent contacts with the members in the chain.
- The construction SMEs are less focused on information sharing nor the entire supply chain members but the immediate supplier/customer in the chain.
- The SMEs are concerned with the lack of interest among supply chain members which reveals supply chain members' ignorance of the fundamental interdependency which exists in all supply chains. The situation is further exacerbated by concern over the lack of sophisticated information system for efficient and effective communication and information practices.
- The respondents were less worried about competition from other supply chain or trust and cooperation among the supply chain members.

It is recommended that the construction industry, especially the SMEs, to take a broader and longer term strategic view in recognizing the importance of achieving the long-term goals of SCM for better competitive advantage. It is also recommended that the industry place more emphasis on the importance of information sharing and extending the supply chain beyond immediate suppliers or customers, in order to achieve the full benefits of supply chain integration and increase customer satisfaction. Furthermore, more effort should be placed in creating compatible information system to improve communication and flow of information. As such, it may be apparent that the industry is still long way from achieving the full benefits of supply chain integration.

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