CONTRACTORS' SUPPLIER MANAGEMENT

Construction materials supply chain management

M. MUYA, A. D. F. PRICE and A. THORPE
Civil and Building Engineering Department, Loughborough University,
Loughborough, UK.

Abstract

Within the total quality management (TQM) philosophy of continuous improvement, adding greater value, improving quality, reducing costs and reducing construction schedules are no longer mutually exclusive customer requirements. These demands are forcing changes in management approaches in the construction industry. It is now recognised that such gains in efficiency cannot be achieved by companies acting independently. This awareness has drawn attention to the concepts of 'supply chain management'.

Findings of research performed to investigate materials supply chain management practices by the top UK contractors are reported. While there is evidence pointing to a trend towards supply chain integration, it is revealed that entrenched practices and attitudes among UK contractors still impede full supply chain integration in the supply of construction materials.

Keywords: Contractor-supplier management, contractor-supplier relationships, materials supply chains.

1 Introduction

The need to improve performance in construction has drawn attention to the concepts of supply chain management. A supply chain has been conceptualised as "*a system whose constituent parts include materials supplies, production facilities, distribution services and customers linked via the feedforward flow of materials and the feedback flow of information*" [1]. Generally, supply chains comprise: the flow of information between customers and suppliers; the flow of materials, products or services to customers; and the flow of funds from customers to suppliers, designating completed transactions (Figure 1).

There are three types of supply chain: primary supply chain, which deliver materials that get incorporated into the final construction product; support chain which provide equipment and materials that facilitate construction [2] [3], and the third type of supply chain involves the supply of labour [4] [5].

CIB W55 & W65 Joint Triennial Symposium
Customer Satisfaction : A focus for research & practice
Cape Town : 5-10 September 1999
Editors: Bowen, P. & Hindle, R.

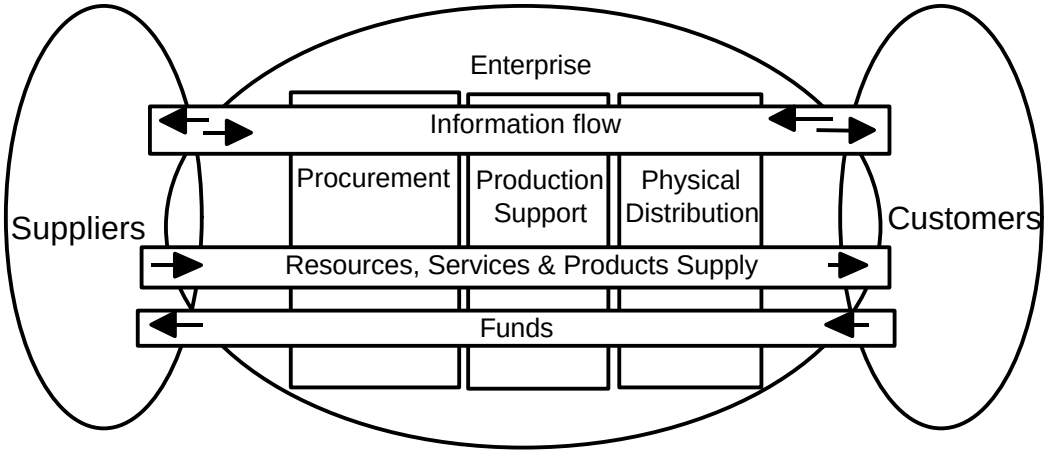

Fig. 1. The supply chain concept

Huge costs can be stored in supply chains. It is estimated that as much as £100 million could be saved from the UK aerospace supply chain each year [6]. The UK construction industry has recently been seeking to reduce costs by 30 per cent [7]. The 30 per cent cost reduction cannot be achieved by companies acting independently. Improvements have to be found in all companies in the entire supply chain, and the supply of construction materials promises to be an area where major cost reductions can be realised.

1.1 Materials supply chains

The supply of construction materials has been estimated to: control 80 per cent of the project schedule from initial materials acquisition to delivery of the last item [8]; and to account for 30 to 80 per cent of the total project installed cost depending on the type of project [8] [9] [10]. Enhancing efficiency in the supply of construction materials can result in major cost savings in the resource itself, as well as in the utilisation of other construction resources. Improvements in materials supply can lead to an estimated 6 per cent increase in labour productivity [11]. In a single case study involving structural steel erection, poor materials management led to a project schedule overrun estimated at 18 per cent [12]. These and numerous other findings have led to the recognition that the way to control project costs and schedules in construction is via an integrated total construction materials procurement cycle [13] [14].

Realisation dawned early during the implementation of TQM in manufacturing that the product is the result of all parties, from suppliers to manufacturers through to distributors [15]. In the search for improved performance in quality, efficiency and cost effectiveness, it was concluded that traditional competitive bidding was working against business objectives, hence the need to develop long-term trading relationships, especially in the form of strategic partnering. Some clients have also started to require their contractors to partner with sub-contractors and suppliers [16] [17]. Good reasons exist for contractor-supplier management. It has been argued that *"An organisation's suppliers directly affect the price, quality, delivery reliability and availability of its products - all of which have a profound impact on customer satisfaction"* [18]. Arguments for long-term customer-supplier relationships, which should hold true for any type of supply chain include [19]:

- it minimises the learning process and the potential for communication difficulties common in transactions between organisations which have not interacted previously;
- adaptation in changing market conditions and technology is less painful in ongoing and mutual beneficial relationships when the parties have been working together for a long time;
- reduction in the probability of quality problems and late deliveries in continuing relationships;
- likelihood to come to each other's aid is greater when organisations' relationships are long term and based on goodwill;
- suppliers are more likely to deliver on time to organisations they have traded with for a longer time than new customers;
- insufficient capacity or supply problems are more likely to be experienced by organisations that purchase opportunistically than those with continuing relationships with suppliers; and
- performance from suppliers who do not see any follow-on business should be less to organisations which purchase opportunistically.

Improved customer-supplier relationships have, thus, been identified to be essential for improving business performance. This paper reports on findings of an investigation into construction materials supply chain management practices by contractors sampled from the top 100 UK contractors. The aim of the research was to establish, based on comparison of opinions of the contractors and surveyed suppliers, construction materials supply chain practices of UK contractors and identify areas requiring improvement.

2 Research methodology

From a review of literature, two near 'mirror image' questionnaires on materials supply logistics, one for contractors and the other for suppliers were developed, pilot-tested and sent out into industry.

The statements analysed in this paper, which surveyed contractors and suppliers responded to, were a section in each of the two questionnaires. They were designed with the intention of developing insight into supply chain relationships between UK contractors and suppliers. To assess levels of agreement or disagreement, responses of the contractors and suppliers were tested for group differences and the results are displayed in Table 1.

2.1 Samples

A total of 71 companies ranked among the top 100 UK contractors, based on turnover [21], were sampled at random and sent the contractor questionnaire. Of the 71 sent out, 35 returned usable questionnaires represented a 49.3 per cent response rate.

The second questionnaire was sent to a total of 76 construction materials suppliers. These were sampled from, based on turnover, the top 25 UK construction materials suppliers [21] further supplemented, due to inadequacy of the sample size, by another sample from suppliers listed in the Construction and Civil Engineering CD - ROM [22]. Of the 35 questionnaires returned, only 30 were usable representing a response rate of 39.5 per cent.

2.2 Statistical test and scale of measurement

The two independent variables were the contractor and supplier groups. Differences in responses between the two groups to the posed questions, which had ordinal scales of measurement, were tested using the 2-tailed Wilcoxon-Mann-Whitney test. This test was chosen because among the non-parametric tests reviewed it was the most powerful in guarding against differences in location (Siegel and Castallen, 1988). The level of significance for testing group differences was set at $\alpha = 0.05$.

Table 1 displays results of the survey. The 7-point scale of measurement ranging from 7="Strongly Agree", through 4="Neutral" to 1="Strongly Disagree" was used in recording opinions of surveyed companies. Group differences were tested on the basis of this scale. For purposes of assessing which direction opinions of the majority of the respondents fell, the response categories were combined as shown in the table. Response categories "Slightly Agree" to "Strongly Agree" were broadly categorised as "Agree", "Neutral" was left as "Neutral" and responses from "Slightly Disagree" to "Strongly Disagree" were broadly grouped as "Disagree".

3 Discussion of results

Results of the survey are displayed in Table 1 and what follows is a summary discussion of comparisons of responses of surveyed contractors and suppliers to each of the statements.

3.1 Summary of survey results

The results of the tests show that there were significant differences in responses of contractors and suppliers to most of the statements concerning their trading relationships. The proportion of contractors who agreed with statements alluding to good contractor-supplier relationships were generally higher than that of suppliers.

Results of the survey concerning improved construction materials supply chain management practices show that the majority of the surveyed contractors and suppliers agreed that UK contractors:

- knew which suppliers were more important to them;
- tried to reduce the number of their suppliers to a minimum;
- attempted to obtain mutual beneficial relationships with their suppliers;
- sought to obtain unique advantage over their competitors through their relationships with their suppliers;
- sought the commitment of suppliers to achieve project delivery goals of cost, time and quality;
- maintained open and honest communication with their suppliers based on mutual respect; and
- ensured trust in the sharing of project information with their suppliers.

These findings reflected good supply chain management practices on the part of contractors. The total cost of materials is a function of many factors and not of price alone. Choice of suppliers should, therefore, not be based solely on price alone, but consideration should be taken of other factors such as reliability, flexibility, lead times, location and quality of products when evaluating and selecting suppliers.

Table 1. Contractor - supplier relationships

Legend of response modes: Agree (5 to 7), Neutral (4), Disagree (3 to 1)
where 1=Strongly Disagree, 2=Disagree, 3=Slightly Disagree, 4=Neutral, 5=Slightly Agree, 6=Agree, 7=Strongly Agree

Practice		Contractors Combined responses				Suppliers Combined responses				Probability Wilcoxon-Mann-Whitney 2-Tailed p
		Agree	Neutral	Disagree	Total	Agree	Neutral	Disagree	Total	
Contractors know which of their suppliers are vital to their businesses	Frequency	34.0	1.0	0.0	35	25.0	4.0	1.0	30	
	% of Total	97.1	2.9	0.0	100	83.4	3.3	3.3	100	0.0099*
Contractors buy on the basis of lowest price alone	Frequency	9.0	5.0	21.0	35	14.0	2.0	14.0	30	
	% of Total	25.7	14.3	60.0	100	46.7	6.6	46.7	100	0.1337
Contractors try to reduce the number of suppliers to a minimum	Frequency	20.0	4.0	11.0	35	16.0	6.0	8.0	30	
	% of Total	57.2	11.4	31.4	100	53.3	20.0	26.7	100	0.8979
To obtain the best deal, contractors change their suppliers frequently	Frequency	7.0	3.0	25.0	35	13.0	4.0	13.0	30	
	% of Total	20.0	8.6	71.4	100	43.3	13.3	43.4	100	0.0009*
Contractors attempt to obtain mutual beneficial relationships with their suppliers	Frequency	31.0	4.0	0.0	35	19.0	3.0	8.0	30	
	% of Total	88.6	11.4	0.0	100	63.3	10.0	26.7	100	0.0011*
Contractors seek to obtain unique advantage over their competitors through their relationships with their suppliers	Frequency	31.0	4.0	0.0	35	23.0	4.0	3.0	30	
	% of Total	88.6	11.4	0.0	100	76.6	13.3	10.0	100	0.0080*
Contractors do not believe that sharing their strategic plans with their suppliers is in their best interests	Frequency	8.0	13.0	14.0	35	11.0	15.0	4.0	30	
	% of Total	22.9	37.1	40.0	100	36.7	50.0	13.3	100	0.0165*
Contractors give feedback to suppliers on delivery performance	Frequency	23.0	7.0	5.0	35	15.0	1.0	14.0	30	
	% of Total	65.7	20.0	14.3	100	50.0	3.3	46.7	100	0.0044*

*Significant at the 5 per cent confidence level

CIB W55 & W65 Joint Triennial Symposium
Customer Satisfaction : A focus for research & practice
Cape Town : 5-10 September 1999
Editors: Bowen, P. & Hindle, R.

Theme Index
Main Index

Table 1. Contractor -supplier relationships *Continued....*

Legend of response modes: Agree (5 to 7), Neutral (4), Disagree (3 to 1)
where 7=Strongly Agree, 6=Agree, 5=Slightly Agree, 4=Neutral, 3=Slightly Disagree, 2=Disagree, 1=Strongly Disagree

Practice		Contractors Combined responses				Suppliers Combined responses				Probability Wilcoxon-Mann-Whitney 2-Tailed p
		Agree	Neutral	Disagree	Total	Agree	Neutral	Disagree	Total	
Contractors expect their potential suppliers to deliver exactly what they specify without question	Frequency	25.0	4.0	6.0	35	22.0	2.0	6.0	30	
	% of Total	71.4	11.4	17.1	100	73.3	6.7	20.0	100	0.6866
Contractors check every delivery - it is the only way to ensure consistent quality	Frequency	26.0	5.0	4.0	35	8.0	7.0	15.0	30	
	% of Total	74.3	14.3	11.4	100	26.7	23.3	50.0	100	0.0001*
The commitment of suppliers is always sought to achieve project delivery goals of cost, time and quality	Frequency	33.0	1.0	1.0	35	25.0	5.0	0.0	30	
	% of Total	94.2	2.9	2.9	100	83.3	16.7	0.0	100	0.0454*
Suppliers always get involved during development of project goals at the tendering stage	Frequency	32.0	2.0	1.0	35	13.0	9.0	8.0	30	
	% of Total	91.4	5.7	1.9	100	43.3	30.0	26.6	100	0.0005*
Communication between contractors and is open, honest and based on mutual respect	Frequency	30.0	3.0	2.0	35	20.0	5.0	5.0	30	
	% of Total	85.7	8.6	5.7	100	66.6	16.7	16.7	100	0.0020*
There is trust in the sharing of project information between us and contractors	Frequency	31.0	4.0	0.0	35	19.0	6.0	5.0	30	
	% of Total	88.6	11.4	0.0	100	63.4	20.0	16.6	100	0.0124*
Suppliers are always given ample time to prepare quotations where they bid to supply materials	Frequency	13.0	8.0	14.0	35	5.0	5.0	20.0	30	
	% of Total	37.2	22.9	40.0	100	16.6	16.7	66.7	100	0.0013*
Suppliers get paid in time for materials already delivered	Frequency	22.0	7.0	6.0	35	6.0	7.0	17.0	30	
	% of Total	62.9	20.0	17.1	100	20.0	23.3	56.7	100	0.0000*

*Significant at the 5 per cent confidence level

Real gains should be achieved in mutual beneficial contractor-supplier relationships in which suppliers are allowed to participate actively in the learning process. This is better achieved with a small number of suppliers. Reducing the number of suppliers enables concentration of resources on the development of best suppliers, who should be easier to manage. Increased mutual dependence lowers the risk of losing supply source and creates greater stability through increased supplier loyalty. This may only be possible in an environment where there is trust, open and honest communication based on mutual respect.

Statements over which the survey revealed poor supply chain management practices, with significant differences in responses to most of the statements among contractors and suppliers, were that:

- contractors changed their suppliers frequently;
- the practice of contractors sharing their strategic plans with their suppliers was not common practice in the industry;
- contractors did not give as much feedback to suppliers as the suppliers would have liked;
- contractors expected suppliers to deliver exactly what was specified without question;
- contractors checked every delivery to ensure consistent quality due to lack of trust in the reliability and quality management systems of suppliers;
- suppliers did not get quite involved during project development goals at the tendering stage;
- contractors did not pay suppliers in time for materials already delivered; and
- contractors did not always give enough time to suppliers to prepare quotations when bidding to supply materials.

The practice of changing suppliers frequently does not auger well with development of long-term relationships, even though this practice may be unavoidable in construction where the one-off project nature of the industry is location dependent. The practice can lead to loss of supplier loyalty. While the majority of both contractors and suppliers agreed that there was trust in the sharing of project information, this was not the case at the corporate level and the practice of sharing strategic plans was not common. Many of the surveyed suppliers were also either neutral or disagreed with the statement that contractors involved them during development of project goals at the tendering stage.

By expecting suppliers to deliver exactly what was specified without question, contractors could be losing out on opportunities to use suppliers as sources of new ideas and new business. Without sufficient feedback on their performance, suppliers cannot be expected to be up-to-date with expectations of contractors and would not know in which areas to improve performance.

All these were poor supply chain management practices on the part of contractors. Trust is a pivotal element in the development of relationships between trading organisations. While responses to some of the statements in the survey pointed to the fact that relationships between contractors and suppliers were towards co-operative behaviour and mutual benefit, responses to a number of the other statements also indicated that entrenched practices and attitudes among UK contractors still impeded full supply chain integration with construction materials suppliers.

In general, higher percentages of contractors expressed agreement to existence of good contractor-supplier relationships than did suppliers. In other words, more of the surveyed suppliers were less satisfied with supply chain management practices employed by contractors. It may be inferred from these findings that full opportunities for performance improvements in materials supply logistics through closer involvement of suppliers were still not being exploited.

Greater benefits accrue to contractors when suppliers feel they are in win/win collaborative relationships [24]. Therefore, much was still needed to be done by UK contractors before they could fully realise the benefits of closer working relationships with their suppliers.

4 Conclusions

Adding greater value, improving quality, reducing costs and reducing construction schedules can only be sufficiently achieved by the combined effort of all the companies in the entire supply chain.

While this study produced evidence of practices leading towards integration in construction materials supply chains, it also revealed entrenched practices and attitudes among UK contractors which impeded full supply chain integration in the supply of construction materials. For suppliers to contribute to customer satisfaction by improving quality, adding greater value, reducing costs, and reducing construction schedules much was still needed to be done by UK contractors in improving relationships in materials supply chains.

5 References

1. Towill, D. R. (1996) Time compression and supply chain management - a guided tour. *Supply Chain Management*, Vol. 1, No. 1, pp. 15 – 27, MCB University Press Ltd.
2. Porter, M. (1985) *Competitive advantage: creating and maintaining superior performance*, Third Edition, Free Press.
3. Saunders, M. (1994) *Strategic Purchasing and Supply Chain Management*, Pitman Publishing, London.
4. Druker, J., White G. and Hegewisch A. (1996) Between hard and soft HRM: human resource management in the construction industry. *Construction Management and Economics*, Vol. 14, No. 5, pp. 405-416.
5. Agapiou, A., Price, A. D. F. and McCaffer, R. (1995) Planning future construction skill requirements: understanding labour resource issues. *Construction Management and Economics*, Vol. 13, No. 2, pp. 149 -161.
6. *Sigma Management Ltd* (1997) Working Together: Managing the Supply Chain within the UK Aerospace Industry.
7. Latham, M. (1994) *Constructing the Team*, HMSO, London.
8. Kerridge, A. E. (1987, May) Manage materials effectively. *Hydrocarbon Processing*, pp. 63-67.
9. Muehlhausen, F. B. (1991) Construction Site Utilisation: Impact of Material Movement and Storage on Productivity and Cost. *AACE Transactions*, pp. L.2.1 – L.2.9.
10. Stukhart, G. (1995) *Construction Materials Management*, Marcel Dekker.
11. The Business Roundtable, (1983) *More Construction for the Money: Summary of the Construction Industry Cost Effectiveness Project.*
12. Thomas, H. R., Sanvido, V. E. and Sanders, S. R. (1989) Impact of Materials Management on Productivity: A case study. *Journal of Construction Engineering and Management*, Vol. 13, No. 3, pp. 370-384.
13. Berka, J. H. and Conn, W. D. (1994). Materials Management: A Comprehensive System. *AACE Transactions*, pp. SI.2.1 - SI.2.5.

14. Marquardt, T. R. (1994). Total Cost Management Via Effective Materials Management. *AACE Transactions*, pp. MAT.1.1 - MAT.1.5.
15. Miles, R. S. (1996) Twenty-First Century Partnering and the Role of ADR. *Journal of Management in Engineering*, ASCE, Vol. 12, No. 3, pp. 165-176.
16. Sykes, M. (1996). Supply Chain Management. *In: Working Together for Exceptional Results.* ECI Conference.
17. Nunn, D. (1997, January) Client forces Birse into partnering. *Contract Journal*, pp. 6.
18. Pearson, J. N. and Ellram, L. M. (1995, October) Supplier selection and evaluation in small versus large electronics firms. *Journal of Small Business Management*, Vol. 33, pp. 53-65.
19. Dobler, D. W., Burt, D. N. and Lee, L. (1990*) Purchasing and Materials Management: Text and Cases*, Fifth Edition, McGraw-Hill.
20. NEDO (1990) *The Innovation Management Tool Kit. The Manager's Test*, HMSO.
21. Construction News, (1996). Financial review of the top 100 UK construction contractors, No. 6478, 22 August, 1996
22. Construction and Civil Engineering CD-ROM (1997, July-October). Reproduced from *Technical Indexes Ltd and Information Handling Services*.
23. Siegel, S. and Castellan, N. J. (1988). Nonparametric Statistics for the Behavioural Sciences, Second Edition, McGraw-Hill Book Company.
24. Fojt, M. (1996) Briefings. Supplier alliances: Chrysler-MAGANA International, *Logistics Information Management*, Vol. 9, No. 5, pp. 55-56.