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Client-led strategies for construction supply chain improvement

GEOFFREY H. BRISCOE¹, ANDREW R.J. DAINTY^{2*}, SARAH J. MILLETT³
and RICHARD H. NEALE⁴

¹*School of Science and the Environment, Coventry University, Priory Street, Coventry CV1 5FB, UK*

²*Department of Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire LE11 3TU, UK*

³*Construction Industry Training Board, East Office, 1a Peel Street, Luton LU1 2QR, UK*

⁴*School of Technology, University of Glamorgan, Pontypridd, RCT, CF37 1DL, UK*

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Recent research into the UK construction industry has identified various drivers for change and prominent among these is the need for better client leadership. The aim of this research was to examine the role of the client in securing a greater degree of supply chain integration. It used three diverse case studies to examine the association between clients, the environmental factors that affect their businesses, the procurement decisions made and the level of supply chain integration that can be achieved. The results of this research provide independent empirical support for some of the recommendations of the recently released *Accelerating Change* report and some practical amplification. Clients are shown to be key drivers of performance improvement and innovation and are the most significant factor in achieving integration in the supply chain.

Keywords: Clients, environment, procurement, supply chain and integration

Introduction

Many aspects of the construction industry's performance in the UK have been heavily criticized over recent years. The industry has suffered from cost overruns, programme delays and poor productivity for a long period of time. High profile projects, such as the Channel Tunnel and the Jubilee Line extension of the London Underground, have suffered from such problems. At the same time, the profitability of construction firms is frequently acknowledged to be extremely poor in comparison to other industries.

In recent years, the poor performance of the industry has been recognized by the UK government, which responded by commissioning reports into how it could be improved. The Latham report (1994) underlined the reliance of the construction sector on competitive tendering for subcontracted work and drew attention to

the adversarial attitudes that commonly exist between main contractors and their suppliers. The Egan report (1998) criticized the industry further and demanded improvements in terms of reducing construction costs, time, defects and accidents. Suggestions for improvement include 'benchmarking', 'lean construction', 'supply chain management' and 'partnering', identified as steps towards potential solutions. These suggestions have been widely embraced by parts of the industry as potential mechanisms for improving performance and inter-organizational relations (O'Brien and Fischer 1993; Naoum and Mustapha, 1994; Agapiou *et al.*, 1998; Green and Lenard, 1999; Murray *et al.*, 1999; Reed, 1999). Most recently, a further report, *Accelerating Change* (Strategic Forum, 2002), builds on the progress made by the earlier initiatives. Specifically, this report suggests that by integrating clients and suppliers it is possible to achieve better value from projects.

Integration is strongly reliant on the philosophy of supply chain management. This ultimately strives for the

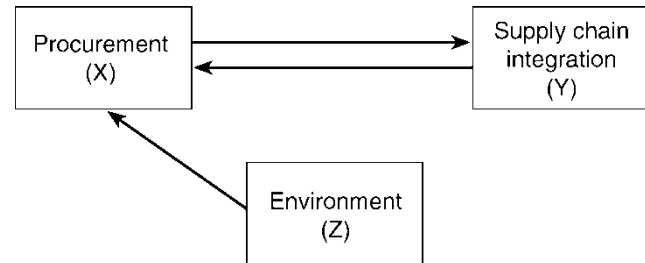
*Author for correspondence. E-mail: a.r.j.dainty@lboro.ac.uk

integration of the processes and organizations that come together to add value through the flow of goods and services, eventually to produce the end product (Stevens, 1989; Alber and Walker, 1997; Lockamy and Smith, 1997). Supply chain integration has been defined at three different levels, including co-operation, co-ordination and collaboration, which rely on information flow, cash flow, trust and delivery to lower organizational barriers needed to improve integration (Christopher, 1992; Levy *et al.*, 1995; Spekman *et al.*, 1998). Earlier research has focused on specific interfaces within the construction supply chain; those between the client and main contractor (Himes, 1995; Bresnen and Marshall, 1998, 1999) and relationships between the main contractor and subcontractor (Uher and Runeson, 1985; Hinze and Tracey, 1994; Matthews *et al.*, 1996). Research across more than two tiers of construction supply chains has been limited (London *et al.*, 1998; Murray *et al.*, 1999), but has recognized the benefits of providing longer-term stability between the various parties.

Research objectives

This paper describes follow-on research undertaken in response to the findings of preliminary studies carried out to establish the problems preventing main contractors and subcontractors from becoming more integrated (see Millett *et al.*, 2000; Dainty *et al.*, 2001a, 2001b). The results of these studies highlighted the barriers that prevented the integration of subcontractors into the construction process. This included the fact that some main contractors' efforts to collaborate with their subcontractors were superficial and largely to ensure inclusion on clients' tender lists. The earlier papers concluded that for supply chain management to be realized, there was a need for change to be driven by the construction clients. This supported Alber and Walker's (1997) claim that change needs to be driven by the customer and it also anticipated the Strategic Forum's (2002) emphasis on client leadership.

The aim of this paper is to explore how the client can influence construction supply chain integration. In the general business arena, New and Payne (1995) have identified a research paradigm for the purposes of supply chain management. This indicates a relationship between the environment, practice and performance. The authors of this paper have modified this model (as shown in Figure 1) to make it more relevant to the UK construction industry. In essence, it indicates that an organization's business environment will influence the procurement route undertaken. This in turn will affect the level of supply chain integration, and the level of supply chain integration will affect future procurement decisions. This paper reports on research that investigates the paradigm described in Figure 1. An emphasis is placed on the way



Note: Z causes X, moderated by Y

Figure 1 Construction supply chain research model

in which the results relate to the directions recently proposed by the Strategic Forum (2002), although this research was largely completed before the publication of *Accelerating Change*.

Methodology

The research adopted a case study approach to examine construction supply chains. Three different client organizations and nine of each of their supply chains were examined in depth. The clients taking part in this research were from the public transport (Client A), vehicle manufacturing (Client B) and telecommunications sectors (Client C). Clients were selected on the basis of their procurement experience. Although construction was not their primary activity, they were experienced 'secondary clients'. For longer-term supply-chain relationships to become established, there is a need for clients to have an on-going demand for construction work (Nahapiet and Nahapiet, 1985). It was considered important to use secondary clients because this group of clients have a vested interest in the end product facility.

The main form of data collection consisted of semi-structured interviews that were carried out across each of the individual supply chains. Case study questions were adapted to reflect the sub-unit of each chain under consideration and so separate interview schedules were produced. More than 100 interviews were recorded and transcribed verbatim, all of which were analysed through the use of qualitative analysis software package NUDIST NVivo™. This allowed data to be coded under conceptual headings or nodes that could then be retrieved in order to produce cross case comparisons. The nodal system was derived from the initial interview questions, which were in turn derived from a conceptual framework that brought together the issues arising from the literature. New issues and headings emerged inductively from the data as the transcripts were analysed. The analysis continued until the data had been reduced sufficiently to enable conclusions to be drawn from the coded data. The researchers returned to the individual cases following analysis to ensure that the findings were well grounded in the data.

Case study findings

The findings of the interviews are discussed below under headings derived from the model shown in Figure 1. In the interests of brevity, verbatim quotations have not been included within the text. Rather, descriptions of the findings of each case have been provided as a narrative supported by summary tables, which provide cross-case comparisons of the main issues emerging from the data.

The impact of environmental variables

Initially, the operational approach and complexity of each organization was considered, defined as *environmental variables* within Figure 1. The environmental variables that affected the construction procurement decisions made by the clients' construction specialists were grouped under four broad headings reflecting the *personal, department, organization* and *external* factors that influenced supply chain relationships. The main influence of each of these factors is summarized in Table 1.

Previous research has suggested that procurement decisions are guided by various influences that affect the client organizations (Cherns and Bryant, 1984; Nahapiet and Nahapiet, 1985; Dulaimi and Dalziel, 1994; Bresnan and Marshall, 1998). Similarly, the range of factors summarized in Table 1 suggests that the individuals working on behalf of the client influence the procurement decisions. Of particular significance were the previous experiences of managers and their experiences of managing procurement from other industrial sectors, as well as construction. The client organizations were complex structures comprising of different individuals and groups of people, who often had opposing interests and objectives. These individuals influenced the formation of the project team and therefore had an impact on the procurement route selected.

The complexity of the organizations was also reflected in the departmental structures. These structures varied depending upon the organization, but they all influenced the procurement route selected. The case studies indicated that the organization's attitude and awareness of risk, and in particular skill shortages in the external labour market, significantly influenced the procurement route selected.

At an organizational level, key business environmental factors included the volume of construction work, finance, the operational aspect of the company, organizational structure and strategic decisions made outside of the construction department. The importance of these factors varied between the cases, but all influenced the way in which construction was procured. Of significance was the fact that some of these issues impacted on the relationships the clients had with their suppliers. Finance had an

Table 1 Environmental variable results

Factors	Client A (public transport)	Client B (vehicle manufacturing)	Client C (telecommunications)
Personal	Old-fashioned values; knowledge	Managerial experience; supply chain experience; mechanical engineering experience	Supply chain experience; knowledge of unusual procurement systems; construction professionals
Department	Skills shortages; team synergy	Civil specification; automotive experience	Procurement route; competitive tendering; procurement trail
Organization	Business strategy; operational needs; finance; organizational change; client experience; volume of construction	Purchasing department (general purchasing; no construction experience); corporate identity; payment systems; strategic decisions; volume of construction	General business/accountancy; attitude towards risk; construction experience; operational needs
External	Authorities; legislation; physical environment; labour market; improvement initiatives; documents and processes	None identified	Market place

impact on the clients' ability to form such relationships, either through budgeting strategy or a need for prices to be competitively tested. Where these relationships were well developed, the emphasis on the operational interface was less important because suppliers had an increased awareness of the client's business. This led to a greater understanding of how to work in such an environment.

The final set of variables related to external factors from outside of the organization. Client B was a wholly owned subsidiary of a multi-national parent organization that managed the influence of external factors through their established supply chain. Most external issues related to legislation and the market place and included both the construction market and the client's own business market. Undoubtedly in many situations, specific market factors may serve to constrain the full integration of the supply chain.

Previous research (Stevens, 1989; Bresnen, 1996; Spekman *et al.*, 1998) has indicated that by improving the way in which transactions take place between organizations and by striving to achieve zero defects, individual companies and their supply chains can obtain competitive advantage through the value they add to the process. These efficiencies can only be realized through long-term relationships involving cost transparency, an alignment of systems and procedures and, as a result, increased openness and trust. In this research, the case studies identified environmental factors leading to a greater need for the organizations to have longer-term supplier relationships. Compliance with legislation required investment by suppliers, which needed to be recouped from the customer. These investment costs need only be paid once and so future costs should be lower, assuming the same suppliers are used. Longer-term relationships were also advantageous when there was a sustained demand for suppliers' services in the market place, particularly because there was a greater likelihood of supplier commitment towards the client organization.

Procurement factors

Table 2 indicates how the three clients all approached procurement in different ways. Client A followed set procurement procedures and had a large number of construction professionals working for them. Client B had a smaller team who tended to follow procurement procedures that were not construction specific, but were imposed by the parent company. Client C had a team of project managers working for the operational side of the business and they seemed to be able to determine their own procurement procedures. The decisions made by these different clients to adopt these procedures were influenced, in part, by the environmental variables described in the previous section, especially the organizational factors.

Table 2 Procurement results

Factors	Client A (public transport)	Client B (vehicle manufacturing)	Client C (telecommunications)
Preferred contract	NEC	Bespoke contract withholding 10% retention	Industry standard contracts with some minor amendments
Procurement routes	Design and build; target cost	Design and build; traditional; GMP	Varies depending on the project manager
ICT	Restricted use due to client's inefficient system	Developing online tendering	Limited use of IT with the exception of one project that has adopted the main contractor's EDMS
Longer-term suppliers	Preferred or nominated subcontractors but little evidence of similar relationships with main contractor	Little evidence of long-term relationships within Client B, although parent company has some good relationships with main contractors	Senior management requires prices to be market place tested reducing the likelihood of longer-term relationships
Open book accounting	On some contracts	Not within Client B but evident within parent organization	Only on one project at the moment
Variations and claims	Many variations. The use of NEC manages these better.	Poor management of variations	Many variations due to the dynamic nature of the business

This research identified a wide range of procurement routes in use, the choice varying depending on project circumstances and environmental variables. It was found that by using strategies that involved suppliers earlier on in the process, they became more integrated into the supply chain. This strategy facilitated faster construction, better understanding of client needs and project objectives, improved communication and a fuller involvement in value engineering exercises. This added value to the project process and increased the potential for innovation. There was particular enthusiasm for the use of design and build contracts because information generation and control were the responsibility of the main contractor rather than the client. However, other procurement routes that were chosen to speed up processes, such as fast-track construction, also required a greater degree of integration. This was harder to achieve because the information flow rarely kept pace with the execution of the project.

The exact roles, payment mechanisms and systems for dispute resolution were defined within the contractual documents. Whilst Clients A and C predominantly used industry standard contracts, Client B used a bespoke form. The latter document, although withholding ten percent retention, did not include a defects liability period - instead suppliers were encouraged to rectify defects by the possibility of future work. The presence of this defects liability clause engendered a lack of trust, which was not conducive to longer-term dyadic relationships. Client A's use of the NEC contract was considered to facilitate a better flow of information and a better management of variations. This was found to reduce the likelihood of disputes, improved relationships and increased project value.

Supply chain integration

Supply chain integration has been considered in terms of both *information flow and systems* (Table 3) and also in terms of *collaboration* (Table 4). The sub-headings that are used as factors in both tables follow those commonly applied in the literature (Christopher, 1992; Levy *et al.*, 1995; Lamming, 1996; Alber and Walker, 1997; Spekman *et al.*, 1998; Croom *et al.*, 2000).

Table 3 suggests that good communications are a key factor in successful supply chain integration, as in all three cases the effectiveness of communications at various levels in the supply chain was a key issue. Where longer-term working relationships had evolved, as with Client C, then communication became more effective, although communication was rarely effective between the client and the subcontractor.

Information flow is another critical factor, and again this came through as a variable which became more significant where longer term relationships had developed. Despite systems and processes being in place to encourage

relationships, information flow and communications between the individuals involved in projects was the key to the efficiency of its execution. Benefits of long-term relationships were often lost where the staffing on projects changed, pointing to a lack of effective knowledge management mechanisms within the organizations studied. Individuals who were responsible for building the relationships retained the knowledge of different organizations and were very important in the integration of the supply chain. It was also found that design and build procurement benefited information exchange over other methods of procurement.

Both value and knowledge also benefited from longer-term associations in the supply chain. Where such relationships had evolved naturally, there were greater levels of integration because they were able to add value through closer alignment and improved communications. It was important for clients to recognize the value of such relationships and to develop them to glean greater knowledge.

The alignment of ICT systems, alongside developing relationships, improves the flow of information and encourages trust to grow. The importance of trust in the development of longer-term supply chain relationships has been recognized in both the literature (Nam and Tatum, 1992; Naoum and Mustapha, 1994; Rowlinson, 1999) and within the case studies. This was particularly true when there was an expectation for sensitive information to be shared, as was the case in open book accounting. Where this practice had taken place, trust existed and this had been developed through longer-term relationships. Therefore, the development of previous relationships had enabled open book accounting to be practiced.

Although the research did not uncover any examples of comprehensive integration of the complete supply chain in the operations of the three clients, some good examples of long-term customer-supplier relationships were found. Here, the parties had a greater knowledge of each other's business, which had proven beneficial in improving project quality. This was because fewer defects were likely to occur where the supplier was familiar with working on the client's projects. This quality could be further improved by involving the suppliers earlier on in the process. They could then be involved in value engineering and innovation exercises and they could plan the works better. However, to do this requires a procurement strategy that introduces the suppliers earlier in the process.

Table 4 suggests that where higher levels of co-ordination, commitment and collaboration can be generated within the supply chain, better integration will result. Client A used pre-qualification requirements that necessitated a significant investment in training resources to establish supplier co-ordination. In contrast, Clients B and C did not use enforced procedures and the observed degree of co-ordination was markedly lower.

Table 3 Supply change integration: information flow and systems results

Factors	Client A (public transport)	Client B (vehicle manufacturing)	Client C (telecommunications)
Communication	The complexity of projects required greater degree of communication but its effectiveness was reliant on individuals and trust	Few interactions between client and main contractor. Degree of communication dependant upon geographic location of site and proximity to office	Communications more effective with longer-term relationships. The earlier parties are involved in the process the more effective communication. Minimum communication between clients and subcontractors. Co-location of project team improved communication
Information	Poor information flow; D&B produces information quicker; NEC contract encouraged improved information flow	D&B procurement better at generating information. Longer-term relationships facilitate a better flow of information	Information exchange was dependant on individuals. Some lack of trust existed preventing the open exchange of some financial information. Co-location of project team improved information flow
Value	Longer-term relationships can reduce costs and increase value	Value engineering exercises carried out to increase value	Value increased through longer-term relationships.
Knowledge	Knowledge retained by using preferred and nominated subcontractors but some knowledge lost by using unfamiliar main contractors	Longer-term relationships lead to increased knowledge. Greater knowledge when subcontractors were nominated	Specific knowledge of certain manufacturing aspects of the business required, therefore suppliers were generally quite knowledgeable.
Innovation	Minimal level of innovation, although some evidence of suppliers working with the client to develop new products	Negligible	Limited
Quality	Longer-term relationships improved quality, as there was a greater awareness of the clients' environment	A strict standard specification meant that quality improvements were difficult to implement. Longer-term relationships improve quality	Despite a need for a high quality product, little evidence existed for the improvement of construction quality

Table 4 Supply chain integration results: collaboration factors

Factors	Client A (public transport)	Client B (vehicle manufacturing)	Client C (telecommunications)
Co-ordination	Higher degree of co-ordination through compliance with set procedures and associated training	Lack of enforced procedures meant a reduced degree of co-ordination	Less co-ordination than the other clients although payment systems were aligned
Commitment	Commitment driven by client's future workload. Client A was unable to plan future works due to budgeting constraints. This was offset due to the investment in training for procedural compliance	High level of commitment driven by the potential of future work. Longer-term suppliers were more committed	Suppliers were generally less committed due to the lack of continuous workload in one specific geographic location
Collaboration	Examples of longer-term extended arm contracts, negotiated and target contracts and framework agreements. Initiatives to reduce supplier base	Parent company had good examples of partnering whereas there was no evidence of this within Client B	Longer-term supplier relationships were being developed and this facilitated negotiated contracts, earlier involvement of suppliers

The continuity of workload was found to be the most important factor in securing commitment from contractors and subcontractors. Clients who had a high future workload could benefit by developing longer-term relationships with their suppliers and so obtained a greater level of commitment. Client C found that its suppliers were much less committed since its projects were widely spread across many geographic regions.

The development of continuing relationships between client and suppliers engendered trust and this was the basis for clients appointing suppliers through negotiation. If there was no previous relationship, negotiation was highly unlikely to occur. There was also recognition by clients that suppliers who were appointed on a repetitive basis could increase the value provided to the process. However, clients often seemed more enthusiastic about retaining subcontractors' experience rather than that of the main contractors. This retention was achieved through client recommendation and nomination of certain subcontractors to the main contractors. In some instances, this nomination procedure led to frictions in the supply chain.

All actors in a particular supply chain also have other relationships with different suppliers and clients. Such network linkages have been fully explored by Gadde and Håkansson (2001). It was apparent from the range of interviews with the different supply organizations that this interdependence was an important conditioning factor on the amount of collaboration that developed with the selected clients.

Conclusions

The central aim of this research was to determine the extent to which construction supply chain integration can be influenced by client organizations. It is the client that makes the initial decision to procure construction works and the way in which procurement takes place. This in turn influences the degree of supply chain integration and ultimately the overall success of the project. This decision is affected by the environmental variables exerted on the client organization, many of which originate from their supplier organizations. Therefore, it can be stated that the clients' role in the integration of the supply chain is critically important. Without the clients' desire to develop supply chain relationships, integration cannot be realized. It can be concluded that the client is the most significant factor in the success of supply chain integration and the client must develop practices that facilitate such integration if the construction process is to be improved.

If a fully integrated supply team is to be realized, account must be taken of some of the significant factors identified in this paper. The so-called environmental

variables strongly impact on procurement decisions, which in turn critically determine the degree of achievable supply chain integration. The specific impact of departmental and organizational structures, as well as the experience of individual managers and the dictates of particular business markets, must be recognized in deciding the most appropriate form of project procurement. If long-term relationships in the supply chain are to be nurtured, changes in the client's traditional approach will often be necessary and a clear change programme will need to be established. Case study comparisons of the kind reported in this paper will be helpful for establishing best practice.

This research has indicated how the specific procurement decisions of clients influence the way in which longer-term relationships are developed and, as a result, the degree of supply chain integration. Not surprisingly, it was found that frequent changes in the forms and terms of contract and the preference for competitive price tendering are detrimental to supply chain relationships. However, practices such as the use of negotiation to secure suppliers and the development of open-book accounting practices assist in building better relationships and integration. Improved communications and information exchange are critical to efficient supply chains and often these will only emerge when the client invests in training. These case studies also suggest that continuity of client workload was a dominant factor in securing high levels of commitment and collaboration throughout the supply chain.

The findings presented in this research paper are a condensed summary of case material drawn across three very different clients. Nevertheless, the findings from these studies chime with some of the proposals contained within the *Accelerating Change* report. This report notes how clients intent on a successful project outcome need to enter the construction process with a clear understanding of their business need. Moreover, it argues that achieving maximum integration of the team at the earliest opportunity is essential, and that clients should lead and actively participate in the creation of integrated teams. The findings of this research concur with *Accelerating Change* in that client action is needed to make integrated teams the norm across the industry and their focussed objective should be creation of added value to the project.

It is clear from this research that the full integration of the supply chain is often difficult to achieve. The clients in these case studies are experienced procurers of construction projects, yet each company was found to engage in some practices that were not conducive to integrated team working. Whilst the proposals in *Accelerating Change* to develop integrated teams and mobilize value streams are very welcome, the achievement of such fully integrated supply chains may well prove difficult to realize, even for experienced and powerful clients.

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