MYTHS OF SUPPLY CHAIN INTEGRATION WITHIN THE UK CONSTRUCTION INDUSTRY

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Abstract

Traditional procurement methods within the construction industry are recognised to have resulted in delays, over-spend, inferior quality and overall dissatisfaction amongst clients. The emerging concept of partnering within innovative procurement routes has resulted in project participants working together within an integrated supply chain. However, it is suggested in the research that the benefits of partnering, to all supply chain participants, might have been taken for granted. The key question posed is whether whole supply chains are being integrated. The research goes on to focus on the myths and realities of supply chain integration and fragmentation within the UK construction industry. As researchers we have considered both traditional procurement methods within construction as well as emerging innovative procurement methods.

An extensive literature review was conducted in conjunction with analyses of construction data in the UK and case study research methodology. The conclusion of this study is that the current structure of a supply chain on a particular project within an innovative procurement method is integrated upstream and fragmented downstream. This means that supply chains are not fully integrated and consist of both integrated and fragmented elements. The subsequent argument made is that there is nothing wrong in having such fragmentation within the industry; in fact it is healthy. This argument is based upon a literature review of the research area and information from case study practitioners.

Keywords: UK Construction Industry; Integration; Fragmentation; Supply Chain.

Introduction

The problems in the UK construction industry, including delays, over-spent, inferior quality, and over all dissatisfied clients, have prompted a series of studies in last 15 years aimed at improving efficiency and adding value for money. Most of the reports from these studies prefer integration of supply chain participants to other forms of organisation setups. The overall aim of this study is to present the degree of variability in the form of integration suggested in policy reports, as well as the level and form of integration in a project supply chain. This study utilises social as well as economic notions of integration as a measure of the supply chain integration. It also utilises the statistical data from the UK construction statistics, theoretical analysis of points of responsibilities via procurement routes, and four case studies from the industry for the analysis. The result shows that: (1) the UK construction industry is not (economically) integrated because, (a) the specialist trade firms are actively involved in construction processes, (b) the Small Scale Firms (SSFs), the Medium Scale Firms (MSFs) and the Large Scale Firms (LSFs) have maintained their positions in the industry with increment in their number by 7.56%, 75.81%, and 45.72% respectively, between 1999-2005. Their value of work done between 1999 and 2005 has surged by 2.98%, 102%, and 109.03% respectively. (2) The strong performance of the MSFs category supports the fact that the industry utilises social integrative devices i.e. a form of management-oriented approaches e.g. collaborative arrangement, framework arrangement, partnering, etc. through innovative procurement methods instead of actual integration (economic) process. The study can serve as learning opportunity for the construction stakeholders by laying stronger emphasises on management system rather than point of performance responsibility.

The aim of the paper is to examine the level of supply chain integration in the UK construction industry based on the concepts and measures of social and economic notions of integration in relation to the policy documents. The paper argues that the UK construction practice/industry is both socially integrated as well as fragmented. The paper will present a brief literature review on construction procurement and how it is used to integrate the supply chain within construction industry, through two case studies. This will be then followed by the discussion of the structure of the supply chains involved in those case studies to support the argument that having both fragmentation and integration within a supply chain is normal and healthy, and that is how our industry is performing and delivering at this moment in time.

Research methods

Based on the extensive literature review, the UK construction statistical data on the structure of the industry was used as a general frame of reference. Another feature of economic integration according to Gort (1962) is the presence of major and auxiliary activities within a firm and their ratio of employment. In the following sections, the number, the value of work done, and number of operatives along some selected specialist trades is used. In contrast, specialist trade firms that carry out only major activities related to their specialist trade, show lack of integration within the industry. Theoretical analysis of procurement routes, along point of responsibilities, was also presented to support the earlier mentioned argument. ‘Procurement route’ was chosen to study because it serves as an organisation setup and defines inter-firm relationships. Three major types of procurement routes, design bid build or lump sum (Dorsey 1997), traditional design and build (Akintoye 1994), and management for fee (construction management, Haltenhoff 1999) were used in analysing the points of responsibilities. The analysis utilises the work of Lawrence and Lorsch (1967) on organisation type based on integration and fragmentation within the UK construction industry.

In order to support the above discussion, a case study from a recently completed research project is now presented. The research project looked at the changes occurring within the industry, the introduction of innovative ways of procuring the construction works, the potential benefits and

bottlenecks experienced during the whole process, and changes within organisational cultures and personal attitudes. Here the focus will be to demonstrate that the upstream supply chain participants within a project are socially integrated and the rest of the downstream supply chain is fragmented.

The case studies attempted to uncover the perceptions of firms within the construction industry with regard to the existing partnering arrangements they currently undertake. The research used multiple methods to collect qualitative and quantitative data. Basic quantitative data and company documentation were used to provide research context while qualitative data, collected in the form of a number of unstructured interviews, sought to understand how innovative procurement was viewed by different supply chain partners. The case study approach followed the protocol developed by Yin (1994) in order to improve the validity of the research. As a result, the research included a number of key elements such as clear and concise research objectives, research propositions, case study selection criteria, unit of analysis, a structured questionnaire, unstructured questionnaire for interview, a predetermined case study procedure, and an interview guide (Yin, 1994). The study involved multiple visits to each organization involved, including an average of three interviews with the Managing Directors of these companies and other staff, and a few other interviews with their supply chain members in North West of England. All interviews lasted for at least 1 hour. An assumed name for each company has been adopted for the purpose of confidentiality, when reporting the case studies.

Research question:

The main aim of this research proposal is to determine if there are ways of integrating the supply chain that will ensure service and product quality whilst still supporting the government and client initiatives aimed at increasing the competitiveness of the construction sector.

Research Objectives:

Specifically this project has the following objectives against which the outcome of the work should be assessed:

- Identify current international and national best practices in supply chain integration within the construction industry and identify current and completed research within the same area;
- Reveal the *critical success factors* for the establishment of effective and efficient supply chain integration – the behaviours/ responses to the new means of procurement made by successful firms in innovative supply chains, how successful firms are coping – through individual and corporate responses – (change programmes/change agents, training, alliancing, merging, new ventures etc. will be revealed);
- Test the proposition that the effective configuration of long-term supply chains will be different for different kinds of construction.

Research results

Integration vs. Fragmentation

In construction projects, integration denotes a single point of responsibility in risks, responsibilities and under single ownership, e.g. traditional design and build. Conversely, multiple points of responsibilities denote fragmentation of risks, responsibilities and under different ownership, e.g. traditional and management contracts. Nowadays, the dichotomy is faint, as all the procurement routes have multiple points of responsibilities either directly or indirectly through outsourcing.

Fragmentation often denotes multiple points of responsibilities with multiple form of ownership by different players. Risks and responsibilities are carried by each of the players for his tasks or trade. Lawrence and Lorsch (1967) conceptualise an organization structure in terms of integration and differentiation. They believed that the functional departments of a firm differ from one another, yet there is a need for them to cooperate in order to achieve the organisation's goal i.e. the integration of the differentiated units. Further, they profess that differentiation between departments occurs because they differ in their tasks, goals and time orientations, formality of structures, and interpersonal orientations. Therefore, integration is needed through integrative devices/mechanism because the greater the differentiation between departments, the more effort is required to bring them closer to achieve set goals for the organization.

On the other hand, integration means that there is a single point of responsibility for projects in all stages. In traditional design and build (Akintoye 1994), the contractor accepts the total responsibility for both the design and construction. The design and construction is the responsibility of a single firm, usually a construction firm a single point of responsibility and risks. Though there is a variety of design and build forms (Akintoye 1994). For instance, Atkins (1994) proposed an integrated system based on the UK Design-Build route and the French "La consultation performancielle". The system allows that schematic design, client requirements and performance specification precede contractor involvement. Technically, the newer forms of design and build do not fall under single point of responsibility because portions of the responsibilities are subcontracted to other firms/companies, especially design/documentation and specialists' work.

Economic and Social Notions of Integration

The term integration was coined from economic studies which was later applied to information technology (system integration) and construction processes (process integration and clustering). Gort (1962) defines the integration concept from an economic perspective as the act of combining two or more separable stages of production under common ownership. This view was shared in the construction process where traditional design and build combines separable tasks and activities in different stages under common ownership. The economic notion of integration has become a means of measuring the level of integration in a practice. For instance, Oyegoke (2006) refers to the UK practice as moving towards integration based on the number and value of design and build contracts from the Langdon and Everest survey ,1994-1998.

As the design and build becomes fragmented through outsourcing of key activities and tasks, integration is shifted from common ownership to point of (performance) responsibilities. Nowadays, the term integration is loosely applied to inter-firm collaboration (industry level), framework agreement, partnering and alliances (project level), system clustering (system level), trade and task outsourcing (trade and task level) etc. These forms of arrangements can be referred to as management-oriented approach or social integrative devices. Lawrence and Lorsch's (1967) concept of integration and differentiation take into account the separable functions by different departments in the same company under single or common ownership. The

major activity for a main trade contractor is construction and for a consortium group is design documents. Although, a main contractor's firm has many specialist tasks within his organisation while a consortium firm has many consultants within the group. The combinations of production of design documents with actual construction work delineate the feature of economic integration in construction.

The social notion of integration in construction is aimed at encouraging alliances between different stakeholders beyond a single project. Figure 1 presents different business levels in the construction industry in relation to the type of integration. Economic integration focuses on integration within a firm while social integration focuses on integration among firms within the industry. Economic integration ensures that task, trade and project levels are integrated within a firm under a single ownership. The span of integration extends from task level to industry level in social integration while it extends to firm level in economic integration. However, the ratio of number of firms with economic indicator is used as a measure of integration in a practice. It is pertinent to state that a company which is economically integrated can also use social integrative devices to socially integrate in higher social integration levels, e.g. partnering between design and build firms and project owners.

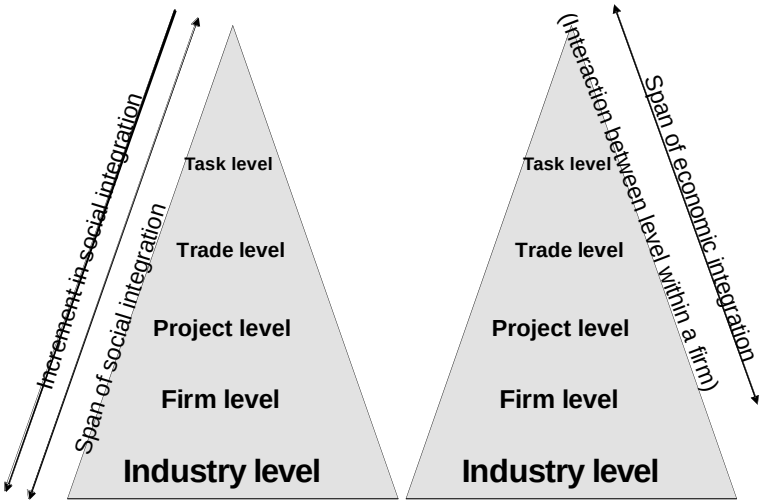

Fig. 1. Different business levels in the construction industry

Figure 2 shows different levels of social integration. The higher the scale of integrative device the greater social integration is achieved. There is enough evidence that the two forms of integration (economic and social) are mutually reinforcing forms of growth. For instance, among many other advantages, social integration leads to team building while economic integration, in addition to team building, leads to administrative economies of scale. Social integration flourishes in a practice which is fragmented. The social notion drives on a number of management-oriented studies which have contributed immensely to the management of construction processes. These management tools are devices for promoting collaboration in industry across different construction business levels, i.e. project, trade and task levels. This has not in anyway lead to integration of different levels as separable functions and tasks are performed by different companies under different ownership. A good example is prime contracting. The Defence Estates defines prime contracting based on a prime contractor accepting responsibility for the management and delivery of a project using a system of incentivisation and collaborative working to integrate the activities of the supply chain members to achieve project objectives (Nicolini et al. 2001). Partnering is another arrangement that encourages social integration. Extensive work on partnering and collaborative partnerships' has been carried out by CII 1989; Bennett and Jayes 1995; Bennett and Jayes 1998 (Bresnen and Marshall 2000). Although Bresnen and Marshall

(2000) postulate that in the 1990's partnering and related forms of collaborative frameworks were seen as a way of dealing with the fragmentation and the lack of integration. Collaborative partnership or partnering or framework agreement, in a form of design and build, was advocated as a means of integrating the process through single point of responsibility.

The UK Construction Industry Outlook

The UK economy has witness a steady positive growth since 1992. The economic performance is a mixture of different trends: a current annual growth of about 1.6%, an inflation rate of about 2.4%, current account deficit of 3.2% of GDP, and low unemployment, which is about 1.4 million people when compared to over 3 million people in 1993 (National Statistic Office 2006).

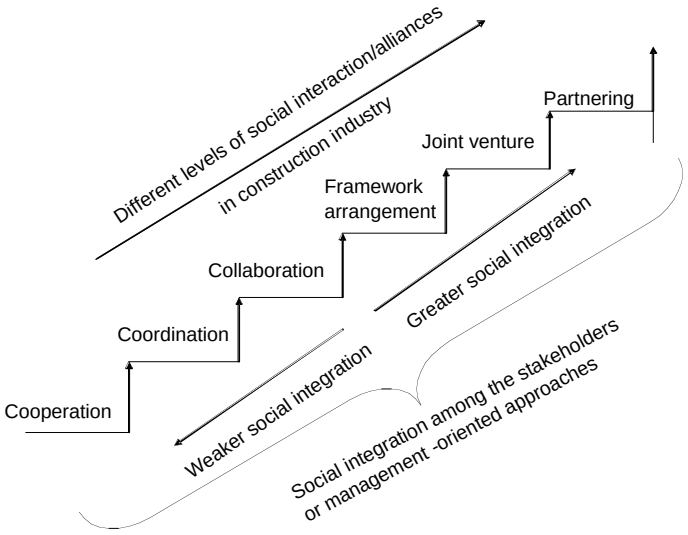

Fig. 2. Different levels in social integrative devices

The demand chain of the UK construction sector comprises private and public clients with huge investment in housing, infrastructure, non-housing, etc. For instance, in 2005, about 9.7 billion pounds was the combined new orders by both private (8.5 billion) and public (1.2 billion) in the housing sector (Construction Statistics 2006). According to Construction Statistic (2006) the new order for infrastructure amounted to about 4.8 billion pounds while in the non-housing sector (excluding infrastructure) public order amounted to about £4.9 billion, private commercial 9.8 billion, and private industrial 2.8 billion. The public sector is further fragmented along different tiers of government, departments, etc.

The supply side of the UK construction industry is fragmented both from a consulting and contracting point of view. In consulting practice, different firms across different disciplines are represented by different professional bodies engaged in different tasks and activities. For instance, the survey of UK construction professionals undertaken in 2001/2002 shows that there are 8882 architectural firms, 6,309 civil and structural engineering firms, 1,875 Building Services Engineering firms, 1,871 Quantity Surveyors firms, 1,558 other Surveyors, 722 Managers, and 2,293 others firms (including Planners). Each of these disciplines has a range of specialisation resulting in a further fragmentation of the professional supply chain. In 2001/2002, the industry employed about 225,000 people with estimated income of about 12.3 billion, in fee income.

From the contracting spectrum, the industry remains fragmented as the number of Small Scale Firms (SSFs) increased during the years 1999-2005. The Statistical data on the number of private contractors from 1995 to 2005, in Construction Statistics Annual 2006, shows a mixed trend as

there were increments in the number of contractors operating in each category. The number of private contracting firms rose from 165,561 in 1999 to 182,644 in 2005. In 2005 the share of the small scale firms (SSFs) from 1 to 13 employees amounted to 93%, medium scale firms (MSFs) from 14-79 employees 6%, and large scale firms (LSFs) from 80-1200 over 1%. The small scale business or specialist have grown in sizes, for instance, the number of firm from 8-13 employees has almost triple from 4,148 firms in 1999 to 11,599 in 2005.

The structure of the industry indicates a high level of collaboration in the industry among main and subcontractors, as the number of firms under main contractor (general builders, building and civil engineering contractors, non-residential building, housing and civil engineering) decline, while subcontractors with specialist trades increased in number. The number of main trades declined by 33.15% from 60,858 in 1999 to 45,706 in 2005 while the number of specialist trades surged by 23.54% from 104,703 in 1999 to 136,938 in 2005.

The value of work done by each of the specialist has grown considerably from 1999 to 2005, supporting their active involvement and fragmentation of the industry. For instance, Construction Statistics Annual 2006 shows that demolition firms increased from £126.2 to £207.7 million, plant hire decreased by 4% due to lack of personnel and operatives, insulating firms increased by 67%, and installation of electrical wiring and fittings increased by 63%. Other firms that recorded increments in their values of work done between 1999 and 2005: plumbing 361%, plastering 75%, joinery 174%, glazing 136%, painting 1%, and roofing 61%. The statistical data supports the notion of growth, independence and interdependence in the industry with subsequent implication on fragmentation of the industry rather than integration. The number of operatives in main trades fluctuated from 45.88% in 1999, to a nose dive 27.52% in 204, to 36.77% in 2005. Conversely, the number operatives in specialist firms' increased from 54.11% in 1999, hit its highest peak in 2004 with 72.48%, to 63.23% in 2005.

Case Study: Local Authority Framework Agreement

A framework was developed by the local authority, i.e. the client, to construct educational buildings in the value range £500,000 to £5M. Three constructor partners were appointed in December 2003, which would result in knowledge retention passed on from one project to another over a three year period. The developers are referred as Contractor A, B and C in this paper. The authority's vision is that the framework partnership will deliver good quality school buildings that will lead to: better educational results,, greater inclusion within the community,, better safety and environmental performance,, and reduced demand on future school budgets by addressing whole life cycle costing at the inception of the projects. This confirms the argument presented earlier that the upstream supply chain participants are socially integrated. The following sections present a brief account of fragmentation and integration observed during the case studies within the context of those three main contractors. The contractors were working with the local authority as part of the framework agreement resulting in the move from traditional contracting, one-off project team, to an innovative procurement (Khalfan and McDermott, 2006a,b), and knowledge-based long-term integrated supply chain partners. It confirms the second half of the argument that the downstream supply chain is still fragmented and traditional in nature, which only becomes part of the supply chain through competitive one-off tendering.

Contractor A
Contractor A believes in the best value procurement with their suppliers and subcontractors and has around 12 – 13 key strategic goals for supply chain management. For the following trades, Contractor A has developed a long term partnering relationship with one company per trade in the North West (NW) of England in order to provide services to the local authority as part of the framework agreement: brick layers, carpentry, plastering, painting and decoration, and scaffolding. In other words, social integration on a long term basis was observed for all the above

trades, where contractor A makes sure that these trades are involved at the initial stage of project development so that the best price can be achieved, and also the issues related to the build-ability are resolved by contributing towards value engineering exercises. For other trades and products, contractor A maintains a list of 3 selected suppliers/subcontractors for each trade/product, i.e. practicing the same old notion of most competitive price.

Contractor B
Contractor B usually goes for a few sub-contractors for each trade, based on their resources and based on the contract size, confirming the full fragmentation at the downstream level. For the framework agreement with the local authority, the architectural team, the M & E team, and pre-cast concrete team, are all part of the integrated supply chain of contractor B in providing services confirming the socially integrated team on the upstream level. Contractor B would argue that the list of preferred suppliers and subcontractors for each trade is an evolving list and new subcontractors get on the list as well. For the school projects as part of framework, drawings and BOQ were sent to the subcontractors on the list for pricing. Selection was done based on resource capacity, value of work, locality (location of subcontractor), flexible start and finish time, price, quality, etc. with greatest weighing on the price.

Contractor C
The current experience of the contractor in this framework agreement is regarded as a very good learning opportunity by senior management. This contractor had previously worked with the local authority before this framework agreement using JCT 98. In past experience, the scenario was that everybody on the project was struggling for to get information from each other; there were problems relating to extension of time; and there was increased cost incurred for the client; etc. Currently contractor C has moved beyond the above mentioned problems to a long term partnering relationship with the authority. However, he has exactly the same story as contractor B for the downstream supply chain participants.

Discussion and conclusions

It was observed that all three contractors came with their integrated supply chain for the 1st tier, including the Design team and M & E Contractors. They were all involved with the client to develop the plans for the school buildings, proving the socially integrated notion as presented earlier. For rest of the supply chain partners in other tiers, all contractors were using a preferred subcontractors and suppliers list, as done in traditional fragmented environments. Selection was then done based on quality-price mechanism. Despite all efforts, lowest cost plays a primary role in the selection. On the other hand, the outlook of the construction industry, from the statistical data shows that the industry is vital to the UK economy and the gross value added has been on the increase. Theoretically, it has been established that the measure of integration in a practice is based on the level of integration within a firm rather than between firms or within an industry. However, for a firm to be integrated there must be separable activities (major and auxiliary) under a single ownership. The appropriate procurement method that falls into this category is the design and build (traditional) route which combines both design and construction capabilities under single ownership. There is no evidence that the UK is moving towards traditional design and build practices (i.e. no evidence that the UK practice is moving towards economic notion of integration).

On the contrary, the statistical data signifies that the consulting practice is fragmented and it shows a further trend toward fragmentation via specialisation within existing disciplines. The statistical data also shows that in contracting spectrum there has been tremendous growth in specialist trade firms both in number of firms, value of work done, and in number of operatives. At the same time, the number of main trade firms has declined considerably, and their value of work done has increased due to economic boom but not at the same proportion as the specialist firms. The number of operatives working for the main trade firms has also declined. The implication is that there is a high level of specialisation for a major activity that firms have no auxiliary activity

and are under different ownership. This indicates that any device to bring a company together is social rather than economic integration. Another major implication is that there is high level of collaboration between main contracting firms and specialist firms, which can serve as evidence supporting the work of Egan (1998) recommendation for team building.

Key Lessons Learned:

- The upstream supply chain participants, on a specific project under an innovative procurement route, are socially integrated but downstream participants are still fragmented.
- The authors emphasise that the above mentioned is the industry structure with a project specific context, it seems to be working and looks healthy, as it is bringing in revenue to service providers.
- Hence, the UK construction industry is fragmented and socially integrated.
- The UK construction industry cannot be categorised as fully integrated in nature.

The authors have demonstrated that the upstream supply chain participants on a specific project under an innovative procurement route are socially integrated but downstream participants are still fragmented. The authors point of view is not that the above is wrong but they emphasise that this industry structure with project specific context, and it seems to be working and looks healthy, as it is bringing in revenue to service providers (both socially integrated partners and fragmented supply chain specialist organisations) and satisfying clients and end users. Hence, the UK construction industry is fragmented and socially integrated, therefore, the UK construction industry cannot be categorised as fully integrated in nature.

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Author's Biography

Dr Malik M A Khalfan graduated with a first class degree in Civil Engineering from NED University, Karachi, Pakistan in 1998. He worked briefly as a site engineer before undertaking his postgraduate degree in Construction Project Management, followed by research on Concurrent Engineering in Construction, both at Loughborough University, UK. On completion of his PhD in 2001, he joined Loughborough University and was involved in an EPSRC funded project as a Research Associate. Currently, he is working with the Salford Centre for Research and Innovation at the University of Salford as a Research Fellow. Dr Khalfan's research interests include Concurrent Engineering (CE), Readiness Assessment of CE in Construction, Sustainable Construction, Knowledge Management in Construction, Supply Chain Management, and Partnering and Strategic Alliances within Construction Industry. He was the winner of the CIOB Innovation Award in 2000 for the Best Research Paper Competition.

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Peter McDermott is a specialist in construction procurement. From the academic base at the University of Salford he manages research contracts and doctoral studies concerning, inter alia, strategic procurement, impact of newer forms of procurement on the construction supply chains, and construction industry development. From his position as Associate Director at CCI (Centre for Construction Innovation, Constructing Excellence in the North-West) he has advised and consulted with a wide range of local authorities and government departments on their response to the “Egan” agenda. Recently he has been working with OGC (Office of Government Commerce) on a number of projects including their response to the “Kelly” Report, concerning the capacity of the construction sector to deliver against the public spending plans of the government.

Michael Dickinson is currently on full-time secondment from the University of Salford at Elevate East Lancashire, one of the government's Housing Market Renewal Pathfinders. Michael's current research is related to sustainable procurement and the implementation of innovative procurement policies. In his role at Elevate, Michael is working to maximise the impact of multi-million pound regeneration programmes on local communities. Michael has MRes degree in Innovation and Improvement in Construction from the School of Built Environment, University of Salford.