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Critical review of procurement method research in construction journals

Shamil Naoum[a] * and Charles Egbu[a]

[a]*School of The Built Environment and Architecture, London South Bank University, 103 Borough Road London SE1 0AA, UK*

Abstract

One of the features of the construction industry over the last three decades or so, has been the use of various procurement methods for projects such as management contracting, project management and design and build. With the growth in the use of these methods, a number of researchers have investigated the criteria for their selection and their performance in terms of time, cost and quality. However, there is a lack of reporting on the association between procurement methods and the advanced related issues such as innovation and technology, supply chain, lean construction, buildability, sustainability and value management. Through selected papers from well-known academic journals in construction management, detailed coverage of these issues is systematically reviewed with the aim to investigate the state of the art and trends in procurement research. The outcome of this paper may provide a platform for both researchers and industrial practitioners to appreciate the latest developments and trends in procurement method research.

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Keywords: critical review; procurement method; research in construction

1. Introduction

It is axiomatic of construction management that a project may be regarded as successful if the building is completed as scheduled, within budget and quality standards as well as achieving a high level of client satisfaction. Increasingly, the fulfillment of these criteria has been associated with the problem of procurement method for construction. In short, the selection of the appropriate method can shape the success of the project.

Broadly speaking, the problems that are facing the building process are considered in relation to: (1) Separation of design from construction; (2) lack of integration; (3) lack of effective communication; (4) uncertainty; (5) changing environment, (6) changing clients' priorities and expectations, and (7) increasing

* Corresponding author. Tel.: 00442078157282
E-mail address: naoums@lsbu.ac.uk

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project complexity. These, together with economic changes (e.g. inflation and recession), have led construction professionals and the industry to offer alternative methods of building procurement such as design and build, management contracting and construction project management.

There are other mechanisms in procuring a project such as partnering, PFI, PPP, etc., which may also be considered to fall under the term procurement method. However, they might be more accurately labeled as an approach to procurement. Naoum (2003) described it as a philosophy and a contract of trust. For example, most partnering arrangements are an over-arching agreement, which encompass one or several contracts let under one of the three key methods. The large amount of research has given rise to a similarly large number of definitions of procurement method. Two of the many definitions are:

- "a procurement system is an organizational system that assigns specific responsibilities and authorities to people and organizations, and defines the relationships of the various elements in the construction of a project." Love et al (1998, p 221).
- "a mechanism for linking and coordinating members of the building team throughout the building process in a unique systematic structure, both functionally and contractually. Functionally via roles, authority and power, contractually via responsibilities and risks. The main aim is to deliver a project that meets its objectives and fulfill the client criteria and expectations." Naoum (2011a, p 2).

With the increase in use of alternative procurement methods, a number of researchers have developed decision making charts in order to investigate the criteria for their selection and their rate of success in terms of time, cost and quality. However, over the years the selection process has become increasingly complex, mainly as a result of the continuing proliferation of different methods of procuring building projects, the projects' ever-increasing technical complexity and the client's need for a more value for money projects. It is therefore, imperative to say that the classic criteria of time, cost and quality alone are now too simplistic in the context of today's complex construction project environment and the decision charts need updating.

The aim of this paper is to present a comprehensive literature review that seeks to address modern factors that are associated with the selection of current procurement. In order to achieve this aim, the authors have conducted a systematic literature review from 1980 to 2014, focusing on those modern issues with the aim of developing an up-to-date decision making chart for selecting the appropriate procurement method for the project.

2. Research methodology

A two-stage methodology was conducted to achieve the research aim, these are:

2.1 Stage 1 – Identifying the relevant literature material

The literature review process started by looking into primary and secondary sources. The primary literature sources included refereed journals, refereed conferences, dissertations/theses, occasional papers and government reports. Secondary sources included text books, trade journals, newspapers and magazines. The five top journals that were reviewed in the search are: i) American Society of Civil Engineers (ASCE); ii) Construction Management and Economics; iii) Engineering, Construction and Architectural Management; iv) International Journal of Project Management; v) International Journal of Procurement. These top five journals were selected as they frequently publish scholarly papers in the field of procurement methods and they have been ranked highly by several research activists in construction management such as the list that was published by Chau (1997). Apart from these, five other peer-reviewed journals that have published frequently cited construction papers were also added to the selected journal list, namely, i) Construction Innovation, ii) Facilities; iii) An International Journal; iv) International Journal of Managing Projects in Business; v); Industrial Marketing Management vi) International Journal of Quality and Reliability Management. Altogether, 10 top-tier journals were selected for this exercise.

The main international conference proceedings that were reviewed are the CIB (W65, W92, W90) and (ARCOM). Technical reports and occasional papers were also covered as they are comprehensive and often publish up-to-date information. These are the (CIOB), (RICS), (RIBA), (BRE) and (CIRIA). These

conference proceedings were selected as they are well known to have disseminated research findings in the field of construction management and economics.

As a result, a total number of 119 procurement related articles were identified and for the purpose of this paper, the references listed below were selected for discussion as they directly fit the aim and the conference theme.

2.2. Stage 2 – Systematic note-taking and appraisal

At this stage, the recapitulation of the literature was sifted and a literature file was built. The main topics that were reviewed in this research are buildability, supply chain, innovation, lean construction, sustainability, value engineering, e-procurement and BIM. These topics were chosen on the basis of previous literature in these related fields and their link with construction procurement methods. More specifically, the work of Love et al (2008), Al-Bizri and Gray (2010), Weisheng et al (2013), Eriksson and Koskela (2009), Hamza and Greenwood (2007), Henjewele et al (2012), Kameshwaran et al, (2007), Lam and Wong (2011).

After the compilation of the literature material, the authors critically reviewed the articles and systematically analysed the information with the view to identify i) Similarities in the findings of previous writers; ii) Common issues raised; iii) Differences or contradictions of statements made; iv) Criticisms made by previous writers.

3. Critical appraisal of modern issues related to procurement methods

3.1 Buildability/ Constructability

Naturally, a design that is buildable would, arguably, lead to saving in time, costs and cost of change. However, despite its importance, little progress has been made to solve the buildability issue and this is partly due to confrontational attitudes between client, contractors and consultants under the traditional procurement arrangement. In the UK, the term “buildability” was initiated in the 1960s and 1970s but faced criticism for its narrowness in scope as it confines to the design process (Wong et al, 2007). Since then, numerous studies have been conducted in order to strive for better project performance through improving buildability. For example, Love et al (2008), through their research into public sector procurement method selection in Queensland and Western Australia, espoused the notion that “the continual use of traditional lump sum may stifle technological innovation, particularly the design and constructability of public sector buildings.” Indeed, since 2000 the relationship between buildability and procurement method has been widely discussed, with most authors in agreement that fully integrated procurement methods such as Design and Build and project management are most appropriate for clients placing a high priority on the buildability of their project.

3.2 Supply chain (SCM)

Kranz (1996, p4) defined SCM, as “the effort involved in producing and delivering the final product from the supplier’s supplier to the customer’s customer”, while Khalfan et al (2004, p. 901) advocated that “(SCM) is directed toward the minimisation of transaction cost and the “enhancement and transfer of expertise between all parties”. According to Al-Bizri and Gray (2010), current procurement approaches do not create an organisational framework to deal with the cultural issue and fragmentation of the building process. They suggested grouping by a technology clusters approach as a way of tackling integration problem. It was argued that SCM is a management philosophy and that its principal can be applied to any procurement approach; although management oriented forms of procurement provide a better framework.

3.3 Innovation

Innovation, in its simplest form, is about applying new sciences and solutions to construction and it has become essential for construction organisations because of increasing pressures from clients to improve quality, reduce costs and speed up construction processes. This topic was debated as early as

1960s' by Bowley (1966) who classified the following four types of innovation by the reason that they are implemented and developed: i) Time/Cost: An innovation that is cost or time saving when compared with current methods/techniques; ii) Performance Enhancing: An innovation that has a better performance; iii) Aesthetic: An innovation that has a new appearance; iv) Ersatz: An alternative way of doing things that is forced by specific situations (i.e. shortage of specific materials/labour). On the other hand, innovation can be viewed as a major source of competitive advantage and can be perceived as pre-requisite for organizational success and survival. Egbu (2004) argued that the ability to innovate depends largely on the way in which an organisation uses and exploits the resources available to it.

Despite some barriers to innovation in construction, there has been an improvement in the new millennium to resolving the fragmented structure of the construction industry with significant attempts to bring the design and construction together. This is particularly evident in the increases in design and build projects, management contracting and project management as noted in the work of Eriksson et al (2007), Hamza and Greenwood, (2007, Shafik and Martin (2006), and also on Partnering, PPP and PFI as noted by Ng et al (2002), Kumaraswamy and Dulaimi (2001) and Weisheng et al (2013).

3.4 Lean Construction

The Egan report (1998) sought radical changes to improve production within the UK construction industry using lean techniques as best practice to achieve this. This notion has been elaborated upon in recent articles, in particular, in the light of the most recent, long-lasting recession. Forgues and Koskela (2009) elaborated that although the effect of integration on the design and delivery of construction projects have been discussed at length, the impact of this on the teams' organisation deserves further investigation. They put forward the case that researchers in lean construction argue that traditional design practices are obsolete and have performed poorly in managing the flow or meeting clients' requirements. It can therefore be argued that, for the principles of lean construction to be effectively applied, there needs to be cooperation throughout all parties involved in the project which is ultimately fostered through integration. Eriksson and Koskela (2009) list six core elements of lean construction as being: i) Waste reduction; ii) Process focus in production planning and control; iii) End customer focus; iv) Continuous improvements; v) Co-operative relationships; vi) Systems perspective.

In terms of applying lean construction to procurement, it can be argued that strong emphasis can be put upon the importance of forging co-operative relationships from the outset (i.e. partnering) as well as acknowledging continuous improvement. Systematic experimentation, continuous improvement, and continuous learning across all organisational and technical levels are important aspects of the lean philosophy, particularly as a means for trying to enhance customer value while reducing or eliminating waste (Jorgensen and Emmitt, 2007 & 2008). However, Eriksson et al (2007) provided evidence to show that implementing lean practices in the partnering consortium is not necessarily straight forward as often implies. A fundamental change should be in the behaviours and attitudes of the parties involved. They noted three types of barriers to cooperation, namely, industrial, organizational and cultural barriers.

3.5 Sustainability

Sustainable Procurement is a process whereby organisations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in order to generate real long term benefits, not only to the organisation, but also to society and the economy, while minimising damage to the environment (Berry and McCarthy, 2011). Indeed, in the UK it is now mandatory that all new built and refurbished buildings should demonstrate compliance with 'Target Carbon Emissions Rates' as well as with the Building Energy Model (Part L) of the Building Regulations 2006. Hamza and Greenwood (2007) Bower, (2003), and Masterman, (2005) all agree that the production of such models requires several iterations at the design stage and, more than ever before, invites close collaboration between the various professionals involved.

Progress in the area of innovation has been hindered by many barriers, such as the industry's fragmented nature, lack of long term perspective, clients' unwillingness to share burden, lack of clear concept definition of sustainable construction and its benefits, regulatory constraints and inconsistent government policy and lack of fiscal incentives (Adetunji et al, 2003). The NAO (2005) follows on from this, quoting one of the main barriers to sustainable procurement, particularly in central government, as being the conflict between sustainable procurement and reducing costs. Therefore, this would prompt the

question concerning the balance that the design and build contractor is willing to consider between sustainability in favour of submitting a more competitive bid for the works.

Adding to the above, Bullen and Davis (2003) advocated that sustainable construction requires change to construction methods and the use of resource but more significantly the building process will need to change. In order to achieve this, significant change to the organisation, structure and communication channels of the industry will need to be made. They also highlight that the use of traditional procurement process creates a professional barrier to innovative change which sustainability requires. Furthermore, Hamza and Greenwood (2007) stated that under the traditional and design and build procurement arrangements it may prove to be a very challenging task to design environmentally sensitive buildings as the iterations required are at odds with the contractor's incentive to avoid delays and extra cost. Embracing the principle of sustainable construction, from the government's perspective, will facilitate a real cultural change in the construction industry towards the adoption of partnering as a procurement process (Ball and Fortune, 2000).

3.6 Value Engineering

Value engineering is a systematic approach to deliver a project with the required functions at optimum whole life cost without being detrimental to quality, performance and reliability. It is therefore a team exercise that is principally used to identify and eliminate unnecessary costs of a product. Unnecessary cost is one which provides neither quality, use, life, appearance nor customer required features. The features are: Aesthetics (beauty, colour, pattern), Ergonomics (shape, dimensions, ease), Economics (operating cost, maintenance), and Technical (performance). Through the facilitation of workshops throughout the project, value management can ensure active participation from all project stakeholders and therefore encourage collaboration, innovation, improved constructability, enhanced communication throughout the supply chain and the integration of sustainable practices (Egan (1998).

This points towards a more integrated management oriented approach as the design can be adapted early in consultation with the main contractor, utilising his/her expertise and professional input, with a view to reducing waste, improving buildability and promoting clearer understanding of the brief through team working such as Management contracting and partnering (Naoum (1994) and Doloi (2013), Forgues and Koskela (2009), Henjewele et al (2012), Cha and O'Connor (2005). By breaking the fragmented approach of the traditional route and encouraging cooperation through an integrated method of procurement, communication and ideas are able to be shared that can improve value to a project. The earlier that this can take place in the design process the more benefit there will be for a client.

3.7 E-Procurement

It has been argued by Cheng et al (2001), Presutti (2003) and Kameshwaran et al, (2007) that the need for information systems such as e-procurement to facilitate the integration of the supply chain is receiving more and more attention from the construction industry. The usage of e-procurement technology positively affects managers' perceptions of both procurement practices and procurement performance. There are negotiations currently taking place over the proposed revision of the EU procurement directives (OJEU) that, once agreed, will need to be adopted as UK law by June 2014. This revision is aimed at simplifying and speeding up current procurement practices. One of the key changes to these directives is the need for "compulsory e-procurement" with fully electronic procurement, including the online submission of tenders, being required by June 2016. There is however a down side in this new initiative in that, the application of e-procurement platforms requires significant investment in both specialist software and staff training. It can be argued that the time and investment required by suppliers/companies may create a "two-tier" system, with many of the larger, more powerful suppliers investing in e-procurement in line with the directives leaving aside those who are less able of meeting the required investment.

The concept of e-procurement can be used with most procurement methods in mind except, perhaps, the partnering arrangement. This is so due to the fact that with partnering, works are either let to contractors that are on a long-term framework (i.e. strategic partnering) and therefore evaluation is mostly through mini-competitions or it is based on a pre-tender selected interviews. Moreover, partnering relationships are usually formed between two parties on the basis of trust and openness and therefore the e-procurement platform might not be the best approach to facilitate effective partnering.

3.8 Building Information Modelling (BIM)

Francis Maude (Minister of the UK Cabinet Office) stated "this Government's four year strategy for BIM implementation will change the dynamics and behaviours of the construction supply chain, unlocking new, more efficient and collaborative ways of working. This whole sector adoption of BIM will put us at the vanguard of a new digital construction and position the UK to become the world leader in BIM (UK-BIM Task Group 2013).

Indeed, when examining the UK construction industry as a whole, one of the biggest problems is the difficulty in implementing widespread team working and collaboration, primarily due to cultural barriers – something that BIM boasts as one of its main attributes. According to Lam and Wong (2011), Dainty et al (2001), Du et al (2014).), this is due to the working BIM model being universally accessible by all project team members, whereby design changes can be automatically updated. It is well-known that clause 2.1 of JCT's Construction Excellence promotes collaboration as an overriding principle. According to Khosrowshahi and Arayici (2014), BIM promotes input from all members of the building team in order to plan, model and monitor any real-life situations – or site clashes – before commencing on site as well as minimise any re-work. BIM tools were developed to considerably improve productivity in the industry and make it possible to manage and maintain the information generated throughout the lifecycle of buildings more efficiently.Therefore, early interaction is vital to ensure that expertise and knowledge is shared at the outset. Due to this, it can be argued that the management contracting, design and build and partnering approaches are best equipped to deal with this as emphasis is on developing a more 'buildable' design which includes the involvement of the supply chain.

4. Conclusions

Procurement methods have received considerable attention and discussion within the construction industry in the past three decades. This study has provided a critical review of the state of the art of procurement methods in the academic field with the aim of establishing a platform for scholars and researchers to obtain more useful insights into procurement methods concerns. It has identified research trends in procurement methods which may allow industrial practitioners to appreciate the key concerns in their development of modern principles and techniques such as supply chain, lean construction, sustainability, innovation, value engineering, e-procurement and BIM. The sustained implementation of these principles can go a long way towards combating short-termism and industry fragmentation over time. The view is that, this will drive change as clients and their project teams experience the benefits achieved through these techniques. Ultimately, this will equate to a shift towards a more wholly integrated industry where achieving best value and continuous improvement through team integration is of paramount importance, Naoum (2011b). It is difficult to escape the premise that increased collaboration within the industry will be vital to achieve future gains, and for the industry to deliver improvements on the clients triangulated factors of cost, time and quality. If the industry is to deliver best value for clients in a changing world, better use and standardization of information technology is likely to be the key.

In many areas, however, there seem to be barriers in terms of widespread adoption of modern techniques when considering the procurement route for a project. This is partly due to associated risks and attitude towards change. In order for the construction industry to be able to meet the managerial, technical and social challenges, both the industry and its participants have to welcome 'change' and allow innovative procurement methods to grow. As noted by Ruparathna and Hewage (2013) and indeed by many well-known academic journals, this change needs to be a client-driven process supported by the rest of the building team.

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