ASSESSING THE CONTRACTOR PERFORMANCE OUTCOMES OF CONSTRUCTION FRAMEWORK PROCUREMENT FOR THE UK PUBLIC SECTOR

Terence Lam[1], Keith Gale[2]

[1] School of Natural and Built Environments, University of South Australia, City East Campus, Adelaide, SA5000, Australia.
[2] Department of Engineering and Built Environment, Anglia Ruskin University, Chelmsford, CM1 1SQ, UK.
Terence Lam can be contacted via terence.lam@unisa.edu.au

ABSTRACT

The construction industry in the UK has a history of client dissatisfaction. Criticisms have been included within UK Government reports since the 1940's. A potential solution for improvement is through formation of a framework agreement between contractors and a client, where long term relationships may focus upon performance. A typical yet unique local authority was examined to determine whether use of framework agreements for construction projects could result in significant improvement for contractor performance outcomes in respect of quality, schedule and budget when compared with traditional discrete procurement methods. Within the case, performance data was compiled from 164 highways maintenance projects and separated into two groups – one represents those procured using traditional discrete methods and the other within a framework agreement. All projects were subjected to Critical Success Factors (CSFs) determined by the client organisation allowing a Project Success Index (PSI) to be calculated for performance assessment of each project. Independent-samples t-tests proved that there were significant improvements resulted from framework agreements in overall performance and individually in quality (defects), schedule (finish on time), budget limit (accuracy of payment applications). Conclusions from this study support the use of framework agreements as an innovative procurement for the wider public sector environment.

Keywords: public sector construction, framework procurement, contractor performance outcomes

INTRODUCTION

Criticism of performance with the UK construction industry is not new. Concerns were voiced through two significant government reports – Constructing the Team: Latham (1994) and Rethinking Construction: Egan (1998). Other independently commissioned reports not only reflected six decades of concern with performance and project out turns placed within a public sector context, but also recognised difficulties experienced from contractors in achieving such goals. Post 1980 reports seek to elevate the UK construction industry to 'world class' and propose adoption of team values towards this goal. The importance of relationships within the team are highlighted in Egan's Report and emphasised further in *Modernising Construction* (National Audit Office, 2001), together with a call for effective use of investment, training and innovation in projects.

In order to engage with recommendations offered by Latham and Egan, public sector organisations made changes to their contractor selection processes whilst retaining the need to comply with statutory requirements. Public sector frameworks have been developed under EU Directive 2004/18/EC of the European Parliament for coordination of procedures for the award of public works contracts, public supply contracts and public service contracts. This legislation defines frameworks as '*an agreement with suppliers, the purpose of which is to establish the terms governing contracts to be awarded during a given period, particularly in respect of price and quantity*'. Longer term agreements are known by practitioners as strategic frameworks, where objectives of providing stronger relationships through fewer suppliers align with initiatives suggested by Latham (1994) and Egan (1998).

Construction Frameworks are a relatively new idea. Although a number of frameworks have been concluded, there is very little analysis regarding project outcomes. A 'gap in professional knowledge' has arisen due to the long periods required to compile data and the transient nature of the organisations being measured. Construction projects, by their nature, involve teams being assembled for specific projects which are then disbanded upon completion. The lack of available data was recognised as a hindrance to studying construction industry performance by Dainty (2008).

Project success-specific studies have identified time, cost and quality as the three most important indicators to measure construction project performance (Meng, 2011). According to Li *et al.* (2012), project performance is measured on the basis of completion within budget and on schedule, compliance with quality standards, and satisfaction of the owner.

This research aims to assess, through a study of a framework set against a large stable local authority in the UK, whether use of framework agreements for construction projects can result in significant improvement for contractor performance outcomes in respect of quality, schedule and budget when compared with traditional discrete procurement methods. The impact of frameworks on the overall project cost, including production cost (tender prices) and transaction cost (engagement and performance monitoring costs), forms a separate area for research.

FRAMEWORK AGREEMENTS

Framework agreements are created between parties with the intention to establish long term collaborative working arrangements. A client may enter into a framework agreement with a single operator or with several operators. The framework agreement provides an 'umbrella' contract with projects separated into individual 'work packages' which may be procured at the call-off stage throughout the period of agreement, and the projects have their own discrete conditions of contract, specification and payment mechanisms (Morledge and Smith, 2013).

Only one major tendering is required at the 'inclusion into a framework stage' to comply with the EU regulations, one of which is that contracts above a predetermined threshold (reviewed every two years) value must be advertised in the EU-wide Official Journal of European Union (OJEU). This is then followed by the 'call-off' stage which involves a small number of suppliers and hence simple 'mini-competition' procedures. Use of the two-stage tendering can reduce the number of different major tendering exercises that would otherwise be incurred. This, along with use of standard documentation, can greatly reduce the transaction cost.

Like other international relational project delivery contractual arrangements, including project partnering, project alliance and integrated project delivery, construction frameworks have been developed as an innovative production arrangement for improving construction project delivery through collaboration and integration of the project team (Lahdenpera, 2011). A prime characteristic of a framework agreement is the term – the pre-determined timescale for operation of the agreement. For public sector agreements, Public Contracts Regulations 2006 and EU Directive 2004/18/EC of the European Parliament of the Council of 31 March 2004 dictate that the maximum term of a framework agreement shall be four years in duration, unless strong exceptions can be demonstrated. A term of four years allow relationships and understanding to be nurtured where focus can be placed upon overall service rather than individual isolated performance of a project. Moreover, a secondary characteristic of construction frameworks is that a client may enter into identical agreements with a small number of different contractors effectively creating a selected community with which to deliver projects.

Framework agreements are therefore not intended for an individual project. They are designed for use where similar sets of works or services are required of a selected number of contractors over a period of time. Although framework arrangements are permitted between a single client and a single contractor, a lack of incentive or competition may affect outcomes. Most framework arrangements are therefore between a client (or conjoined clients) and multiple contractors to allow competitive elements to be incorporated.

A number of perceived benefits are stated to apply through the use of framework agreements (Construction Excellence, 2009; Morledge and Smith, 2013) for construction projects. These can be summarised as follows:

- More effective and efficient tendering procedures and less transaction cost for clients
- Continuous improvement from engagement of best practice
- A greater depth of understanding between all participants due to longer term relationships
- Ability for contractors to gain a higher success rate with bidding for projects due to a small number of competitors within a framework
- A higher level of commitment for a client due to longer term relationships

Construction Framework South West (2009) is a regional body consisting of geographically adjacent local authorities formed to share resources for effective and efficient delivery of projects and their literature added further incentives for use of frameworks:

- Earlier involvement of contractors
- Faster delivery of projects
- Collaborative working
- Elimination of contractual disputes

Construction framework agreements are typically used where an authority knows they have a need for construction products or services, but are not sure of the extent or content. Frameworks are also used when a contracting authority wishes to develop a strategic relationship with the supply chain over a long period. Examples of such projects are high-risk, high-spend construction and maintenance programmes, often found in housing, education and highways, as suggested by Constructing Excellence (2005).

Although framework agreements have received support from central government (Business and Enterprise Committee, 2008) they do not have universal acceptance by all stakeholders of the construction process. Such criticisms arise through incorrect application of a framework by a public body or questions of economic effectiveness of frameworks, especially during the economic down turn since the financial market collapsed in 2008. British Airports Authority's (BAA) framework arrangements expired during 2009/2010 and were replaced by the traditional procurement model with a wider list of tenderers to increase competition for achieving cost and quality improvement (Morgan, 2009). A substantial government spending cut for the fiscal year 2011/2012 has also questioned the value of framework agreements for public sector, with a number of clients reverting to 'lowest bid wins' models.

PERFORMANCE MEASURES

A review of the impact of framework agreements necessitates examination of the development of a construction project in order to identify the most appropriate period to apply performance evaluation methods. Performance evaluation can be measured at any stage of project delivery, but difficulties occur with methods of measurement and quantification of results until a project reaches sufficient maturity for tangible metrics to be applied. Research into construction project management has identified six phases, namely - conception, planning, design, tender, construction and operation (Lim and Mohamed, 1999). Each phase requires efficient execution in order to contribute toward successful delivery of the completed development, but the nature of the phases incorporates distinct dynamism. Resources used for elements of concept, design and planning may be recorded to provide comparative costs or timescales for a project, but the variances between projects render such outcomes inherently unreliable. A single external variable at the early stage of a project – for example, a planning delay, causes comparisons to be unrealistic. Controlled phases of a project at later stages where levels of specification, time periods and constraints/extent are known allow parameters to be measured and results quantified. For these reasons project management research concentrates upon the construction phase as a focal point for examination of performance outcomes (Ahadzie *et al.*, 2006). This phase involves the tasks of mobilization, temporary works, permanents works and demobilization, and the agreement contracts are managed by client supervisors and construction managers. This research assesses the project success based on the contractor performance outcomes at the construction stage.

Project success arises from use of performance measurement to quantify how well an organisation is in attaining objectives (Evangelidizs, 1992). Classification of project success has changed significantly over the last five decades. In the 1960's a project was deemed successful if 'it worked', that is, fulfilled its prime functional objective (Kerzner, 1998). This single descriptor of success was expanded into outcomes of price, quality and cost (Oilsen, 1971). The 'iron triangle' described by Atkinson (1999) was the focus of performance research for a significant period, where if projects fulfilled all three success factors they would described as extremely successful. Since then, introduction of other criteria has been added to assessment of success according to the environment within which each project sits. Chan *et al.* (2002) introduces post completion, stakeholder involvement, operational measures and the like, as other criteria to be considered toward success. The introduction of total quality management systems into construction operations has seen a further expansion towards measurement of classification of project success by use of specific metrics.

Expansion with a range of metrics being suggested to measure project performance together with associated collection has suggested a polarisation toward critical success factors, which represent those that matter to particular clients and stakeholders rather than including a wider range of parameters. Kerzner (2001) suggests a focus back to the 'iron triangle' but adds secondary criteria such as minimising disruption to stakeholders, change to corporate culture and the like. Yeung *et al.* (2008) modified this concept further by identifying seven key weighted indices aggregated to produce a single partnering performance index to measure the success of projects. This model is proposed for identification of critical success factors and an aggregated project success index to measure performance of the construction projects included within this research. Construction of an index involved weighted apportionment, where selection of such involved analysis arrived through responses from clients. The model adhered to traditional views of performance to price, time and quality – but introduced four other critical success factors, although with lesser weightings. Validation of the model was achieved through the research, but conclusions recognised the need to change critical success factors to suit different objectives of a client and varied project situations. With a single index, quantitative comparison between projects can be made.

RESEARCH METHOD

It was hypothesized that framework agreements could have a positive impact on quality, time and cost at the construction phase due to longer term relationships with contractors so that projects could be completed with less defects, on schedule and within budget. These are the three critical factors measuring project success and they should be further defined by individual clients to reflect their objectives for specific projects.

A single-case study approach was selected to quantitatively examine the impact of framework approach on contractor performance outcomes in terms of quality, schedule and budget limit. The organisation chosen is a major county council regulated by statutory legislation applicable to all similar UK authorities. Consequently, the research findings of this typical yet unique case would have implications for other authorities. To follow the conditions of approval as set out by the relevant ethics review committee, identity of the council is kept anonymous.

Fellows and Liu (2008) and Yin (2009) both state that case study research can be used to investigate phenomena within real context and can therefore draw rich conclusions. Yin (2009) further contends that findings from a typical single-case study are useful to form a vehicle for examining other cases. Consequently, the results will become robust, thus a single-case approach can make significant contribution to knowledge.

Data was collected over a period of four years (2006 – 2010) from construction projects related to highways maintenance. Identification of critical success factors for the client was obtained through documentary evidence from the organisation and group meetings with the senior officers where weightings were calculated for project outcomes. The organisation 'took for granted' that projects would be delivered to required time scales, in accordance with budget provisions and to the required specification, and therefore critical success factors formed an additional supporting role to contractual requirements by encouraging overall project delivery. The five factors were identified in Table 1.

Table 1: Critical success factors identified by the client organisation

Number	**Critical success factor**	**Weighting**	**Description of Metric**
1A	Ratio of start on time	0.165	Ratio of days starting late against contract period
1B	Ratio of finish on time	0.165	Ratio of days finished late against contract period
2	Ratio of accuracy of payment applications	0.270	Interim payments certified within 5% of contractor's application
3	Right first time (defects)	0.200	Projects completed without remedial works – yes score = 1, no score = 0
4	Health and safety inspections	0.200	Percentage of inspections passed

The critical success factors in Table 1 may be considered an extension of the 'iron triangle' of time, cost and quality because CSF1A and 1B are time related, CSF2 is cost related and CSF3/4 are indicative of performance during and at completion of a project. In relation to CSF2, if the contractor's interim payment applications were valid and accurate, project would be completed within the original or adjusted budget limit. Although specific to this research, the CSF weightings were in proportion to those conducted with previous studies (Yeung, *et al.,* (2008).

Two batches of project data which represented differing procurement and contractual engagement processes were examined. Group 1 comprised aggregated data from 60 discretely procured civil engineering highways maintenance projects collected between 2006 and 2008. Group 2 used aggregated data from 104 civil engineering highways maintenance projects collected between 2008 and 2010 through a framework agreement with a performance incentive mechanism. Both groups have the same public sector client controlled by standing orders, New Engineering Contract NEC 3rd Edition conditions of contract and same specifications. Performance differences between the two groups were analyzed by descriptive statistics and inference independent-samples t-tests.

RESULTS AND DISCUSSION

Descriptive statistics results

Section 1 of Table 2 compares the percentage of projects finished on time with those finished late. Discrete projects contained within this research only achieved a completion success of 12% within or at contractual time scales with framework projects having a 64% success rate using the same measure.

Two further areas of initial examination followed. Discrete projects started as required on 53% of occasions, whereas framework projects achieved this with 82% of the case study results, as shown in Section 2 of Table 2. Lastly, discrete projects finished with defects at a failure rate of 38%. By comparison, those projects undertaken within framework agreements produced a reduced 10% failure rate. Section 3 of Table 2 refers.

Table 2: Comparative analysis using descriptive statistics

Section 1 Source	Projects finished early or on time	Projects finished late
Case study discreet projects	12%	88%
Case study framework projects	64%	36%
Section 2 Source	**Projects started on time**	**Projects started late**
Case study discreet projects	53%	47%
Case study framework projects	82%	18%
Section 3 Source	**Projects finished with defects**	**Projects finished without defects**
Case study discreet projects	38%	62%
Case study framework projects	10%	90%

Independent-samples t-tests

Project outcomes for each critical success factor are calculated as numerical values in accordance with specific defined parameters using the metrics in Table 1. These values range from 0 (total failure in performance) to 1 (full performance of the metric). Each performance value is multiplied by the weighting decided by the client in Table 1 to arrive at a critical success value for each element. Measurement of critical success factors (CSFs) allows aggregation of a project success index (PSI) to be displayed as a numerical value between 0 and 1.

PSI was calculated based on the single partnering performance index model to measure the success of projects, as developed by Yeung *et al* (2008) in an empirical study for the Civil Engineering Department in Hong Kong. The model is shown below.

$$\text{Project success index} = \sum \frac{(AS - MV)}{(SV - MV)} We$$

Where:
Project success index = measure of success of a project
AS = Actual Score of the critical success factor being measured in accordance with the measurement definitions
MV = Minimum percentage value of the critical success factor
SV = Stretching percentage value of the critical success factor
We = Weighting of the critical success factor

Resultant CSFs and PSIs for all 164 projects are shown in Table 3. Application of group statistics show arithmetic means, standard deviation and standard errors of the two groups for each CSF and PSI.

Table 3: Group statistics for all 164 projects

	Discrete or framework project	N	Mean	Std. Deviation	Std. Error Mean
CSF1A result	Discrete project	60	.158	.014	.001
	Framework project	104	.160	.013	.001
CSF1B result	Discrete project	60	.129	.047	.006
	Framework project	104	.144	.040	.004
CSF2 result	Discrete project	60	.107	.054	.006
	Framework project	104	.250	.038	.003
CSF3 result	Discrete project	60	.123	.098	.012
	Framework project	104	.180	.059	.005
CSF4 result	Discrete project	60	.158	.044	.005
	Framework project	104	.187	.041	.004
Project success index	Discrete project	60	.677	.149	.019
	Framework project	104	.924	.092	.009

In order to statistically explore whether the two groups performance significantly different, independent-samples t-tests were used to detect the variation of means between the two groups, which was interpreted using the Eta squared formula (Levene, 1960), i.e.

Eta squared = t^2 / (t^2 + (N12 + N2 – 2)), where t=t-value and N=no. of cases

Results were further interpreted using guidelines proposed by Cohen (1998) to determine the magnitude of difference between groups. 0.01 infers small effect, 0.06 for moderate effect and 0.14 for large effect. A summary of results is shown in Table 4.

Table 4: Summary of independent-samples t-test results and interpretation

Variable/factor	**Independent t-test p-value result**	**Levene's Eta squared value**	**Cohen's magnitude of difference between means of the groups**
CSF1A – starting on time	0.278	0.007	Very small
CSF1B – finishing on time	0.034	0.027	Small to moderate
CSF2 – Accuracy of	0.000	0.709	Large

payments			
CSF3 – right first time (defects)	0.000	0.095	Moderate to large
CSF4 – Health and safety	0.000	0.090	Moderate to large
PSI – Project Success Index	0.000	0.454	Large

Results from the t-tests indicated a significant difference between the submission and agreement of accounts between contractor and supervising engineers. Although contractual payment mechanisms for both groups were the same, accuracy of payment applications (CFS2, p-value=0.0005)) within a framework environment significantly increased. This meant that the contractors' interim payment applications are more valid and accurate, thus ensuring that projects were completed within the budget limit. Because of longer term relationships and a collaborative working environment, excessive claims from contractors were reduced. Also framework contractors were able to be involved early in the design phase, thus reducing the extent of uncertainty, which meant less change orders and claims at the construction phase (Le, *et al.*, 2012). Other significant relationships related to quality improvement with framework projects. Defects and health and safety metrics (CSF3 and CSF4, both p-value=0.0005) were significantly higher with this group when compared with discrete projects. Mean scores for the two groups concerning starting on time (CSF1A, p-value=0.278) was insignificant but for finishing on time (CSF1B, p-value=0.034) was significant according to t-test results. This infers that more stringent contract requirements and performance monitoring should be put in place to ensure contractors to start on time. The descriptive findings in Sections 1 and 3 in Table 2 tallied with these inference results.

The aggregated measure of performance between groups was significantly different as the mean PSI score for framework agreement projects was 0.924 compared with 0.677 for discrete projects, as supported by the p-value (0005). The Eta squared statistic was 0.454 so the magnitude of difference was large. As explained by Construction Excellence (2009), Morledge and Smith (2013) and Construction Framework South West (2009), construction clients have a high level of commitment from the contractors due to longer term relationships and better success rate with bidding, which results in continuous improvement from engagement of best practice, a greater depth of understanding between all participants, earlier involvement of contractors and most importantly collaborative working. These arguments have been previously advocated by Latham (1994) and Egan (1998).

In summary, the hypothesis that framework agreements could have a positive impact on time, cost and quality at the construction phase due to longer term relationships was validated.

CONCLUSIONS

The purpose of this research is to assess whether use of framework agreements for construction projects can result in significant improvement for contractor performance outcomes in respect of quality, schedule and budget when compared with traditional discrete procurement methods. Results from this study showed a significant improvement for contractor performance with framework projects, in terms of aggregate performance as well as individual performance of quality (defects), time (finish on time) and cost (accuracy of payment applications). However, the framework did not have a significant impact on 'start on time'.

With longer term relationships and a collaborative environment, projects could be completed with better quality, on schedule and within budget. The results therefore support the use of framework agreements for the typical local authority under study and for the wider public sector environment. To optimize the impact of framework on contractor performance outcomes, the current framework procurement legislation should be extended beyond the 4-year period to a longer duration. Furthermore, more stringent contract requirements and performance monitoring should be put in place to ensure contractors to start on time.

Findings of this research are derived from one single typical county council. Following on from this, further research should be conducted on other local authorities so that findings can become more robust. This study focuses on examination of the contractor performance, leaving the impact of frameworks on the overall project cost to be assessed by a separate research.

References

Ahadzie, D.K., Proverbs, D.G., Olomolaiye, P. and Gameson, R. (2006). 'A conceptual predictive model for evaluating the performance of project managers in mass house building projects', In Baldwin, A., Hui, E. and Wong, F. (ed.), *Proceedings of the BEAR 2006 Construction Sustainability and Innovation/CIBW89 International Conference on Building Education and Research,* Hong Kong.

Atkinson, R. (1999). 'Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria', *International Journal of Project Management,* 17(6), 337-342.

Business and Enterprise Committee, (2008). *Construction Matters: Government Response to the Committee's Ninth Report of Session*

2007-08, House of Commons London: The Stationary Office Limited HC1187, 14 November 2008, London.

Chan, A.P.C., Scott, D. and Lam, E.W.M. (2002). 'Framework of success criteria for design/build projects', *Journal of Management in Engineering,* Vol. 18(3), 120-128*.*

Cohen, J. (1998) *Statistical Power Analysis for the Behavioral Sciences,* Erlbaumm Associates, New Jersey.

Constructing Excellence (2005). 'Why use a framework agreement*,* Constructing Excellence in the Built Environment', http://www.constructingexcellence.org.uk/tools/frameworkingtoolkit/whyuse.jsp, viewed: 23 April 2013.

Construction Excellence (2009). *Never Waste a Good Crisis – A Review of Progress since Rethinking Construction and Thoughts for Our Future,* Construction Excellence, London.

Construction Framework South West (2011). 'A Building Construction Framework for all Public Bodies in the South East', Devon County Council, http://www.cfsw.org.uk/, viewed: 3 August 2013.

Dainty, A. R. J. (2008). 'Methodological pluralism in construction management research', In Knight, A. and Ruddock, L. (ed.), Advanced Research Methods in the Built Environment, Wiley-Blackwell, Chichester.

Egan, Sir John (1998). *Rethinking Construction: Department of Trade and Industry (Construction Task Force),* Her Majesty's Stationary Office, London.

Evangelidizs, K. (1992). 'Performance measured performance gained', *The Treasurer,* February 1992, 45-47.

Fellows, R. and Liu, A. (2008). *Research methods for construction*, Wiley-Blackwell, Oxford.

Kerzner, H. (1998). *Project Management: A systems approach to planning, scheduling and controlling,* Van Nostrand Reinhold, New York.

Lahdenpera, P. (2011). Making sense of the muli-party contractual arrangement of project partnering, project alliancing and integrated project delivery, *Construction Management and Economics*, Vol. 30 (1), 57-79.

Latham, M. (1994). *Constructing the Team: Final Report of the Government/Industry Review of Procurement and Contractual Arrangements in the UK Construction Industry,* Her Majesty's Stationary Office, London.

Levene, H. (1960). 'Robust tests for equality of variances', *Journal of Educational and Behavioral Statistics*. 4, 278–292

Lim, C.S. ad Mohamed, M.Z. (1999), "Criteria of project success: an exploratory re-examination", *International Journal of Project Management,* Vol.17, Iss.4, pp. 243-248.

Li, H. and Arditi, D. (2012). Transactional-related issues and construction project performance, *Construction Management and Economics,* Vol. 30(2), pp. 151-164.

Meng, X. (2012). The effect of relationship management on project performance in construction, *International Journal of Project Management,* Vol.30(2), pp. 188-198.

Morgan, A., (2009), "I will not be taken for granted: BAA's boss on frameworks", *Building Magazine* 26 June 2009, pp. 6-9.

Morledge, R. and Smith, A. (2013), *Building Procurement*, Wiley-Blackwell, Oxford.

National Audit Office (2001). *Modernising Construction: Report by the Comptroller and Auditor General*, Her Majesty's Stationary Office, London.

Oilsen, P.R. (1971). 'Can project management be defined?', *Project Management Quarterly,* Vol. 2(1), 12-14.

Yeung, J.F.Y., Chan, A.P.C. & Chan, D.W.M. (2008). 'Establishing quantitative indicators for measuring the partnering performance of construction projects in Hong Kong', *Construction Management and Economics,* Vol. 26, 277-301.

Yin, R.K. (2009), *Case study research: design and methods*, SAGE, London.