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Outsourcing of Construction Professional Services in the UK University Sector: Prediction of Consultant Performance for the Selection Process

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Outsourcing of Construction Professional Services in the UK University Sector: Prediction of Consultant Performance for the Selection Process

Report for Royal Institution of Chartered Surveyors

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Abbreviations

RICS	The Royal Institution of Chartered Surveyors
HESA	Higher Education Statistics Agency
HEFCE	Higher Education Funding Council for England
POT	Performance Outcome of Time
POC	Performance Outcome of Cost
POQ	Performance Outcome of Quality
POI	Performance Outcome of Innovations
POR	Performance Outcome of Working Relationship with the Client
PST	Project Staff
APP	Executive Approach,
AOP	Competence of Firm
SFM	Size of Firm
CDM	Construction (Design and Management)
CON	Conscientiousness
CFW	Consultant Framework Appointment
CL	Competition Level
EU	European Union
OJEU	Official Journal of European Union
BMS	Building Management System
ISO	International Organization for Standardization
UK	United Kingdom

Executive Summary

Background

The UK had 161 universities in 2011/12. They formed a unique public sector in which an average of 9.4% (£3.136 billion) of institutional income was spent on estate capital and maintenance projects. In the UK, outsourcing of public services has become a significant part of the economy, accounting for £79bn in 2007/08 (nearly 6% of the GDP), and directly employing more than 1.2 million people. Construction services, facilities management and professional services are part of the key public services that have been outsourced. Good construction consultants can bring value to the organisations they serve. A carefully selected consultant can enhance a project in many ways and ensure it successfully meets the client's needs. However, as a purchasing decision, the selection of professional consultants is complex and difficult. Professional services are intangible, heterogeneous and multi-dimensional.

Best value approach is now a predominant principle for procuring public services in the UK. Both quality and cost are considered but assessed separately, based on the technical quality and the fees proposals in the tender. Quality is assessed first to determine whether the consultant's services can meet the client's requirements. It is then weighted against cost (tendered fees) according to their importance in the project to arrive at a final value for money judgment. The final selection should be the tender which offers the best overall value for money. Consequently, quality assessment is important because it forms a key part of the selection process.

As construction professional services are intangible, heterogeneous and multi-dimensional, it is crucial to ensure that performance quality is accurately assessed. Nonetheless, the existing quality assessment method has a major drawback which renders it unsuitable for selecting quality consultants and hence ensuring best value services. For quality assessment, critical selection factors are identified according to the size and complexity of a project, and each of these factors is then elaborated into a list of descriptors. The assessors are allowed to make discretions to choose from the pre-determined ranges of weightings for the selection factors and their individual performance descriptors, thus introducing subjectivity to the assessment. As a result, different consultants may be selected depending on whether an upper or lower range of the weightings is chosen. Quality assessment can be subjectively jeopardised. A revolutionary change is necessary in the current approach so that performance quality/outcomes can be objectively assessed.

It is critical to find practical ways to select high quality services that provide the best value for money for university clients and ultimately taxpayers, especially given the current budgetary pressures. If intangible performance quality can be objectively and significantly predicted, tenders can be assessed for whether the proposed services can meet the client's needs in the first place. The performance quality predicted is then further assessed with the proposed fees to determine the value.

Purpose

Aim of Research

This research aims to develop performance predictive conceptual models to forecast performance outcomes of construction consultants in the UK university environment, covering consultancies for new build, refurbishment and maintenance projects. Empirical studies show that there is a causal relationship between output performance and input economic and management factors in production of services and that regression can serve as a tool to forecast performance quality. Accordingly, it is possible to objectively and significantly predict the performance of construction consultants, based on these influencing factors used at the procurement stage. The regression models developed are in the form of mathematical regression equations to calculate individual performance outcomes. With ratings assessed for individual factors, each model will calculate a performance score for each performance outcome. Performance scores for individual performance outcomes will then be added to provide a total quality score.

Benefits to Stakeholders

The research will benefit the stakeholders in the outsourcing process of professional services as follows:

- The performance predictive conceptual models can be used and adapted as an outsourcing toolkit by estate managers, surveyors and other building professionals practicing consultant management in the university sector.
- Accurate and objective prediction of performance can ensure that a quality consultant is selected and that best value can be achieved for universities, which are currently under stringent budgetary pressures like other organisations in the public sector.
- Surveyors and building professionals can select quality consultants to ensure projects are successful, enabling functional and sustainable buildings, refurbishment and repairs to be achieved.

Research Methods

Combined qualitative-quantitative methods were used to examine the causal relationships between performance outcomes and input economic and management factors. Hypotheses on individual relationships generated by a literature review were refined using the findings from a qualitative multiple-case study and tested by a quantitative hierarchical regression analysis. Performance predictive models were then established in the form of regression equations. Such a methodology was adopted as it can achieve a high level of authenticity and generalisation, and most importantly objectivity.

Qualitative Multiple-case Study

With reference to the qualitative study, in-depth interviews were conducted with experienced consultant management practitioners of three university estate offices of large, medium and small sizes. The interviewees were asked what performance outcomes are expected by their university, what factors influence performance, and whether they agree to the causal relationships as derived from the literature review. Furthermore, policy and practice documents on procurement, selection and appointment of construction consultants were researched and examined. Interviewees' practical views and opinions as well as the documents were evaluated using qualitative content analysis. The findings helped to refine the hypotheses.

Quantitative Hierarchical Regression Analysis

For the quantitative study, a hierarchical regression analysis was conducted using data of 60 construction consultancies collected from a questionnaire survey sent to the universities. The participants were asked to choose a construction consultancy which had recently been completed for the university, upon which they could indicate: firstly, the level of the input of economic and management measures used to select consultants at the pre-contract phases; and secondly, the average performance outcomes achieved by consultants during the consultancy period. Each performance outcome was regressed against influencing factors. Regression analysis was used as it provides a powerful tool for developing a forecast of the future based on the past. It is one of the most efficient methods to analyse the relationship between the results and various types of influencing factors.

Key Findings

Qualitative Study Findings

In the public sector university environment, five generic performance outcomes required from construction consultants were identified by literature review and the qualitative content analysis: time, cost, quality, working relationship with the client and innovations (dependent variables). Details are shown in Table 1:

Task performance, contextual performance and economic factors were identified as generic influencing factors (predictor variables) by literature review, and their measures are refined by the qualitative study. Details are shown in Table 2.

Table 1 Performance Outcomes

Performance Outcomes	Measures
Time	• minimal variation in time against programme • start on time • completion on time
Cost	• at or below the approved cost limit • minimal variation in cost against budget • life cycle cost minimised
Quality	• a functional building/refurbishment/maintenance that meets the client's needs; with minimal rework (making good defects and material waste) due to error made in the design, or a necessary item or component is omitted from the design) • health and safety design and inspections to minimise accidents • sustainable design (reduction of energy, carbon emission, water consumption and waste, improvement of air quality and other aspects, or BREEAM rating for higher education)
Innovations	• cost / time savings expressed as a percentage of project totals
Working relationship with the client	• fair, responsive and courteous in the delivery of quality services • positive and provide service which meet the customers' requirements • get things right first time • respond effectively to customers' complaints and use customer feedback to secure continuous improvement • willingness to engage with end users and flexibility in reacting to or accommodating changes

Table 2 Performance Influencing Factors

Performance factor blocks	Measures
Task performance factors	
Project staff (relevant expertise & experience; level of authority)	• qualifications, experience and time commitment of the project team leader • qualifications and experience of proposed staff • management arrangements for sub-contracted services • details of the authority levels of the team members (clear roles and responsibilities) • ability to innovate • resources level
Execution approach (design and management methods)	• quality of design to meet the client's strategic needs (potential value to student recruitment and learning, staff recruitment, sustainable design) • quality of design to meet the client's practical needs (functional requirements, operational efficiency, aesthetics, cost / time constraints) • managerial procedures (communication with clients, managing the programme and sub-consultants, working around existing occupiers, collaboration with other project team members, management of key project risks, value management, health and safety plan)
Competence of firm (past performance)	• past performance **or** • previous clients' references • health and safety records
Size of firm (overall experience & facilities)	• experience of similar previous university projects, including experience of the form of contract and procurement route to be adopted • suitable qualifications of senior partners / managers • availability of technical facilities • financial stability • quality management system
Contextual Performance factors	
Conscientiousness	• speed in producing design drawings or completing tasks • level of enthusiasm in tackling a difficult assignment • adopting industry best practice
Trust and collaboration	• collaborative consultant frameworks • traditional discrete appointment of consultants
Economic factor	
Competition level	• Number of suppliers in the approved list of consultants or the consultant framework list

Quantitative Study Findings

Participants were asked to rate the average level of each performance measure achieved in the consultancy. Score 5 represents an excellent performance output whilst score 1 refers to unacceptable performance, as shown below:

1 poor/not acceptable

2 acceptable, but with significant reservations

3 good, acceptable with minor reservations

4 very good, no reservations

5 excellent

Participants were also asked to rate each measure of the task and contextual performance factors, according to their knowledge from the quality assessment taken in all tender procedures including prequalification, interview and tender evaluation. Score 5 represents the highest level of input provided by the consultant whilst score 1 refers to the minimum input, using the 5-point scale. However, trust and collaboration is measured by the consultant appointment method: collaborative consultant framework (represented by 1) and traditional discrete appointment of consultants (represented by 0). In relation to the economic factor, participants were asked to indicate the level of competition by referring to the number of competitors in the approved list of consultants or the consultant framework list.

The quantitative hierarchical regression analysis identifies significant positive predictors for four performance outcomes: time, cost, quality and working relationship. ‘Project staff’ (PST) is the most significant factor influencing time, cost and working relationship performance. ‘Competence of firm’ (COP) also significantly affects time and working relationship performance. ‘Execution approach’ (APP) is the only significant predictor for quality performance. ‘Consultant framework’ (CFW) is a significant predictor for cost, quality and working relationship performance. ‘Competition level’ (CL), as operationalised by the number of consultants on the list, is a not a significant predictor for all performance outcomes if the level is below 10. Conscientiousness (CON) is found to be not a significant predictor for all performance outcomes. ‘Size of firm’ (SFM) proved to be negatively correlated with time performance.

Improvements in time and cost through innovations are explicitly required by the government in its recent construction strategy. Nonetheless, it will take time for consultants to build up experience and momentum to innovate. Consequently no significant correlation can be detected between innovation performance and the predictors at this stage. However, it is expected that such a relationship can be established once the innovation culture has become mature in the future.

Conclusions and Recommendations

Performance Predictive Models

Individual performance outcomes (i.e. time, cost, quality and working relationship) can be significantly predicted by the performance predictive models, using related management and economic factors. The regression analysis generalises the performance predictive conceptual models as follows:

Performance outcome of time

$$POT = -6.432 + (0.676PST + 1.035COP - 0.319SFM)$$

Performance outcome of cost

$$POC = -8.761 + 0.788PST + 1.796CFW$$

Performance outcome of quality

$$POQ = 5.725 + 0.475APP + 1.575CFW$$

Performance outcome of working relationship

$$POR = -6.642 + (0.842PST + 0.905COP) + 1.263CFW$$

For each performance outcome, the predicted score should then be divided by the total score so that it can be converted into a weighted score (out of 100). The total score refers to the sum of the scores for individual measures assessed by tender prequalification, interview and technical proposals. It is necessary that the client and his professional estate team should decide the weightings for individual performance outcomes according to the organisation’s needs so that a single performance score can be calculated for each consultant. This quality score can then be combined with the fee score to decide the best value consultant to be selected.

The performance predictive conceptual models are developed based on data from architectural, building services engineering, quantity surveying, project management and combined project management/quantity surveying professional service consultancies. All these professional services are commonly used by construction clients. Their performance outcomes and performance influencing factors can be measured by a number of generic performance characteristics, as confirmed by the qualitative multiple case studies. Such models are adaptable for building and all other disciplines.

Recommendations for Clients

This report serves as guidance notes for enhancing the professional practice of the RICS members and other building professionals involved in consultant management in the university sector, especially building, facilities management, quantity and estate surveyors. The client's professional team should focus on the significant performance influencing factors and take advantage of the performance predictive models to select quality consultants.

Recommendations for Consultants

From the consultant perspective, findings of this research indicate which skills and behaviours are specifically required by university clients when selecting construction consultants.

1. 'Project staff' is the most significant predictor for three out of the four predictable performance outcomes, including time, cost and working relationship performance. Project team leader and members with relevant expertise and post-qualification experience, significant time commitment from the project leader, clear roles and responsibilities for team members, and adequate resources level are all essential for project success.
2. Management arrangements for sub-contracted services are also important in appointments of multi-disciplinary firms to provide the full range of services required. Chartered surveyors firms with expertise in design and construction, especially for teaching and learning spaces, special functions like PE and dance studio, students' accommodation and laboratory facilities, are in a strong position to be selected. Members of the building surveying, quantity surveying, project management and building control professional groups are experts in design, construction and management of real estate assets, cost and procurement of construction projects, management of construction projects, and building regulations, respectively. Firms should focus on clearly articulating the related project staff expertise and optimal staff resource management in the tender technical proposals because these key aspects are likely to succeed in having the firm selected.

Limitations and Further Research

The predictive performance models developed should be regarded as 'conceptual'. Different university estate offices may have different requirements on performance outcomes and selection criteria, which may further vary according to various project situations. It is recommended that the conceptual models developed should be reaffirmed by comparing the predicted performance scores calculated by the models with the performance scores awarded by assessors. If necessary, adjustments can be made by using the combined qualitative-quantitative research methods adopted in this research, thus creating customised models. Similarly, it is recommended further models should be developed based on this principle for other public sector organisations. The conceptual models will therefore benefit not only the university sector but the wider public sector as a whole.

It is recommended that the government and the construction industry should raise the awareness of the need for innovations. Further research can be conducted to establish the causal relationship between innovation performance and influencing factors once the innovation culture has become mature in the future.

The research is limited to construction consultancies. Facilities management is also part of professional services outsourced. Findings of this research form the basis upon which further research can be conducted to develop performance predictive models for selection of facilities management consultants.

All the qualitative interviews suggest that use of key performance indicators and other post-contract phase measures such as steering group meeting, site meetings and progress reports can drive the performance of construction consultants. As such, it is recommended further research be conducted to examine the impact of post-contract measures. A total performance model can then be established for consultant selection and management, covering both pre-contract and post-contract phases.

1.0 Introduction

1.1 Background

Good construction consultants can bring value to the organisations they serve. A carefully selected consultant can enhance a project in many ways and ensure it successfully meets the client's needs (CIC, 2005). Taylor and Booty (2009) consider that consultants can work better, thus enhancing the image of and bringing value to a business. Akin and Brooks (2009) add that consultants can provide better customer care services, uniqueness of service, flexibility for peak load and speedy response for priority works. However, as a purchasing decision, the selection of professional consultants is a complex and difficult process. Professional services are intangible, heterogeneous and multi-dimensional. Every construction or maintenance project is different, with buildings experiencing different user requirements, complexity, age, causes of failure, extent of obsolescence, etc. An experienced professional can recognise many of the same characteristics from project to project, but each project generally has some unique characteristics. Professional judgment is needed to recognise similarities and differences and to decide what to do with a difficult project, one that is going to require extra time or different kinds of techniques. Performance of professional services varies from firm to firm. Measure of quality, in terms of criteria and standards, is therefore difficult.

According to HESA (2012), there were 161 universities in the UK in 2011/12. They form a unique public sector and in 2008/09 an average of 9.4% (£3.136 billion) of institutional income was spent on estate capital (£2.4 billion) and maintenance (£736 million) (HEFCE, 2011). In the UK, outsourcing of public services has become a significant part of the economy, accounting for £79bn in 2007/08 (nearly 6% of the GDP), and directly employing over 1.2 million people (DeAnne, 2008). Construction professional services are part of the key public services outsourced. These services are provided by qualified professionals having a recognised identity in related disciplines, and their offering is advisory, focused on solving problems and usually commissioned on a project or term basis for new build, refurbishment and maintenance works.

Outsourcing is a management strategy for improving business efficiency and effective and has now become a global trend, with an output value that increased from US$146 billion in 1996 to US$1.3 trillion in 2007 (IAOP, 2011; PricewaterhouseCoopers, 2007). Nonetheless, Lember and Kriz (2006) clearly point out that gathering information about providers' behaviour and service outcome is still a most complicated task. A proper procurement mechanism is necessary to effectively decide on the choice of provider for a quality service. According to a study conducted by HfS Research (2013) on 282 enterprises, buyers of outsourcing of construction and facilities services need to develop necessary strategic business skills in order to realise the full value of outsourcing beyond cost reduction. Enterprises should redefine skill expectation for their outsourcing governance team and carefully assess providers' strategic talent and skills in helping them achieve business outcomes. Morledge and Smith (2013) further emphasise that an ineffective project team will result in failure of the three most essential project success criteria: completing the right project at the right price and at the right time. Government and representative bodies are consistently advised that the quality and ability aspect of a bid should take precedence over price. Although it is difficult, the selection of quality consultants is absolutely necessary to ensure project success. This key project success factor is supported by an empirical study undertaken by Ling (2002) which demonstrates that good construction consultants having proper design expertise and ability can interpret the client's needs and produce the right design for a satisfactory building. Extra time and monitoring costs will be incurred if consultants are not properly chosen.

1.2 Problem of the Existing Quality Assessment Method

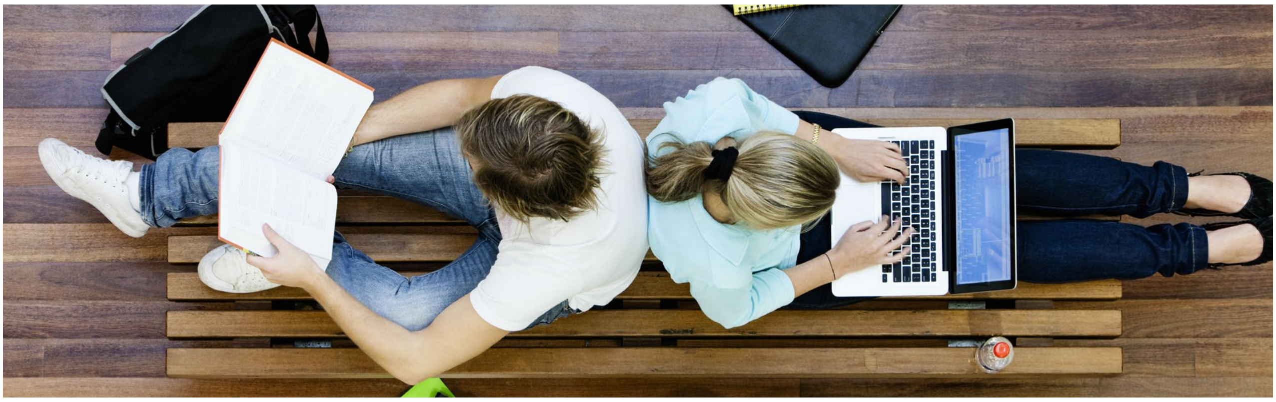
Best value approach is now a predominant principle for procurement of public services in the UK (OGC, 2008; Audit Commission, 2005). For procurement within the European Union, the Public Sector Directive published in April 2004 covers works, supplies and services and it permits tenders to be awarded on the basis of either lowest cost or most economically advantageous tender (MEAT), i.e. best value. It is necessary to consider price, time, technical quality and life cycle costing if projects are let on the 'most advantageous' approach (Morledge and Smith, 2013). Morledge and Smith further add that considering only the lowest price is now discredited in many parts of the world because tenderers are sometimes tempted to take substantial risks in order to win the bid. Best value offer should be considered in the selection of consultants.

To identify the best value offer, the client and the procurer usually combine each consultant's bid with the assessment of his performance quality (Morledge and Smith, 2013; Construction Industry Board, 1996; CIRIA, 1994). Aggregate scores for both quality and tendered price are calculated and then multiplied by their respective weightings to determine the overall score. Quality assessment is therefore of utmost importance because it is part of the selection process so ensures the best value consultant will be selected.

As construction professional services are intangible, heterogeneous and multi-dimensional, it is crucial that performance quality is accurately assessed. Nonetheless, the existing quality assessment method has a major drawback which renders it unsuitable for selecting quality consultants. In assessing quality, critical selection factors are identified according to the size and complexity of a project, and each of these factors is then elaborated into a list of descriptors. The assessors are allowed to make discretions to choose from the pre-determined ranges of weightings for the selection factors and their descriptors, thus introducing subjectivity to the assessment. As a result, a different consultant may be selected depending on whether the weightings' upper or lower range is chosen (Ng *et al.*, 2001). Assessment of construction professional services may involve a number of critical, intangible selection factors including cost effectiveness of design, programme, experience, leadership and staffing, teamwork culture, innovations, health and safety management, lean construction approach, sustainability and risk management (Ng *et al.*, 2001; CIC, 2005). Consequently, quality assessment can be significantly distorted by the assessors' subjectivity. Based on an industry-wide study on procurement of construction consultancy services in the UK, CIRIA (1994) finds that it is difficult to select consultants because procurers have the freedom to vary the selection criteria from project to project, and there is always a degree of subjective judgement about the relative importance of different selection criteria. A radical reform of the existing quality assessment approach is necessary in order for the performance quality / outcomes of consultants to be objectively assessed, based on the selection criteria.

1.3 Aim and Objectives of Research

The public sector in the UK comprises a wide range of organisations including central government, local authorities, the National Health Service, public utilities, housing associations and other entities. Higher education institutions are classified as one of the entities so they are subject to public sector procurement legislation if more than 50% of the project cost is financed by public funding. It is therefore important to find out practical ways to achieve best value services for the sector, especially given the current intense budget pressures. If intangible performance quality can be objectively and significantly predicted, tenders can be assessed whether the proposed services do meet the client's needs in the first place. The performance quality predicted is then further assessed with the proposed fees to determine the value.



Performance predictive models will be developed to forecast performance outcomes of construction consultants in the UK university environment, covering consultancies for new build, refurbishment and maintenance projects. Walker's (2007) project management theory contends that quality services can only be realised when specification requirements are clearly written and performance is stringently monitored. Boyne's (1998) theory of public choice emphasises the impact of market competition on improving cost and performance quality. Empirical studies demonstrate there is a causal relationship between output performance and input management and economic factors in production of services and that regression can be used as a tool to forecast performance quality (Lee *et al.*, 1999). Accordingly, it is possible to predict the performance of construction consultants, based on these influencing factors. The regression models developed will enable an objective prediction of consultant performance, and hence provide a useful toolkit for university facilities and estate managers to select quality consultants when professional services are outsourced. This toolkit will be in the form of a mathematical regression model based on related economic and management influencing factors to which consultants will be assessed. With ratings assessed for individual factors, each model will calculate a performance score for each performance outcome. Performance scores for individual performance outcomes will then be added to provide a total quality score.

To achieve the aim of this research, the study has the following objectives:

- identify the types of construction consultancy services commonly outsourced by university clients
- identify the output performance outcomes required by university clients from construction consultants (dependant variables)
- identify the input economic and management factors at pre-contract stage influencing performance outcomes (predictor variables)
- investigate the causal relationships between performance outcomes and input influencing factors.

Types of consultancy services commonly outsourced are explored in Section 2, along with a review of the existing selection process in Section 3. Project success outcomes and requirements of public sector clients are examined in Section 4. In Section 5, performance influencing factors will be discussed by referring to market competition and job performance theories. Development of the regression models for prediction of performance are then given in Sections 6 to 9. Operational, theoretical and research implications are drawn together at the conclusions and recommendations section.

Performance outcomes and influencing factors vary from organisation to organisation. The performance predictive models developed should be regarded as 'conceptual models' providing a versatile tool upon which customised models can be developed to suit individual requirements. Architectural, engineering, quantity surveying and other related design and advisory consulting activities are construction professional services listed in the UK standard industrial classification of economic activities (Jewell *et al.*, 2010). CIRIA (1994) lists architectural, engineering, surveying and project management consultancy services as the ones commonly employed in the UK construction industry. PACE (1998) provides general contract conditions for appointment of construction consultants in the public sector, which cover architects, landscape architects, structural engineers, building services engineers, civil engineers, quantity surveyors and building surveyors. To procure construction professional services within a university environment, Imperial College (2013) currently uses approved suppliers lists for appointment of architects, cost consultants, structural engineers, M&E engineers and project managers, along with CDM coordinators, approved building inspectors and asbestos management consultants. The conceptual models therefore concentrate on these better known professional services and any other specific services identified in the research. Such models are developed based on the generic performance outcomes and selection criteria within the university environment so they are adaptable to building and all other disciplines.

The scope of this study is limited to selection of consultants for planning, design, cost control and management of works based on the procurement routes commonly used in the UK university sector. Selection of design and build contractors is outside the remit of this study and it forms a separate area for further research.

2.0 Construction Consultancy Services

Image source: Alastair Wallace - Shutterstock.com

2.1 Typical Construction Works

According to the estate management statistics report published by HEFCE (2011) covering the period from 1998/99 to 2008/09, the UK higher education sector has spent an unprecedented capital investment on new build, refurbishment and maintenance projects in order to improve building condition, functional suitability, space efficiency and energy consumption in the context student numbers rapidly growing. Consequently the sector has made a number of significant improvements over the last 10 years. The average (median) percentage of space in good condition increased from 63% to 76% between 1999 and 2009. The average (median) percentage of space deemed functionally suitable rose from 66% to 83% between 1999 and 2009. Space (gross internal area) per student and staff FTE (full-time equivalent) has declined from 9.6 m² to 8.8 m² per person. Lastly, environmental performance improved over the same period against all key metrics, including energy consumption and CO2 emission. The improvements are important in meeting the needs of teaching, learning and research, as well as to attract and retain students, particularly from overseas, which is essential for financial sustainability.

The report includes case studies from five higher education institutions including Queen Margaret University, Edinburgh, Newcastle University, Sheffield Hallam University, University of Plymouth and Roehampton, which have shown the greatest improvement over the four areas aforesaid.

Typical capital and maintenance works that have been undertaken in these cases are essentially as follows:

- **New-build capital works.** The existing estate was in poor condition with deteriorating buildings that were inflexible and unsuitable for modern learning. Decisions have therefore been made either to relocate to an entirely new campus or to redevelop with new buildings for teaching and learning, special functions like PE and dance studio, as well as student accommodations. All new buildings are designed to have a low life-cycle cost for 70 years or so, purpose-built to enable functional suitability as well as space efficiency and flexibility. Green measures like non-industrial biomass heat generator, natural ventilation, extensive building management and lighting control systems (BMS) are also incorporated into design to reduce energy consumption and CO_2 emission.
- **Refurbishment capital works.** This includes major works to improve the functionality of buildings such as replacement of poorly insulated flat roofs, best payback energy saving measures like boiler replacement programme, improvement of building management controls, lighting upgrades, improvement of ventilation system, altering existing laboratories to create more space for current equipment, and extension of transformer sub-stations to meet current power consumption. Works are particularly complex because they are carried out with occupiers in situ and disruptions to existing activities have to be kept to a minimum. This requires the consultant having design and management skills and experience specific to this kind of work.
- **Maintenance works**. This refers to long-term planned maintenance, reactive maintenance, repairs and replacement of building and services components, as well as minor works required to maintain and improve the condition of buildings and the newness of the estate.

2.2 Construction Consultants

2.2.1 Capital Works Consultants

According to RICS (2010), 'traditional route' and 'design and build' are the procurement methods commonly used in Europe. The choice should be based on a number of factors including price certainty, flexibility, quality standards, complexity, risk allocation, price competition and responsibility. 'Traditional route' is probably still the most common procurement method in the UK, as suggested by Morledge and Smith (2013). They advocate that this practice is particularly suitable for the public sector which is always subject to rigid public expenditure and audit demands. In this design-bid-build route, the client has control over the design through their consultants. Designers and other advisors like quantity surveyors are appointed to complete design, cost planning and tender documentation before competitive tenders are invited for the main contract. The works are then administered by the same designer or a separate contract administrator (JCT 2012). Morledge and Smith further suggest three alternatives for appointing the professional project team members:

- Single appointment of a multidisciplinary firm providing the full range of services required, including design, tendering and contract administration.
- Single appointment of a lead consultant, often a project manager, who may directly appoint other consultants as his sub-contractors, or who will both manage the project and act as contract administrator.
- Separate appointments for individual disciplines, with one firm acting as the design team leader and being responsible for co-ordinating the work of other consultants.

Apart from architectural, structural, building services, quantity surveying and project management consultants, the CDM co-ordinator may be appointed for commercial projects to comply with the Construction (Design and Management) Regulations. However, a CDM coordinator service may be provided by the contractor if they have such expertise in-house.

In the 'design and build' route, the overall programme time can be shorter because design and construction are carried out in parallel and there is better communication between all project stakeholders, as suggested by Hale *et al.* (2009). Currently, there are three main variants on the 'design and build' arrangement. Traditional design and build contractors accept full design and construction responsibilities. To mitigate the risk of losing control over design and specification, the client usually appoints a professional advisor to prepare the employer's 'statement of requirements' for tendering purposes (JCT, 2012). The statement specifies the performance requirements and constraints of the project against which the performance of the completed building can be objectively measured.

To gain more control over design, ‘design and construct’ option is now a favourable option where the client appoints designers to prepare design up to Stage C (concept design) or D (developed design) and sometimes up to E (detailed design) on the RIBA 2007 Plan of Work (which are in line with RIBA 2013 Stages 2, 3 or 4), before the design and build contractor is employed to further develop design and construct the works (Morledge and Smith, 2013). The contractor has a responsibility to assess and verify the assumptions upon which the original design was based. ‘Novation design and build’ is another option which is similar to ‘design and construct’, except that once a contractor has been appointed, the designers’ appointment is assigned to the contractor to produce detailed drawings as part of the contractor’s team. However, the client may retain the independent services of the quantity surveyor, structural engineer or building services engineer as his supervisor to monitor cost and quality performance of the ‘design and build’ contractor.

As university teaching and research accommodations have specific design requirements which university clients would like to specify and control, it can be argued that ‘traditional’ design-bid-build route, ‘design and construct’ and ‘novation design and build’ are commonly used for capital new building and refurbishment works within a university environment.

2.2.2 Maintenance Works Consultants

In an empirical study conducted to identify the project procurement routes for European social housing energy renovation projects, Rahola and Straub (2013) find, through case studies, a questionnaire survey and interviews, that the ‘iterative minor renovations’ procurement route is the most commonly used method for project delivery. It was employed by 32 of the 36 social housing organisations, and applied in 55% of their renovation projects. This ‘bid and build’ approach is often used for maintenance to procure many replacements for a particular component when it has reached the end of its service life, for example, windows, kitchens and bathrooms, decoration, electrical installations and lifts. Economies of scale and cost efficiency are the drivers for this procurement path. Because this kind of maintenance work mainly involves replacements of building and services components with standard specification and details, design consultants are usually not required. The in-house maintenance team can undertake project management, preparation of specification and drawings, and the subsequent contract administration.

‘Traditional’ route was the second commonly used method, utilised by 34 social housing organisations and applied in 41.5% of their renovation projects. Akin and Brooks (2009) list architectural, engineering and landscape design to be the typical outsourced professional services for maintenance and improvement for corporate clients. ‘Design and build’ was implemented by some housing organisations but is not commonly used, due to the fact that design in maintenance projects is not an extensive element and that this procurement precludes independent design companies from acting as referees between employers and contractors (Chang *et al.*, 2010). ‘Design, build and maintain’ is an option where a single contract covered design, construction and maintenance works. However, this procurement path was not a common practice.

Building surveying consultants can be appointed to conduct condition surveys for large building stocks and design the long-term maintenance programme. Routine reactive maintenance is normally executed by term contracts, where small works can be specified and managed by the in-house team. Asbestos management consultants are often employed on a term basis to: firstly, prepare and review the asbestos management plan; and secondly, design repairs and removal if required.

2.2.3 Consultant Frameworks

Collaborative procurements are becoming more popular, particularly for large, complex and risky projects. In order to implement the recommendations offered by Latham and Egan, public sector organisations made changes to their consultant and 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, public supply 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 strategically provided to achieve an objective of providing stronger relationships and collaboration through fewer suppliers, which aligns with initiatives suggested by Latham (1994) and Egan (1998).

A prime characteristic of a framework agreement is the term – the pre-determined timescale for the agreement’s operation. 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 allows relationships and understanding to be nurtured where overall service rather than individual isolated project performance can be focused on. A secondary characteristic of construction frameworks is that a client may enter into identical agreements with a small number of different suppliers effectively creating a selected community with which to deliver projects. Supplier frameworks can consist of contractors (construction framework) or consultants (consultant framework). Frameworks are particularly useful where an authority knows they have a constant need for construction works or services, but are not sure of the extent or content. Frameworks have been developed as an innovative production arrangement for improving delivery through collaboration and integration of a project team.

This is especially true for high-risk, high-value long-term construction and refurbishment programmes, such as those found with public sector housing, education and highways capital expenditure (Constructing Excellence, 2005).

Only one major tendering process 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 value (reviewed every two years) 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 the use of standard documentation, can greatly reduce transaction costs (Morledge and Smith, 2013). Tenders may be awarded either on the basis of lowest cost or most economically advantageous tender (MEAT) which considers both price and technical quality proposals. Short listing of tenderers at the call-off stage is not required since only competent suppliers have been selected into the framework. It is argued that competent suppliers for a framework can negate the impact of reduced competition on price and performance quality.

According to GC/Works/5 General Conditions for the Appointment of Consultants: Framework Agreement (PACE, 1999), consultant frameworks are designed to be used with GC/Works contracts. Alternatively, they can be utilised with other standard forms of building contract including JCT Standard Building Contract and JCT Design and Build contract.

2.2.4 Summary

Traditional', 'design and construct' and 'novation design and build' are the procurement methods commonly used for capital new build, redevelopment and refurbishment projects. Architects, landscape architects, building services and structural engineers are appointed to provide the design input, which can be supported by appointments of quantity surveyors, project managers, contract administrators, CDM co-ordinators and approved building inspectors. These consultancy services can be procured on a multi-disciplinary or individual consultancy basis. Consultant frameworks can also be used for the universities where long-term major construction and refurbishment programmes are required to provide facilities to support the strategic expansion of teaching and research activities. In relation to maintenance works, repetitive large scale iterative works are normally procured by 'bid and build' without the need of using consultants. Building surveying consultants can be appointed to prepare the long-term maintenance programme whilst asbestos management consultants are often appointed on a term basis to carry out specific tasks.

Typical construction consultants appointed for capital and maintenance projects are summarised in Figures 1 and 2.

Figure 1 Construction Consultants for Capital and Maintenance Projects using the Traditional Path (Design-bid-build)

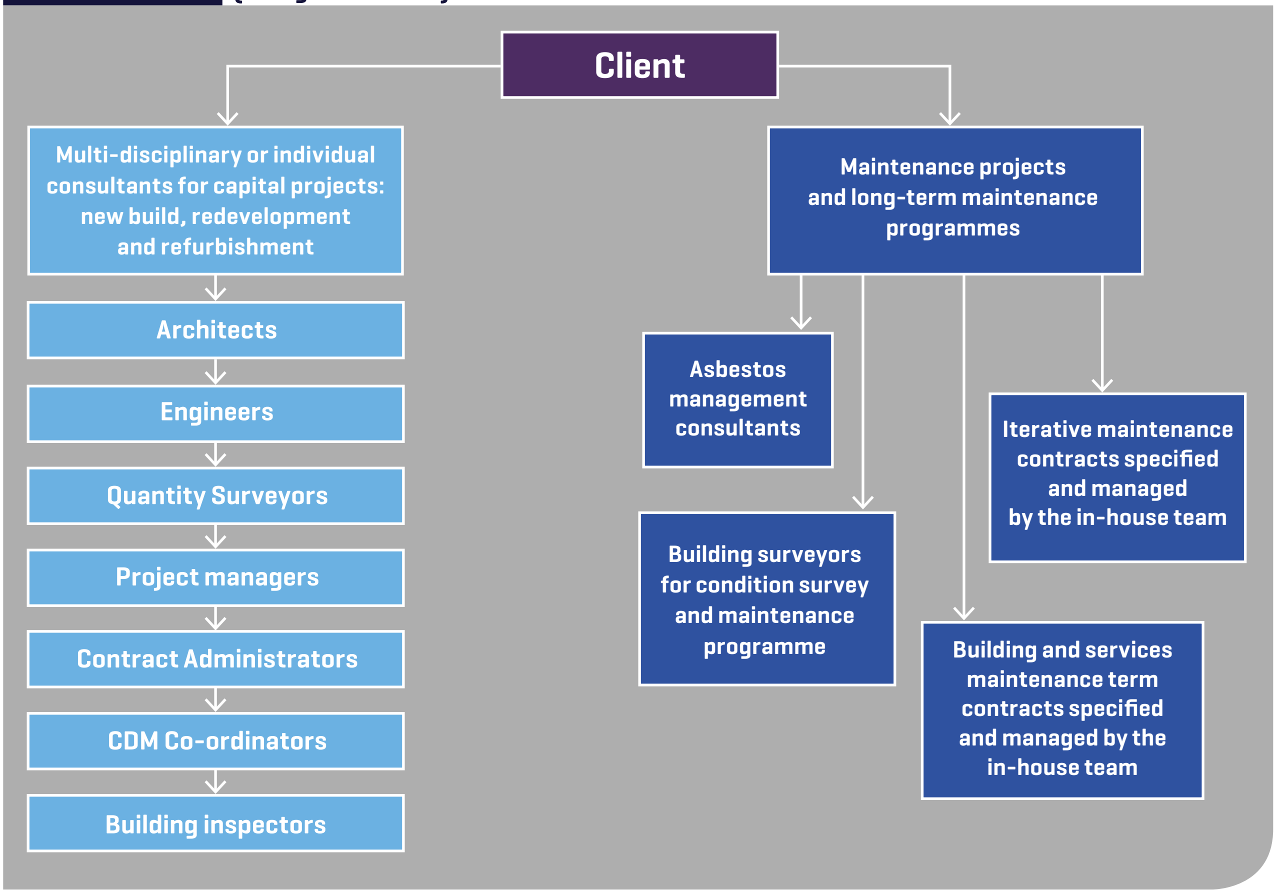
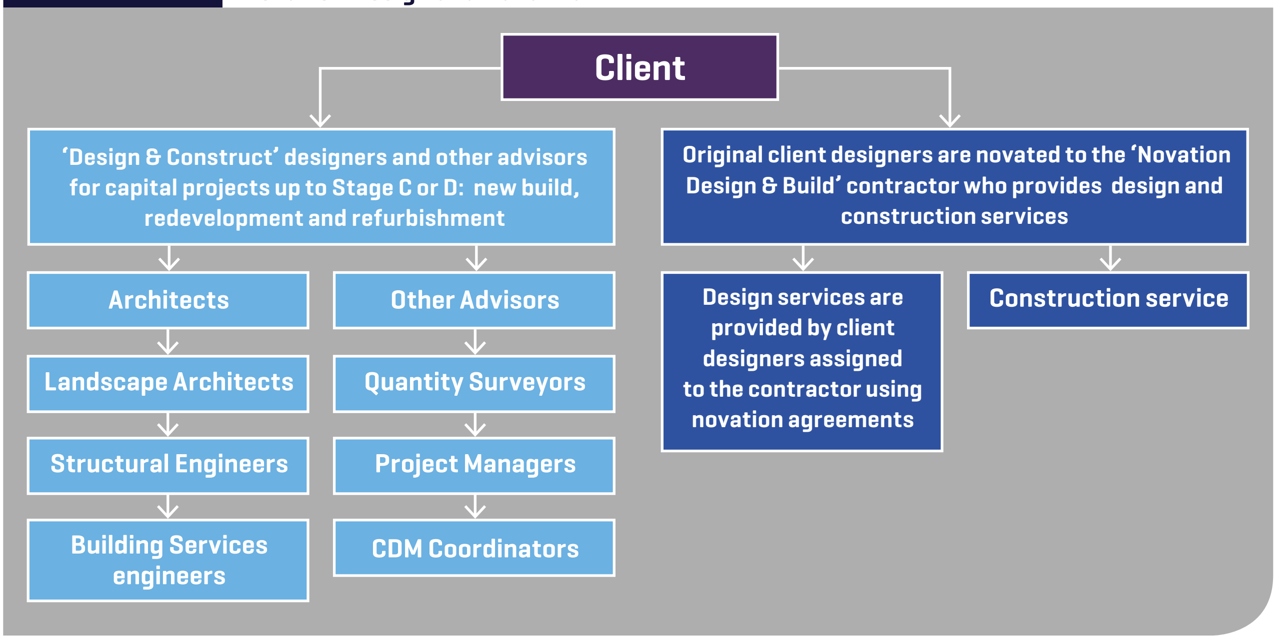


Figure 2 Construction Consultants for Capital Projects using the 'Design and Construct' or 'Novation Design and Build' Path



3.0 Selection Process

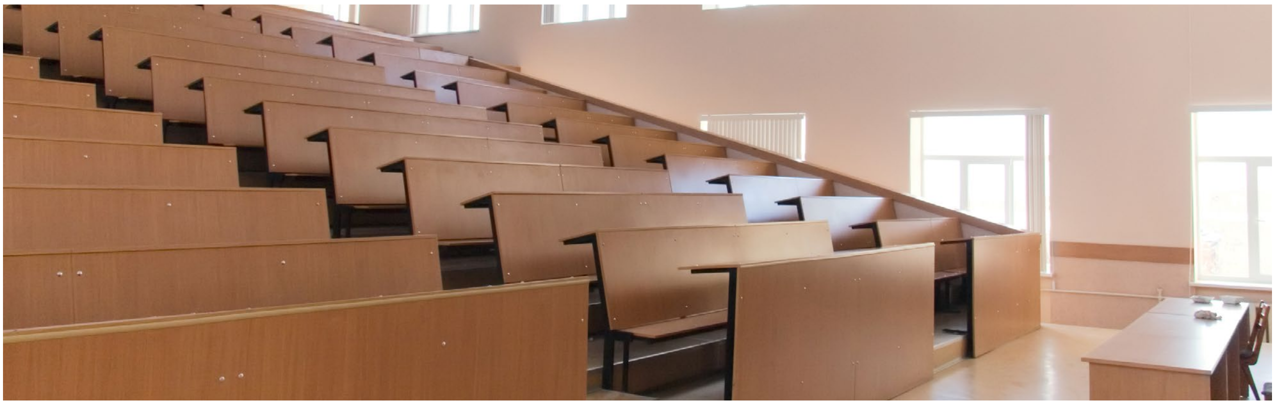


Image source: Alastair Wallace – Shutterstock.com

3.1 3-Stage Approach

The procurement of services in the public sector in Europe is controlled by various EU Directives and these regulations are incorporated into UK law through the Public Works Contract Regulations. To ensure maximum fairness and transparency, the selection of consultants goes through three stages (Morledge and Smith, 2013):

- Prequalification and compilation of the tender list
- Tender invitation and submission
- Tender evaluation and acceptance

Higher education institutions are one of public sector organisations so are required to follow this public procurement regime. In the prequalification process, a tender list can be easily compiled for each project where a client maintains a standard 'list of approved consultants' or a 'consultant framework'. Alternatively the tender list can be compiled on an 'ad hoc' basis. As previously explained in Section 2.2.3, if the contract value is above a predetermined threshold value, open tendering must be advertised in the OJEU. The purpose of prequalification is to ensure that the organisations chosen to tender have the necessary technical and managerial skills as well as technical and financial resources to complete the works, and that they wish to submit a genuinely competitive bid. This research focuses on the tender evaluation procedure in which quality and cost of the tenders are assessed.

3.2 Best Value Assessment

In the UK, best value regime has been imposed on local authorities and many other public bodies since 1997 for procurement of construction works and services in order to maximise value for money, as stated by the Office of Government Commerce for managing a wide range of construction projects (OGC, 2008) and Audit Commission (Audit Commission, 2005). The government's Construction Strategy (Cabinet Office, 2011) reiterates that best value principle should be used for the procurement as consideration of only price is unlikely to secure value for money. Higher education institutes (apart from a few private universities) are classified as one of the public sector organisations and accordingly they are required to comply with the best value regime for procurement.

According to Morledge and Smith (2013), Construction Industry Board (1996) and CIRIA (1994), best value offer is usually achieved by a combined assessment of each consultant's tendered price and his performance quality (which is termed the double-envelop or two-envelop bids) based on their relative weightings, i.e.

Combined score = W1 × Fee Score + W2 × Quality Score, where

W1 = weighting of fee

W2 = weighting of quality, where more complex projects have a higher weighting for quality.

In this equation, price is relatively easy to measure but quality is not. Quality involves consideration of a diverse range of factors which assess the consultant's ability to satisfy the client's needs such as creativity, technical competence, managerial skills, availability of resources and professional integrity as well as the consultant's approach to a commission. This information is all included in the technical proposals of a tender. Tendering involving competition on both quality and price is considered to be the most rigorous procedure which should be open and accountable, help demonstrate value for money and most importantly select the most suitable consultant (CIRIA, 1994). However, the final choice may not just simply depend on the combined score. A tender may have to be rejected if the fee is found to be unrealistically low for the resources that are needed. This is to avoid substandard performance and unwanted claims for additional payment, particularly in a depressed market. It is therefore advisable to request a statement of staff levels and other resources which consultants are to provide for the fee quoted.

3.3 Quality Assessment

Quality assessment is based on an evaluation of the technical proposals and is achieved by marking each of the quality criteria out of 100 and multiplying the score by the weighting percentage. Consultants passing quality threshold may then be interviewed to supplement or to refine the evaluation of their technical proposals. The assessors are allowed to make discretions to choose from the pre-determined ranges of weightings for the quality criteria, and for their individual performance descriptors. Based on an industry industry-wide study on procurement of construction consultant services, CIRIA (1994) finds that the pre-determined ranges can be quite broad, i.e.

General experience and facilities: 10 to 30%

Relevant expertise and experience: 30 to 70%

Approach for meeting the client's requirements: 20 to 60%

Similar findings are reiterated by Morledge and Smith (2013). Section 1.2 has highlighted that this subjective assessment can result in wide distortions on the weightings chosen, thus jeopardising the final decision because different consultants may be selected depending on whether upper or lower limit of the pre-determined range is used.

3.4 Fee Assessment

Professional consultants can be paid by a fee percentage of the construction cost, a lump sum or on a time charge basis. Lump sum fees are considered by Morledge and Smith (2013) to be the most satisfactory and common form of remuneration as the scope and timescale of the services to be provided can be reasonably defined and hence quite accurate. The most popular technique for evaluation of fee bids is to compare various tender prices and score them with a pre-set formula. One popular and yet simple formula is to allocate 100 marks to the lowest tender and to rank each other tender according to the percentage difference between it and the lowest, i.e.

$$\text{Fee Score} = 100 + \frac{(\text{Tender Price} - \text{Lowest Tender Price})}{\text{Lowest Tender Price}} \times 100$$

As this assessment is based on tender prices, fee scores would be factual and objective. This means that the only subjective element in the assessment of best value score would be from the quality assessment. Consequently, this research contributes to the selection practice by developing an objective performance predictive model which alleviates subjective judgement on quality assessment.

4.0 Performance Outcomes

4.1 Construction Project Success

Poor performance, including quality defects, time delays and cost overruns, are not uncommon in construction projects (Lo *et al.*, 2006). Having gone through an extensive literature review, Meng (2012) concludes that time, cost and quality are the three most important indicators to measure construction project success.

In research which assessed the impact of competitive fee tendering on the quality of construction professional services, Hoxley (1998) developed a service quality measure scale called SURVEYQUAL. The model was based on a service quality model proved by Parasuraman *et al.* (1988) for the retail service industry to use, but with specific items related to construction professional services in architectural, real estate and building surveying professions. The resulting model is a 28-item one, comprising both output and input performance measures. Reliability and validity of the model were tested and proved with data from 244 client organisations, including mainly local authorities and public bodies (78%): district councils, county councils, universities, government agencies, housing associations and the NHS (National Health Service) Trust. The professionals assessed included chartered surveyors (59%), architects (19%), engineers (11%), multi-disciplinary (6%), and other professions (5%).

The model confirms that quality, time and cost are the performance outcomes that construction clients look for. First, the consultant's solutions to problems are technically correct. Second, the consultant provides its services at the time it promises to. Lastly, the consultant provides good cost control of projects. Ling (2002) suggests that architectural and engineering consultants with potential for successful performance should be selected. Consultants must be able to produce a functional and satisfactory building that meets the client's needs, based on their proper design capability. If consultants are not properly selected, extra time and monitoring costs will be incurred (Russell and Jaselskis, 1992). Design quality is considered to be the most important factor when measuring the consultant's performance.

Project success outcomes should cover both design and construction phases (Ahadzie *et al.*, 2008). Yeung *et al.* (2008) developed a model to measure project success for civil engineering projects undertaken by the Hong Kong Government, which was based on the traditional criteria of price, time and quality. However, it did introduce four other critical success factors. Validation of the model was achieved through structured interviews with the public sector clients in Hong Kong, resulting in seven critical success factors. Apart from time performance (variation in time against programme), cost performance (variation in cost against budget) and quality performance (cost of rectifying defects, number of defects or number of complaints) during the construction phase, innovations (cost and time savings expressed as a percentage of project totals) at the design phase were also considered to be crucial. The research also identified that management commitment (percentage of meetings attended by project managers and directors), trust and respect (speed of solving disputes) and communication (number of letters and emails sent between parties) significantly influenced the project outcomes.

Most importantly, Yeung *et al.* recognise the need to use specific critical success factors tailored to suit the requirements of different clients and various project situations. Moreover, the client and his/her advisory team should decide the importance of each project success factor by choosing a weighted apportionment.

4.2 Requirements of Public Sector Clients

The UK government has set out a clear construction strategy for developing a right model for public sector construction procurement so that the potential and value for construction and infrastructure projects can be maximised (Cabinet Office, 2011). Public sector clients should concentrate on required performance outcomes instead of prescriptive input to measure project success. In alignment with the recommendations from Latham (1994), a collaborative project execution approach is spelled out: designers and contractors should work together to develop an integrated and innovative solution that best meets the required outcome, in particular cost efficiency and reduction. To get full value from the public sector construction, public authorities should identify the criteria for value against which suppliers' propositions will be appraised. These in turn should be related to the whole life of projects to minimise the lifecycle cost.

Recent budgetary cuts from the central government mean that councils have to seek ways to ensure value for money from their construction budgets. Such need for cost reduction and quality improvement is reiterated by Audit Commission (2011). Apart from cost efficiency, reduced carbon emission in the government estate through the procurement of new construction is also one of the government strategic objectives in public sector construction. This should be achieved by reduced energy consumption, water consumption and waste to landfill in accordance with agreed targets from the existing and emerging government policy, as stated by Cabinet Office (2011).

Through research into highways maintenance projects undertaken by a county council, Lam and Gale (2014) identified five critical success factors that measured the success of public sector projects. These factors can be categorised into time: start on time (ratio of days late starting against contract period) and finish on time (ratio of day finished late against contract period); cost: accuracy of payment (interim payments certified within 5% of contractor's application); quality: right first time (project completed without remedial works) and health and safety inspection (percentage of inspection passed). In terms of quality, Love and Heng (2006) point out that defects and failures can be caused by errors and omission in design, thus resulting in rework which involves repairing defects, replacement of waste materials and warranty repairs. Errors are related to mistakes made in the design whilst omission refers to a necessary item or component omitted from the design.

Performance requirements of quality, time and cost are explicitly specified in the public sector contracts for appointment of construction consultants, including GC/Works/5 General Conditions for the Appointment of Consultants (PACE, 1998) and GC/Works/5 General Conditions for the Appointment of Consultants: Framework Agreement (PACE, 1999). Consultants are required by these contracts to carry out all necessary services and obligations to complete the project satisfactorily at or below the approved cost limit.

Based on the literature findings revealed in Sections 4.1 and 4.2, quality, time and cost are the most important performance outcomes required by the public sector construction clients (see summary in Table 3). Universities in the UK are virtually public sector organisations so they should look for these performance outcomes when they are selecting construction consultants. If these individual outcomes can be predicted by using performance predictive models based on related economic and management factors, the client and his advisory team can decide their weightings according to the organisation's needs. This will make it possible to calculate a single performance score for individual consultants. This quality score can then be combined with the fee score to decide the best value consultant to be selected.

Table 3 Performance Outcomes and Measures

Performance Outcomes (Dependent Variables)	**Measures**
Time	• minimal variation in time against programme • start on time • completion on time
Cost	• at or below approved cost limit • minimal variation in cost against budget • life cycle cost minimised
Quality	• a functional building/refurbishment/maintenance that meets the client's needs; with minimal rework (making good defects and material waste) due to error made in the design, or a necessary item or component is omitted from the design • health and safety design and inspections to minimise accidents • reduction in carbon emission, water consumption and waste
Innovations	• cost / time savings expressed as a percentage of project totals

5.0 Economic and Management Input Factors

5.1 Economic Factor

5.1.1 EU and UK Regulations

The UK is a member of the European Union (EU) and therefore subject to compliance with the public procurement rules under the EU Directives for public works, services, and supplies. The three Directives were consolidated into one Public Sector Directive in 2004. For public sector works, there is an obligation to comply with the directive if they are directly subsidised by more than 50%. Architectural, engineering, urban planning, landscaping, maintenance and other associated technical consultancy services are all subject to full compliance with the procurement regime.

As explained in Section 3.1, tendering of public sector works and services must ensure maximum fairness and transparency in the selection process. Competition is a fair and transparent process and it can give clients better value for money, as argued by CIRCA (1994). According to the Public Sector Directive, open tendering should be used wherever possible because it maximises competition. However, public clients are allowed to opt for restricted tendering on the grounds of the nature of work and the administrative cost involved in assessing tender. In fact, construction work is most often let under the restricted tendering (Morledge and Smith, 2013). Restricted tendering is a two-stage process that involves pre-selection of consultants to form a short list from which final bids will be invited. This can ensure that all short-listed consultants are competent to carry out the work and that it is more cost effective to assess a relatively small group of suitably qualified consultants in the competition process.

The EU regulations allow tenders to be awarded on the basis of either lowest cost or the most economically advantageous tender (MEAT). In relation to the latter, a wide range of selection criteria are permitted, including price, time, technical quality and life-cycle cost, although it is necessary to establish the validity of the lowest tender price if it is not accepted. In other words, the best value procurement regime in the UK complies with the EU requirements.

5.1.2 Effect of Competition on Performance

The effect of market competition on delivery of public services is primarily founded on 'public choice' theory. The theory argues that if public officials monopolise service delivery, the result is oversupply and inefficiency. By contrast, if services are contracted out, the pressure of a competitive market would improve quality and cost performance (Flynn, 2002; Boyne, 1998).

In a survey of around 670 manufacturing companies in the U.K., Nickell (1996) found that competition had a significant positive correlation with the rates of total factor productivity growth, including improvement of product quality. Nickell explained that both efficiency and quality performance were driven by competition. Competition not only drives the performance of managers and workers, but also allows ways of doing things to be tried out before selecting the best. In other words, competition leads to innovations so that firms can maintain a bargaining position in the market and subsequently remain in the approved list of suppliers maintained by the client.

In relation to the consultant frameworks, competitive forces can arise from the framework suppliers list through a reward system. Such system is used by a major local authority located in the South East Region. Suppliers' performance is appraised quarterly, based on critical success factors related to time, cost and quality. An aggregate performance value is awarded to individual suppliers. Depending on aggregated values, suppliers are placed in one of three zones – red, amber or green. The zone positions are used for tender assessment purposes for a subsequent three-month period where a green zone supplier will gain a 10% advantage in tender assessment, an amber zone supplier receives neutral tender assessment and a red zone supplier has a 10% disadvantage in tender assessment. These results offer a financial advantage or disadvantage for each supplier according to objective and measured past performance that may be used when choosing suppliers for future projects. Such incentive-based financial systems can facilitate performance following the propositions made by Bayliss *et al.* (2004) and Tang *et al.* (2006).

Lam (2009) examines the impact of market competition on performance in housing maintenance consultancies. In an empirical study on the procurement of maintenance consultants at the Hong Kong Housing Authority, Lam found from a regression analysis of 50 maintenance consultancies that the performance quality was significantly influenced by the number of direct competitors on the tender list. Consultants had to provide competitive quality and quantity of resources in order to win a contract. Following a study into the measures of performance of consultant performance, Hoxley (2000) examined the impact of competitive fee tendering and fee levels on service quality. Surprisingly, it emerged that construction professionals had not allowed fee competition to compromise their professionalism. Instead of inputting fewer resources into the projects, consultants minimised costs by improving the organisational structure and working methods as well as using better production equipment and technology, as explained by Boyne (1998) for the positive impact of competition on performance. Lam (2009) also found that the quality of professional services had no significant correlation with the fee percentage.

It can therefore be argued that there is a positive correlation between the consultant performance and the level of competition, which can be operationalised by the number of competitors either in the approved list of consultants or consultant framework list, or on the tender list.

5.2 Management Factors

5.2.1 Theory of Job Performance

The theory of job performance suggests that it consists of task performance (Van Scotter and Motowidlo, 1996) and contextual performance (Borman and Motowidlo, 1993). The former refers to the proficiency and skills in job-specific tasks related to the project and the relevant job experience. The latter refers to general communication and coordination skills as well as initiative and teamwork within an organisational setting.

5.2.2 Task Performance Factors

Construction professional firms are heterogeneous, involving a wide range of architectural, engineering, quantity surveying and related technical services for a variety of types of construction such as residential, non-residential and civil engineering. Nonetheless, Lowendahl (2007) clearly states that the professional services can be described by a number of generic performance characteristics such as knowledge intensiveness, professional assessment and judgement, highly customised services, high degree of interaction, etc. Morledge and Smith (2013) suggest three generic ability factors for final selection of consultants, namely, capability of firm, competence of firm, and staff proposed for the project. In addition to these, CIRIA (1994) suggests that execution approach, i.e. the strategy chosen to execute a project, should be considered.

Capability refers to the size of firm which is measured by the overall experience of firms in projects of similar function as well as the availability of sufficient staff, finance, facilities and quality management system for the firm to meet the demand of project programmes. Through an extensive questionnaire survey mainly to the public sector clients and local authorities, Hoxley (1998) confirmed that relevant experience and use of up-to-date technology influenced the performance of construction consultants. With reference to the size of a firm, Rowbotham (1992) explains that large firms often allocate resources to other major projects so it is argued that firm size does not really matter. This is because the most important consideration is whether the firm can provide adequate, competent and experienced project staff to provide prompt and quality services to meet the client's needs.

Competence refers to the performance of a firm in past projects. This can be ascertained by seeking references from previous clients if and when a new consultant is assessed. Past behaviour and performance is considered to be the best predictor of future behaviour performance according to the theory of selection psychology (Hogan *et al.*, 1996; Ling, 2000). Hogan *et al.*'s meta-analytic research suggests that performance in many jobs should, in principle, be predictable using good measures of past behaviour and performance, including 'being responsive to client's needs', 'being persistent' and 'taking initiatives'. Similarly, measures are revealed by Hoxley (1998), including 'whether the firm is always willing to help its clients' and 'whether the firm provides prompt services'. Many studies show that past performance is an important selection criterion for construction consultants (Winch and Schneider, 1993), particularly when projects are of a complex nature. According to Kashiwagi (2004), clients are likely to have a successful project if project team members, who can prove previous success, are selected. Based on a regression analysis, Lam (2009) proved that the quality of professional services had a significant relationship with past performance, competition level and project leadership, amongst which past performance was found to be the best predictor.

Project staff refers to the relevant expertise and experience of the personnel directly employed for the project, including the project team leader and other nominated staff. Lewis (1989) finds that leadership is a critical factor affecting team performance. Such a finding is supported by Terziovski and Dean (1998) in their analysis of 550 medium to large sized Australian service organisations that assessed the impact of quality management practices on performance outcomes. The research revealed that there was a significant correlation between performance outcomes and quality management practices which included quality in the strategic planning process, customer involvement, empowerment of the workforce, and using quality performance as a key performance indicator. All of these management practices are driven by the project leader. Yeung *et al.* (2008) adds that management commitment, expressed as a percentage of meetings attended by project managers and directors, is one of the critical factors to guarantee project success.

The way to execute a project (execution approach) is a measure of the consultant's design and management methods to meet the client's needs at three levels. First, it is a measure of the consultant's overall approach to meet the client's strategic needs for adding value to their business, for example, providing a good working environment for staff to attract talents, a good study environment to facilitate student learning and increasing student numbers. Second, execution approach is a measure of understanding the client's practical needs in terms of function, operational efficiency, aesthetics, cost, and time constraints. Within a specific construction context in Singapore which involved selection of architects and engineers by the design and build contractors, Ling (2002) confirms, through a multiple regression analysis, that problem-solving ability and project approach is one of the significant factors influencing the consultant's performance. This is consistent with Hoxley's (1998) findings that 'whether the firm understands client's problem' and 'knowledge and competence to solve the problem' were significantly correlated to performance. Church (1993) and Bennett *et al.* (1996) confirm that problem-solving ability and understanding project scope and brief, as shown in the project approach, are important requirements for selection of consultants by construction clients. Third, execution approach is a measure of the consultant's managerial procedures for liaising with the client and managing the programmes and sub-consultants. Yeung *et al.* (2008) point out that communication, as measured by the number of letters and emails sent between parties, is a critical success factor. Atkin and Adrian (2009) also emphasise that working within occupied environments requires special attention. How work and services are delivered and the manner in which communication with the client and other stakeholders occurs have now become increasingly relevant. This consideration is particularly pertinent to the university sector where construction works are always carried out around existing buildings and users.

5.2.3 Contextual Performance Factors

Conscientiousness, initiative, social skills, control and commitment should be considered when assessing contextual performance (Borman and Motowidlo, 1993). Ling (2002) confirms that conscientiousness, comprising the level of enthusiasm in tackling a difficult commission and the speed in producing design drawings, is a significant factor influencing consultant performance. According to Motowidlo and Van Scotter (1994), individuals who enthusiastically tackled difficult work performed better. According to Chen and Mead (1997), building owners, consultants and contractors contended that slow production of drawings would hinder team performance and compromise teamwork. Owners often want their projects to be completed speedily.

Other factors, including initiative (offering suggestions to improve design), social skills (interpersonal and communication skills), controllability (respect for team work and collaboration, compliance with instructions and speed of response) and commitment (loyalty to employer, preparedness to revise design and interest in the commission), were found by Ling (2002) to not be significant in influencing how well architects and engineering consultants performed.

PACE (1998) requires that for construction consultancy services in the public sector, consultants should collaborate with other project team members at all stages including design, cost planning and control, procurement, tendering, construction and operation and maintenance. Yeung *et al.* (2008) find trust and respect, as measured by the speed of solving disputes, is one of the critical success factors for construction projects. When compared to the traditional discrete appointment approach, consultant frameworks provide longer and stronger relationships and hence enhance trust and collaboration and teamwork between the client and the supplier. A number of perceived benefits are stated to apply through the use of framework agreements (Construction Excellence, 2009), as summarised below:

- greater depth of understanding between all participants due to longer lasting relationships
- ability for suppliers to gain a higher success rate with bidding for projects due to the fact that frameworks normally have a smaller number of suppliers
- higher level of commitment from the client and the supplier due to longer lasting relationships
- continuous improvement by the supplier engaging in best practice and continuous improvement.

5.2.4 Summary of Performance Influencing Factors

Based on the literature findings, task and contextual performance influencing factors, along with their respective measures, are summarised in Tables 4 and 5.

Table 4 Task Performance Factors

Performance factors (Predictor Variables)	Measures
Project staff (relevant expertise & experience)	• qualifications, experience and time commitment of the project team leader • qualifications and experience of proposed staff • management arrangements for sub-contracted services
Execution approach (design and management methods for the commission)	• quality of design to meet the client's strategic needs (potential value to student recruitment and learning, staff recruitment, carbon reduction) • quality of design to meet the client's practical needs (problem-solving ability to resolve functional requirements, operational efficiency, aesthetics, cost / time constraint) • managerial procedures (communication with clients; managing the programme and sub-consultants; working around existing occupiers; collaboration with other project team members)
Competence of firm (past performance)	• performance on past projects or job references from previous clients
Size of firm / capability (overall experience & facilities)	• experience of similar previous university projects • suitable qualifications of senior partners / managers • availability of technical facilities • financially stability • quality management system

Table 5 Contextual Performance Factors

Performance factors (Predictor Variables)	Measures
Conscientiousness	• speed in producing design drawings or completing tasks • level of enthusiasm in tackling a difficult assignment
Trust and collaboration	• collaborative consultant frameworks • traditional discrete appointment of consultants

6.0 Research Methods

6.1 Combined Qualitative-Quantitative Methods

This research aims to develop performance predictive conceptual models for selection of construction consultants. To address this aim, the following objectives were established:

1. To identify the types of construction consultancy services commonly outsourced by university clients
2. To identify the output performance outcomes required by university clients from construction consultancies (dependant variables)
3. To identify the input management and economic factors at pre-contract phase influencing performance outcomes (predictor variables)
4. To investigate the causal relationships between performance outcomes and input influencing factors

Combined methods were used, consisting of a qualitative multiple-case study to address Objectives 1, 2 and 3, and a quantitative regression analysis to address Objective 4. Employing qualitative and quantitative methods in tandem can achieve a higher level of authenticity and generalisation (Raftery *et al.*, 1997; Chau *et al.*, 1998). Hypotheses on individual relationships were generated by literature review, which were refined by the findings from a qualitative multiple-case study and tested by a quantitative regression analysis. Performance predictive models were then developed in the form of mathematical regression equations.

In relation to the qualitative case studies, in-depth expert interviews were conducted with experienced consultant management practitioners of the estates offices of three universities of large, medium and small sizes in terms of building portfolio size and the associated capital and maintenance budgets. Each interview took approximately 45 minutes using a semi-structured questionnaire as shown in Appendix 1, which was developed based on Table 3 in Section 4.2 and Tables 4 and 5 in Section 5.2.4. The participants were first asked about what construction services are outsourced in the organisation. They were then specifically asked whether they agreed to the proposed individual performance outcomes (time, cost, quality or innovations) and the management and economic influencing factors as well as their causal relationships, based on their practical experience within their organisation. Furthermore, a document research was conducted to examine their policy documents on procurement, selection and appointment of construction consultants, as well as tender invitation letters and evaluation reports. Their practical views and opinions and the documents were analysed by qualitative content analysis. The findings were used to refine the hypotheses which were further tested by a quantitative regression analysis. Fellows and Liu (2008) and Yin (2009) advocate that a case study approach can serve to investigate phenomena in a real context and from which rich conclusions can be drawn.

The positivist approach was adopted as the analytical framework to examine the causal relationship between the output performance and input management and economic factors. This rigorous scientific approach can produce robust results through generalisation.

In the quantitative study, a hierarchical regression analysis was conducted using data collected from a questionnaire survey sent to the estates offices of the universities in the country. The informants were asked to choose a construction consultancy recently completed, upon which they could rate: firstly, the average performance level of individual performance outcomes achieved by the consultant over the consultancy period (dependent variables); secondly, the level of task and contextual performance inputs revealed in the quality assessment in all tender procedures including prequalification, interview and tender evaluation; and thirdly, the level of economic force (predictor variables). These three blocks of predictor variables (task performance, contextual performance and economic factors) were entered into the hierarchical regression equation one by one for analysis. For each performance outcome, an analysis was conducted to validate the relationship between the performance outcome and the influencing factors, to identify the relative contribution of each block to the performance, and to identify the significant performance predictors.

Regression is a powerful tool for developing a forecast of the future based on the past (Schleirfer and Bell, 1995). It is one of the most efficient methods that can analyse the relationship between the result and various types of influencing factors. In fact, multiple regression models have been used in a number of empirical cases to study the relationship between output quality of services or products and input management practices in the manufacturing, medical and construction environments (Forker, 1997; Terzioviski and Dean, 1998, 1997; Lam, 2009).

The names of individuals and organisations participating in this research will not be divulged for ethical reasons.

6.2 Hypotheses

Based on the literature findings, the following hypotheses were developed:

H1: Time performance outcome of construction consultants was positively correlated to the level of task and contextual performance inputs and the level of competition.

H2: Cost performance outcome of construction consultants was positively correlated to the level of task and contextual performance inputs and the level of competition.

H3: Quality performance outcome of construction consultants was positively correlated to the level of task and contextual performance inputs and the level of competition.

H4: Innovation performance outcome of construction consultants was positively correlated to the level of task and contextual performance inputs and the level of competition.

6.3 Operationalisation of Data

In a study on the appointment of architects and engineers by design and build contractors in Singapore, Ling (2002) adopted a 10-point Likert scale to measure the overall performance outcome and its attributes in order to find out their relationship by regression analysis. CIRIA (1994) suggests that a 5-point scale should be appropriate in most circumstances for measuring the consultant inputs. The 5-point Likert scale is relatively simple and hence encourages better returns for the questionnaire survey, so it was adopted to measure both performance outcomes and influencing input factors in this research. Details of the performance scores are as follows:

1 poor / not acceptable

2 acceptable, but with significant reservations

3 good, acceptable with minor reservations

4 very good, no reservations

5 excellent

Score 5 represented an excellent performance output whilst score 1 referred to unacceptable performance. Since the scores were clearly defined, an accurate rating could be achieved and this eliminated the possibility that rating scores would fall within a narrow range. Responses to the measures of each sub-scale / performance outcome were added to form a single score. Scores for individual performance outcomes were considered separately and not combined into a single unitary. This approach for measures of dependent variables is in line with Pallant (2007) and Love *et al.* (2010). As explained in Section 4.1, the client and his advisory team should determine the weightings of individual performance outcomes according to the organisation's needs, and a single quality score can then be calculated based on the weightings apportioned.

Participants were also asked to use the same 5-point scale to rate the sub-scale measures of individual task and contextual performance factors. Score 5 represented the highest level of input provided by the consultant whilst score 1 referred to the minimum input. Responses to the measures were added to form a single score for each performance influencing factor.

In relation to the economic factor, participants were asked to indicate the level of competition by referring to the number of competitors in the approved list of consultants or consultant framework list.

Operationalisation of the dependent and predictor variables finally proposed after the qualitative study, along with the regression equations, are shown in Tables 6 and 7 in Section 7.4 and Table 8 in Section 8.1.

7.0 Qualitative Multiple-case Study

7.1 Case Study 1

7.1.1 Background

This university is located in East England and is the largest of the three universities studied here. Its Estate Management Office is a multi-disciplinary organisation responsible for the development, management and maintenance of the University estate. The estate has a broad and complex nature. Some buildings are 800 years old, Grade I Listed and protected by English Heritage, whilst others are new with highly sustainable building fabrics and building management systems. The Estate Management Office is responsible for:

- Planning and managing the University's estate development programme
- Project managing new building construction and the refurbishment/alteration of the existing stock
- Maintaining the University's teaching, research and administrative buildings
- Promoting the University's environmental sustainability initiative, particularly with regard to reducing carbon emissions

The Estate Development Section of the Estate Management Office is responsible for the capital building programme for new building and refurbishment projects and its current budget in 2013/14 is more than £110 million. The programme provides a rich mix of activities that utilise best practice 'risk-averse' methods of planning, design, development and construction. The Maintenance Section is responsible for planned maintenance of the operational estate as well as carrying out repairs and minor refurbishments and alterations, having a current annual maintenance budget in the order of £31 million plus.

In-depth qualitative interviews were conducted with the Estate Development Section, using the semi-structured interview questionnaire. In addition to this, the following documents were researched to examine the consultant selection process:

- Selection and Appointment of Consultants, Contractors and Suppliers: Section 5 / Consultants (Document 1, 2012).
- Selection and Appointment of Consultants, Contractors and Suppliers: Section 5 / Construction and Construction Related Goods and Services (excluding Consultants) (Document 2, 2012).
- Two invitation for interview letters: one for appointment of an architect lead consultant (Document 3, 2011); one for appointment of a services engineer (Document 4, 2010)
- One tender evaluation report for appointment of an architect lead design consultant (Document 5, 2013)
- Customer Care Statement (Document 6, 2014)

7.1.2 Outsourcing of Construction Professional Services

The Estate Development Section has a lean structure with 20 in-house professional staff acting as client project managers and over 90% of the construction professional services are outsourced. Consultants are selected from the approved lists of consultants which are reviewed four times a year for quality assurance purposes. The current approved lists cover the following professional services:

- Architectural (building and landscaping)
- Engineering (building services and structural engineering)
- Quantity surveying
- Project management and contract administration
- CDM co-ordination
- Approved building control inspectors
- Asbestos management
- Other consultancy services: vibration specialists for laboratories, acoustics consultant, planning consultants (for works involving listed buildings and historic buildings within conservation areas), and environmental consultants

To ensure quality consultants are selected, the selection process has to go through three steps: shortlisting, interview and quality/price assessment (Document 1, 2012). A minimum of three consultants should be shortlisted from a specific discipline, either by selecting suitable firms from the approved list, or from responses from an OJEU Notice. Three consultants are normally shortlisted for contracts with an estimate value of less than £3 million, and four or five consultants for contracts above that value. In arriving at an agreed shortlist, the project manager needs to obtain an agreement from the Head of Section and the Representative User (where applicable), and to consult colleagues about the consultant's performance on previous projects. After being shortlisted, consultants are required to submit a technical proposal detailing the following information:

- Turnover
- Resources of the firm, including management, capacity and capability
- Experience on similar projects
- Experience of the form of contract and the procurement route to be adopted
- References
- Proposed personal, including CVs, who are to be assigned to the project
- Previous performance on other university projects for the University
- Sustainability policy and achievements
- Schedule showing the level and quantity of resources to be devoted to the project
- Professional indemnity insurance details
- Quality assurance

Consultants may be asked to submit a fee quotation in the proposal document or, in the event that the selection process is to include interviews, at that time.

For smaller projects up to £1 million in value, technical submissions are scored against the selected quality criteria. This, along with the weighted price score, will decide upon the firm to be appointed. For larger and other projects where deemed necessary the selection process is likely to include interviewing the shortlisted consultants. The information contained in the consultant's technical proposal, along with their presentation and responses in the interview, will be assessed and scored against the quality criteria by the selection panel. According to a tender evaluation report (Document 5, 2013), as supplemented by Document 3 (2011) and Document 4 (2010), quality criteria for selection are as follows:

- The firm's experience of similar projects, laboratory refurbishment and live operational environments
- Experience of working with the university and / or other higher education (HE) establishments
- Team structure, management and capacity
- Key personnel, qualifications and experience
- Experience of Single Stage tender or 2-Stage procurement
- Key project risks and proposals for managing these risks

The quality and price weightings used to determine the firm to be appointed will be set by the selection panel but would normally be 60 to 80% for quality and 20 to 40% for price. Quality is considered to be more important than price and this finding further supports the need for this research which aims to develop a performance predictive model for selection of quality construction consultants.

Single Stage selective tendering (with design responsibility and appointment of designers remaining with the employer) is mostly used for projects with a value not exceeding £1 million. For capital projects valued over £3 million, a 2-Stage 'Develop and Construct' procurement is normally used (Document 2, 2012). At Stage 1, the designer develops the design up to the RIBA Stage C or D and the project quantity surveyor prepares the tender documents for appointment of a 'Design and Construct' contractor. The tender returns from the contractor should include a technical proposal for quality assessment and a price quotation allowing for preliminary costs, overhead and profit percentages to be applied to the works packages, pre-construction services fees and design fees. Part of the contractor's Stage 1 services is to invite tenders for all sub-contract works packages. At Stage 2, the contractor will undertake this process and based upon the sub-contract tender returns and the additions priced at Stage 1, the contractor can develop a tender sum for the construction works.

If the selected procurement route dictates that the consultant is to be novated to the contractor, 'Novation Design and Build' approach will be used and the consultant is advised prior to submitting a fee quotation.

In maintaining the operational estate as well as carrying out minor refurbishments and alterations, the Maintenance Section uses in-house surveying design staff and craftsmen as well as making extensive use of external consultants and contractors. The area surveyors work closely with faculties and departments to identify their requirements and deliver solutions in respect of the alteration and use of university buildings, and are responsible for the delivery of smaller to medium sized works from small scale office refurbishment to larger scale structural modifications. In outsourcing construction professional services, the Section follows the selection procedures as set out in Document 1 (2012) and Document 2 (2012), which are applicable to both capital and maintenance projects.

7.1.3 Comments on the Proposed Performance Outcomes and Influencing Factors

The participants strongly agreed to the expected performance outcomes of time, cost, quality and innovations listed in Table 3 under Section 4.2. They considered that cost (budget control and life cycle cost) is the most important performance outcome, and that quality should include sustainable design covering carbon reduction, waste minimisation, optimal use of water, travel arrangement and other aspects, which are measured by BREEAM rating for higher education. As well as those four performance outcomes, they indicated that 'working relationship' with the customer department should be considered. This is in line with Hoxley (1998) who proved 'working relationship with clients' and 'whether the firm provides personal attention to the client' to be significant to influence the performance of construction consultants. Based on the Customer Care Statement (Document 6, 2014) and Hoxley (1998), this performance outcome can be measured by:

- Being fair, responsive and courteous in the delivery of quality services
- Being positive and providing a service which meets the customers' requirements
- Getting things right the first time
- Responding effectively to customers' complaints and using customer feedback to secure continuous improvement

The participants also strongly agreed to the proposed performance influencing factors and their measures as listed in Tables 4 and 5 under Section 5.2.4. For the impact of competition, the participants considered that the number of bidders in the tender list is effective in achieving competitive prices but not conclusive regarding its impact on the performance quality.

The participants believed that other factors can influence the consultant performance. Performance monitoring measures taken at the pre- and post-contract phases are necessary to ensure high service quality. This includes using approved lists of consultants, shortlisting and interview at the pre-contract phase and employing key performance indicators at the post-contract phase. The consultant lists are reviewed four times a year and consultants who perform poorly are removed.

7.1.4 Use of Consultant Frameworks

The Estate Development Section has planned to replace the existing approved lists with consultant frameworks in the near future. This is to reduce the cost and time required for the procurement process within an environment of constant high volume of capital and maintenance works and to improve the consultant performance through a longer and stronger relationship. As explained by Morledge and Smith (2013), only one major tendering exercise is required at the 'inclusion into a framework stage' which is then followed by the call-off mini-competitions, thus reducing the number of different major tendering exercises that would otherwise be incurred. Furthermore the use of standard documentation can greatly reduce the transaction cost. A commercial advantage is prevalent to suppliers chosen for a framework. Callaghan (2010) suggests that suppliers to a framework agreement are provided with more chance of being awarded valuable business opportunities due to a smaller number of competitors. This, along with potential savings achieved through aggregated costs of tendering from economies of scale, in turn prompts suppliers to offer more competitive prices. Tennant and Fernie (2012) use axioms at the centre of neoclassicism to explain the collaborative behaviour of suppliers within construction frameworks. There is always a corporate self-interest to maximise profit in pursuit of a successful business outcome and it is argued that frameworks allow continuity of workload providing increased turnover and allowing economies of scale. Consequently firms may adopt collaborative practices as a business strategy in order to gain these benefits.

7.2 Case Study 2

7.2.1 Background

This University is located in East England and currently owns and leases 36 buildings over three campuses. Its building portfolio size and capital and maintenance are the smallest of the three universities evaluated here. The premises are used for teaching, research, administration and student accommodation. The Projects Team of the Estates and Facilities Office is responsible for new build, redevelopment, refurbishment of existing facilities and enhancement of the environment by landscaping the campuses, whilst the Facilities Team deals with day-to-day cleaning, janitorial, parking, general repairs and maintenance. Most buildings were built in the 1950s and 1960s so there has been an extensive redevelopment and refurbishment programmes over recent years for upgrading and expansion purposes, along with new developments.

In-depth qualitative interviews were conducted with Projects and Facilities Teams. These were supplemented by a qualitative analysis of the following documents to examine the consultant selection process:

- A tender evaluation report for appointing an architectural consultant for a research and education centre project (Document 7, 2009).
- A tender evaluation proforma for appointing building services consultants for CHP and district heating major improvement projects (Document 8, 2014).
- Performance evaluation proforma for pre-construction, construction and post-construction aftercare phases (Document 9, 2014).

7.2.2 Outsourcing of Construction Professional Services

The current capital budget of 2013/14 for building and refurbishment works is around £17 million. Capital projects requiring design input are basically outsourced to construction consultants. Projects of this type with a value of up to £250,000 are executed by the traditional procurement route. Architectural and engineering consultants are responsible for full design and the in-house project team deals with project management and contract administration. Projects with a value exceeding £250,000 are considered to have higher risks so they are procured by 'Design and Construct' route so that design and construction risks can be transferred to the contractor. Construction consultants are appointed to prepare a design up to RIBA Stage C or D where the 'Design and Construct' contractor is employed with a 2-Stage procurement. 'Novation Design and Build' is adopted for major building projects. Professional services outsourced include:

- Architectural (building and landscaping)
- Engineering (building services and structural engineering)
- Quantity surveying
- Project management (part in-house and part outsourced; combined with contract administration service for large and complex projects)
- Contract administration (part in-house and part outsourced)
- CDM co-ordination
- Approved building control inspector
- Asbestos management

Refurbishment of building services mainly refers to sustainability improvement works for heating, ventilation, lighting and building management systems (BMS). Consulting building services engineers are appointed to prepare design, leaving tendering, contract administration and project management to be undertaken by the in-house team. Refurbishment involving building and services improvements are usually procured using the 'Design and Construct' route.

For consultancy contracts that are valued below the OJEU threshold, an ad hoc tendering list is prepared for every project and the shortlisting at this stage is based on the consultant's past performance, as reflected in the in-house records and other universities' recommendations. This finding is consistent with the theory of selection psychology and many empirical studies which indicate that past behaviour and performance is the best predictor of how well construction consultants will work (Ling, 2000; Lam, 2009). The procedure is then followed by tender submission, interview and the final tender evaluation based on both price and quality. Price to quality ratio is typically 60% to 40%, but it varies according to the extent of design input, indicating that more emphasis is put on quality when choosing construction consultants.

Quality is assessed according to the following criteria (Document 7, 2009; Document 8, 2014):

- A short statement of capability demonstrating the company's skill and relevant experience to carry out the work
- Details of similar projects that have been carried out by the company
- A statement and examples on the company's ability to innovate
- Two references
- Full details of proposed team for the project demonstrating their relevant experience, including resources level
- Details of the professional and trade qualifications of the proposed team
- Details of the authority level of the consultancy team members, which clearly defines their roles and responsibilities
- Curriculum vitae of the key personnel
- Understanding client aspirations and project brief
- Certificate of indemnity and public liability insurance
- Three years audited accounts
- Quality management systems (ISO9001 and ISO14001) and project review process
- Programme and methodology of how to keep to the schedule
- Approach to environmental and health and safety issues arising on the project
- Management of key project risks
- Value management approach in keeping to budget while ensuring client's requirements are still met
- Management of live site logistics

For consultancy contracts with a higher value, OJEU tendering procedures may follow and these involve an EU-wide advertisement. Alternatively, tenderers may be selected from a framework currently used by regional local authorities, for example, Smarte East Framework which was formed by Essex, Hertfordshire and Suffolk County Councils for delivering public sector works projects. The purpose of this was for them to share their expertise and best practice while using their combined purchasing and bargaining power to secure collective objectives.

In relation to long-term and routine maintenance, the Facilities Team is fully responsible for maintenance of building fabric and services to provide an attractive and functional environment for teaching. 'Iterative maintenance' for replacement of a large number of standard building components and services such as windows, toilets, decoration and electrical wiring is procured by the 'bid and build' route. These standard works are basically specified and managed by the in-house team and the 'bid and build' method can achieve economies of scale, as revealed by

Rahola and Straub (2013) in their study on maintenance of social housing (see Section 2.2.2). Routine maintenance of building work is managed by the in-house direct labour whilst a term contract is arranged for maintenance of building services. Order and supervision of works are done in-house. To prepare the long-term maintenance programme, building surveying consultants are appointed to carry out extensive condition surveys because of their expertise and capacity to complete the task within a tight schedule.

7.2.3 Comments on the Proposed Performance Outcomes and Influencing Factors

The participants agreed to the proposed performance outcomes as listed in Table 3. It was suggested by Document 9 (2014) that 'meeting the agreed milestones' should also be used to measure the 'time' performance outcome, which is similar to the findings of Yeung *et al.* (2008) that 'minimal variation in time against programme' should be one of the measures for time performance outcome. In line with the findings from Case 1, the participants considered that 'working relationship with the client' should be regarded as one of the performance outcomes, but further suggested that willingness to engage with end users and flexibility in reacting to or accommodating changes should be one of the accepted measures. Moreover, innovation is certainly an important performance outcome in which sustainable design should be measured.

Both participants agreed to the proposed performance influencing factors and their measures as listed in Tables 4 and 5. They also suggested the additional measures should be considered as well:

- It is important to supplement task performance factors with contextual performance factors. The former is mainly assessed by a technical proposal which may not be realised during the course of consultancy. The latter are fundamental factors driving performance.
- Competence (past performance): health and safety records
- Project staff (relevant expertise and experience): ability to innovate
- Execution approach: management control procedures should cover risk management, health and safety plan, and value management
- Conscientiousness: use of industry best practice

Five tenderers are usually invited to tender if OJEU predetermined threshold value is exceeded, and for consultancies of less value three tenderers are invited to tender. One of the participants contended that consultant performance is less a function of number of tenderers than having the right tenderers. Apart from shortlisting, interviews and use of key performance indicators, steering group meetings, site meetings and progress reports were also deemed to be effective performance measures to ensure quality performance from consultants.

7.3 Case Study 3

7.3.1 Background

This University is situated in London and owns one of the largest estates in the UK's higher education sector. It has seven campuses and two groups of miscellaneous properties, comprising buildings for teaching, research, teaching hospitals, administration and student accommodation. The Estates Office undertakes a wide range of refurbishment, redevelopment and new building projects. The Support Services Office is responsible for providing comprehensive building and landscape maintenance across campuses, including planned major maintenance, responsive maintenance and minor improvement projects such as retrofits of existing buildings and plant to improve energy efficiency.

In-depth qualitative interviews were conducted with the Estates and Support Services Offices, along with the Finance and Procurement Office which supports these two offices. Additionally, the following documents used by the Estates Office were examined:

- Procurement management: Section 5.0 of the Project Processes (Document 10, 2014)
- Approved suppliers lists (Document 11, 2013)
- Post project review – proforma outcome report (Document 12, 2010)

7.3.2 Outsourcing of Construction Professional Services

Currently the University has an annual budget of over £60 million for capital projects and over £12 million for maintenance works in 2013/14.

The Estates Office is tasked with the development and delivery of projects with a value of over £100,000. 'Design and Construct' route is adopted as the procurement strategy in order that design and construction risks are transferred to contractors. Also external consultants can relieve peak demand for construction professional services from large scale projects such as the postgraduate institute development for teaching, research and administration. Accordingly the in-house structure is quite lean, comprising one director, two senior project managers, two assistant project managers, one quantity surveyor and one planner. Designers are appointed to prepare design up to RIBA Stage C, D or E. They can be novated to the contractor for major projects by means of the 'Novation Design and Build' method, or retained by the client to act as the supervisor to monitor the contractor's performance (Document 10, 2014). Regarding the appointments of consultants, the Estates Office should consider the need for appropriate external consultants and agree to this with the Finance Procurement Office. A decision will be taken on which of the following consultants will be required for the project:

- Project manager
- Architect / building surveyor
- Cost manager
- Structural engineer
- Mechanical and electrical engineer
- Fire consultant
- Security consultant
- Safety consultant
- Energy consultant
- CDM coordinator
- Approved building control inspector
- Asbestos manager
- Planning consultant

Approved lists of consultants were formed in August 2013 to replace the previous consultant frameworks system in order to achieve more competitive prices. Each specialist framework normally lasted for four years and had only a small number of consultants available for tendering. The approved lists have two tiers: T1 and T2. The current approved lists for architects, cost consultants, project management and structural engineers have five suppliers in T1 and another five in T2, while the approved lists of approved building control inspectors and CDM coordinators have three T1 suppliers and three T2 suppliers (Document 11, 2013). T1 consultants have higher prequalification scores and hence more opportunity for tendering. Suppliers are invited for tendering based on their existing workload, recent performance and the consultancy contract value.

A minimum of three tenders is required for contracts with a value between £100,000 to £2 million and a minimum of four tenders for contracts up to £10 million. Performance of the consultants in approved lists is reviewed on a quarterly basis so that good performers can be promoted from T2 to T1 and are given more chance to tender whilst poor performers can be downgraded or even expelled from the list. This kind of competition is based on the number of suppliers in an approved list and the associated performance review, which is somewhat different from the findings of Hoxley (2000) and Lam (2009) which show that consultant performance is correlated to the level of tender competition, i.e. the number of tenderers on the tender list.

Tenders evaluation is based on price and quality, typically in a ratio of 60% to 40%. In relation to consultancy contracts with a value between £100,000 to £2M, quality is assessed on a technical proposal, along with an interview if necessary. The technical proposal should address ten key design and management areas as listed in the assessment report checklist (Document 12, 2010), namely:

- Production of a comprehensive design brief
- A shared and good understanding of the project objectives: time, cost and quality
- Coordination of design activities
- Balancing of 'cost in use' issues versus 'capital costs'
- Stakeholder and user communication
- Clearly defined roles and responsibility
- Proactive risk identification and management during design
- Value engineering and cost control during design
- Integration and management of cost control with drawing / design revisions
- Innovative design solutions

A team of electrical and mechanical engineers and building surveyors are directly employed by the Support Services Office to design and manage maintenance works. A term maintenance contractor and a body of specialist sub-contractors are utilised to provide planned and reactive maintenance as well as minor improvement services. A number of specialist 'approved' contractors are available to undertake one-off pieces of work or maintenance activities. External consultants or 'Design and Build' contractors are employed to relieve existing in-house workload or to provide necessary design inputs. Suppliers are obtained from the approved lists used by the Estates Office and the final selection is based on price only because shortlisting is considered to be sufficient for small sized consultancies.

7.3.3 Comments on the Proposed Performance Outcomes and Influencing Factors

The participants strongly agreed to the performance outcomes as listed in Table 3. One of the participants from the Estates Office suggested a working relationship with the client should be considered a key performance outcome and this finding tallies with the comments revealed in the other two case studies. All participants also strongly agreed to the proposed performance influencing factors and their measures as listed in Tables 4 and 5. Participants from the Estates Office indicated that contextual performance factors can be assessed through interviews, but their feedback on the effect of tender competition level (number of bidders on the tender list) on performance quality was not conclusive. The participant from the Support Services Office suggested that working around existing occupier skill is particularly important for maintenance consultancies. However, he did not agree that tender competition is correlated to performance outcomes because shortlisting is sufficient and increasing the number of tenderers could cause loss of interest in providing bona fide tenders.

Using approved lists of consultants and the associated quarterly performance review as well as utilising key performance indicators were considered to be useful in driving the consultant performance at the pre- and post-contract phases respectively.

7.4 Qualitative Content Analysis

The three cases represent large, medium and small sized university estate organisations. A review of these cases yields some key themes.

Within a university context, the commonly outsourced construction professional services include the following:

Key consultants

- Architect
- Landscape architect
- Quantity surveyor
- Structural engineer
- M&E engineer
- Project manager
- CDM coordinator
- Approved building control inspector
- Asbestos management consultant

Other consultants

- Building surveyor
- Contract administrator
- Planning consultant
- Civil engineer
- Environmental consultant
- Fire consultant
- Security consultant
- Safety consultant
- Energy consultant
- Vibration consultant (laboratories)
- Acoustic consultant

Construction professional services for small capital and maintenance projects are commonly outsourced by the 'traditional' route, with the designers being fully responsible for planning, design and implementation of works. Large capital new build, redevelopment and refurbishment projects tends to use 'Design and Construct' in order to bring in the contractor and its designer at an early stage of the project delivery process in order to improve design and constructability and to transfer detail design and construction risks to the contractor. Consultants are appointed to prepare design up to RIBA Stage C, D or E, along with tender documents for the 2-Stage contractor procurement. 'Novation Design and Build' can be used when more design input is required from the initial client designer to the contractor for large and complex projects.

Approved lists of consultant or consultant frameworks, shortlisting, interview and assessment of quality / price are implemented to select consultants. More emphasis is put on quality assessment, which has a higher weighting in comparison to price. This means that consultants' service quality is considered to be more important than cost in the outsourcing process, an emerging trend that has been noted in the literature (Juga *et al.*, 2010).

Interestingly, the Estate Management Office in Case Study 1 will replace the existing approved lists of consultants with consultant frameworks, whilst the Estate Projects Division in Case Study 3 has moved in the opposite direction. Because this result is inconclusive, these two appointment methods were included in the regression model for empirical testing.

The proposed performance outcomes and influencing management factors and their measure scales were confirmed but refined as follows:

- 'Working relationship with the client' was added to the list of performance outcomes, along with time, cost, quality and innovations.
- Quality should cover all aspects of sustainable design.
- More measures were added to the task performance factors block. These included experience of the form of contract and the procurement route to be adopted, previous performance on university projects, the level and quantity of resources to be devoted to the project, management of the key risks, health and safety issues arising from the project, value management for control of budget whilst meeting client requirements and use of industry best practice.
- For the economic factor that influences performance, competition level should be based on the number of competitors recorded on the approval list of consultants. Quarterly review of the consultants is considered to be effective for ensuring good performance. Consultants need to consistently work well in order to stay on the list and to gain more tendering opportunities.
- Quality has more weighting than price in the selection of consultants, which underpin the importance of this research.

Details of performance outcomes and the management and economic factors that influence them were refined and summarised in Tables 8 and 9.

In all three cases the key performance indicators and other post-contract phase measures such as steering group meeting, site meetings and progress reports were considered to be effective in driving performance. Since this research focuses on the selection of consultants at the pre-contract phase, it is suggested that those post-contract measures form a separate topic for further research.

Table 6 Performance Outcomes identified by the Qualitative Study

Performance Outcomes	Measures
Time	• minimal variation in time against programme • start on time • completion on time
Cost	• at or below the approved cost limit • minimal variation in cost against budget • life cycle cost minimised
Quality	• a functional building/refurbishment/maintenance that meets the client's needs; with minimal rework (making good defects and material waste) due to error made in the design, or a necessary item or component is omitted from the design) • health and safety design and inspections to minimise accidents • sustainable design (reduction of energy, carbon emission, water consumption and waste, improvement of air quality and other aspects, or BREEAM rating for higher education)
Innovations	• cost / time savings expressed as a percentage of project totals
Working relationship with the client	• fair, responsive and courteous in the delivery of quality services • positive and provide service which meet the customers' requirements • get things right first time • respond effectively to customers' complaints and use customer feedback to secure continuous improvement • willingness to engage with end users and flexibility in reacting to or accommodating changes

Table 7 **Performance Influencing Factors identified by the Qualitative Study**

Performance Outcomes	Measures
Task performance factors	
Project staff (relevant expertise & experience; level of authority)	• qualifications, experience and time commitment of the project team leader • qualifications and experience of proposed staff • management arrangements for sub-contracted services • details of the authority levels of the team members (clear roles and responsibilities) • ability to innovate • resources level
Execution approach (design and management methods)	• quality of design to meet the client's strategic needs (potential value to student recruitment and learning, staff recruitment, sustainable design) • quality of design to meet the client's practical needs (functional requirements, operational efficiency, aesthetics, cost / time constraints) • managerial procedures (communication with clients, managing the programme and sub-consultants, working around existing occupiers, collaboration with other project team members, management of key project risks, value management, health and safety plan)
Competence of firm (past performance)	• past performance **or** • previous clients' references • health and safety records
Size of firm (overall experience & facilities)	• experience of similar previous university projects, including experience of the form of contract and the procurement route to be adopted • suitable qualifications of senior partners / managers • availability of technical facilities • financially stability • quality management system
Contextual Performance factors	
Conscientiousness	• speed in producing design drawings or completing tasks • level of enthusiasm in tackling a difficult assignment • adopting industry best practice
Trust and collaboration	• collaborative consultant frameworks • traditional discrete appointment of consultants
Economic factor	
Competition level	• Number of suppliers in the approved list of consultants or the consultant framework list

8.0 Quantitative Study

8.1 Performance Predictive Models and Hierarchical Regression Analysis

This research primarily aims to: firstly, identify relevant management and economic factors influencing the consultant performance; and secondly, develop performance predictive models. Hypotheses on the relationships were refined by the qualitative study results as follows:

H1: Time performance is positively correlated to the level of task and contextual performance inputs and the level of competition.

H2: Cost performance is positively correlated to the level of task and contextual performance inputs and the level of competition.

H3: Quality performance is positively correlated to the level of task and contextual performance inputs and the level of competition.

H4: Innovation performance is positively correlated to the level of task and contextual performance inputs and the level of competition.

H5: Relationship with the client is positively correlated to the level of task and contextual performance inputs and the level of competition.

These hypotheses were further developed into performance predictive models which set out the relationship between individual performance outcomes and influential management and economic factors, as shown by the hierarchical regression equations in Table 8. The questionnaire was finalised as shown in Appendix 2.

Table 8 Dependent / Predictor Variables and Regression Equations

Variables	Operationalisation
Dependent Variables (performance outcomes)	
POT Performance outcome of time	Score (between 1 and 5) for the average level of performance in individual measures during the consultancy period (see Table 6) POT score = sum of all sub-scale scores
POC Performance outcome of cost	Score (between 1 and 5) for the average level of performance in individual measures during the consultancy period (see Table 6) POC score = sum of all sub-scale scores
POQ Performance outcome of quality	Score (between 1 and 5) for the average level of performance in individual measures during the consultancy period (see Table 6) POQ score = sum of all sub-scale scores
POI Performance outcome of innovations	Score (between 1 and 5) for the average level of performance in individual measures during the consultancy period (see Table 6) POI score = sum of all sub-scale scores
POR Performance outcome of working relationship with the client	Score (between 1 and 5) for the average level of performance in individual measures during the consultancy period (see Table 6) POR score = sum of all sub-scale scores
Predictor Variables (performance factors)	
Task performance factors (Block 1)	
PST Project Staff / relevant expertise and experience	Score (between 1 and 5) for the level of individual measures assessed at the tender stage (see Table 7) PST score = sum of all sub-scale scores
APP Execution approach / design and management methods	Score (between 1 and 5) for the level of individual measures assessed at the tender stage (see Table 7) APP score = sum of all sub-scale scores
COP Competence of firm / past performance	Score (between 1 and 5) for the level of individual measures assessed at the tender stage (see Table 7) COP score = sum of all sub-scale scores
SFM Size of firm / overall experience and facilities	Score (between 1 and 5) for the level of individual measures assessed at the tender stage (see Table 7) CAP score = sum of all sub-scale scores
Contextual performance factors (Block 2)	
CON Conscientiousness	Score between 1 and 5) for the level of individual measures assessed at the tender stage (see Table 7) CON score = sum of all sub-scale scores
CFW Trust and collaboration	Collaborative consultant frameworks = 1 Traditional discrete appointment of consultant = 0
Economic Factor (Block 3)	
CL Competition level	Number of suppliers in the approved list of consultants or the consultant framework list

Regression Equations for prediction of time, cost, quality, innovation and relationship with the client:

$$POT = \alpha_t + (\beta_{1t}PST + \beta_{2t}APP + \beta_{3t}COP + \beta_{4t}SFM) + (\beta_{5t}CON + \beta_{6t}CFW) + (\beta_{7t}CL)$$

$$POC = \alpha_c + (\beta_{1c}PST + \beta_{2c}APP + \beta_{3c}COP + \beta_{4c}SFM) + (\beta_{5c}CON + \beta_{6c}CFW) + (\beta_{7c}CL)$$

$$POQ = \alpha_q + (\beta_{1q}PST + \beta_{2q}APP + \beta_{3q}COP + \beta_{4q}SFM) + (\beta_{5q}CON + \beta_{6q}CFW) + (\beta_{7q}CL)$$

$$POI = \alpha_i + (\beta_{1i}PST + \beta_{2i}APP + \beta_{3i}COP + \beta_{4i}SFM) + (\beta_{5i}CON + \beta_{6i}CFW) + (\beta_{7i}CL)$$

$$POR = \alpha_i + (\beta_{1r}PST + \beta_{2r}APP + \beta_{3r}COP + \beta_{4r}SFM) + (\beta_{5r}CON + \beta_{6r}CFW) + (\beta_{7r}CL)$$

Where

α = *constant, or the Y-intercept of the regression line*

β_n = *regression coefficients for the predictor variables*

PST, APP etc = values of the predictor variables

$_{c,\ t,\ q,\ i,\ r}$ = *indices for cost, time, quality, innovations and relationship with the client*

8.2 The Sample

Generalising the quantitative study results requires having a sufficient number of cases for the regression analysis. Coakes and Steed (2007) stipulate that the minimum requirement is at least six times more cases than the number of predictor variables. As there were 7 predictor variables established from the qualitative study, the minimum number of cases required was 42. Questionnaires were sent to the university estate directors, deputy directors, senior engineers, senior project managers and consultancy managers of the university estates in the country through Association of University Directors of Estates, Association of University Engineers and direct contacts using the email addresses available on the university websites. These participants were specifically selected because of their senior position, expertise and experience in the selection and management of construction consultants. 60 questionnaires were duly completed and returned from 38 universities between May and September 2014. There were 161 universities in the UK in 2011/12 (HESA, 2012) so the sample constituted approximately 23.6% of the population. Although the sample size is relatively small, it is sufficient to meet the minimum number of cases required for regression analysis.

Participants had on average worked for 14.5 years in consultant management. The consultancy cases covered a wide range of professional services commonly used by construction clients, including architectural, building services engineering, quantity surveying, project management and combined project management/quantity surveying disciplines.

8.3 Data Analysis

8.3.1 Reliability of the Measure Scale

As shown in Table 8, ‘consultant performance outcomes’ is measured by five sub-scales: cost, quality, time, innovation and working relationship with the clients. These sub-scales are considered separately and not combined into unitary. Measures for individual sub-scales are shown in the table. It is important that these scales are reliable and have good internal consistency (Pallant, 2007). This is to ensure that all items that make up the scale measure the same underlying construct. Cronbach’s alpha coefficient is commonly used to indicate the internal consistency. Ideally, Cronbach’s alpha coefficient of a scale should be above 0.7, but values above 0.8 are preferable. For short scales with fewer than 10 items, it is common to find relatively low Cronbach values, e.g. 0.5.

Table 9 presents the means, standard deviation and Cronbach’s alpha coefficients for the five sub-scales. The Cronbach’s alpha coefficients for time, cost and working relationship with the client are 0.762, 0.749 and 0.897, suggesting very good internal consistency reliability for these sub-scales. The Cronbach’s alpha coefficient for quality is 0.654, suggesting good internal consistency reliability for this sub-scale. ‘Innovations’ is measured by one item (cost/time savings expressed as a percentage of project totals) so there is no need to check its internal consistency.

Table 9 Means, Standard Deviations and Cronbach's Alpha Coefficients for Performance

Sub-scales	N	Means	Standard Deviations	Cronbach's Alpha (α)
Time	60	11.75 (out of 15)	2.183	0.762
Cost	60	11.25 (out of 15)	2.207	0.749
Quality	60	12.40 (out of 15)	1.543	0.654
Innovations	60	3.30 (out of 5)	0.962	N/A
Working relationship with the client	60	21.85 (out of 25)	3.030	0.897

8.3.2 Checking Procedures

Pallant (2007) suggests that Adjusted R^2 value (coefficient of determination) should be used to examine the correlation between dependent variable and predictor variables. This research has a sample size of 60. For a small sample size like this, R^2 value in the sample tends to be a rather optimistic overestimation of the true value in the population. The Adjusted R^2 statistic corrects this value to provide a better estimate of the true population value. The value of Adjusted R^2 is slightly less than the value of R^2. A R^2 of around 0.47 is regarded by Pallant (2007) to be respectable for indicating a significant relationship. Furthermore, the significance of the model as a whole can also be checked by the ANOVA sig. value, which should be <0.05.

In relation to the impact of each predictor block on the dependent variable, the R^2 Change value should be examined. It explains how much of the total variance in the dependent variable is uniquely explained by that predictor block. Furthermore, a Sig. F Change value of less than 0.05 means its impact is significant.

Mohr (1990) considers the relationship between dependent variable and individual predictor variables to be significant if the p-value is <0.05. To compare the contribution of each independent variable, beta values should be examined. A higher value means a stronger contribution. Alternatively, the square value of semi-partial correlation coefficient (sr^2) of a predictor variable indicates its contribution to the total R^2, i.e. how much of the total variance in the dependent variable is uniquely explained by that variable.

Preliminary analyses were conducted and confirmed that no violation occurs of three assumptions, including normality of the distribution of the dependent variable (through P-P Plot of the standardised residuals), linearity of the relationship between dependent and predictor variables (through Scatter Plot of the standardised residuals against standardised predicted values), and multicollinearity of the predictor variables (through examination of the tolerance value). Multicollinearity does occur if the tolerance value is <0.1).

8.3.3 Performance Outcome of Time

Hierarchical multiple regression analysis was conducted to identify the predictors for performance outcome of time (POT) and to develop a regression equation as a performance predictive model. To identify the predictors, the initial model with all the three hierarchical predictor blocks (task performance factors, contextual performance factor and economic factor) and 7 predictor variables was analysed.

The results are shown in Table 10a, with an initial adjusted R^2 = 0.771 and an ANOVA sig. value <0.0005. The initial significant predictor blocks identified were 'task performance factors' (R^2 change = 0.736; Sig. F change = 0.0005) and 'economic factor' (R^2 change = 0.051; Sig. F change = 0.001). Within these two blocks, there were four initial significant predictors identified, including 'project staff' (PST), 'competence of firm' (COP), 'size of firm' (SFM) and 'competition level' (CL), all of which had a p-value <0.05.

To establish a regression equation for the final model, those two predictor blocks and four predictors were extracted from the initial model for further regression analysis. The results in Table 10b present the unstandardised regression coefficient (B) and intercept constant, the standardised regression coefficient (Beta), the standard semi-partial coefficient (sr^2), adjusted R^2, and R^2 change of the entry of each of the predictor blocks. The analysis revealed that the final equation for performance outcome of time has an adjusted R^2 = 0.744 and an ANOVA sig. value <0.0005, indicating that 74.4% of the variance for this construct was explained by the four variables. The significant predictors were 'project staff' (sr^2 = 0.447), 'competence of firm' (sr^2 = 0.134), – 'size of firm' (sr^2 = 0.093) and 'competition level' (sr^2 = 0.053), each adding 44.7%, 13.4% and 9.3%, respectively in contributing to the performance prediction. 'Project staff' and 'competence of firm' had a positive influence on performance whilst 'size of firm' and 'competition level' had a negative one. This suggests that better time performance would be associated with project staff who have more expertise, experience and resources (beta = 0.772) and better competence of firms in terms of past performance (beta = 0.460), but with smaller firm size (beta = –0.420) and lower competition level (beta = –0.236). The most significant predictor is 'project staff'.

The regression equation was established as follows:

$$POT = \alpha_t + (\beta_{1t}\,PST + \beta_{3t}\,COP + \beta_{4t}\,CAP) + (\beta_{7t}\,CL)$$

$$POT = -4.393 + (0.684PST + 1.112COP + 0.444SFM) + (0.117CL)$$

Table 10a Regression Analysis for Performance Outcome of Time (Initial Model)

Block / Predictor variable	p-value	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1, 2 and 3		0.894	0.798	0.771		0.0005
Block 1					0.736	
PST	0.0005				(0.0005)	
APP	0.144					
COP	0.0005					
SFM	0.0005					
Block 2					0.011	
CON	0.226				(0.315)	
CFW	0.564					
Block 3					0.051	
CL	0.001				(0.001)	

Initial POT Predictive Model:

$$POT = \alpha_t + (\beta_{1t}\,PST + \beta_{2t}\,APP + \beta_{3t}\,COP + \beta_{4t}\,SFM) + (\beta_{5t}\,CON + \beta_{6t}\,CFW) + (\beta_{7t}\,CL)$$

Table 10b Regression Analysis for Performance Outcome of Time (Tested Model)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 & 3						0.872	0.761	0.744		0.0005
Block 1									0.708	
PST	0.684	0.772	0.447	0.0005	0.749				(0.0005)	
COP	1.112	0.460	0.134	0.0005	0.631					
SFM	-0.444	-0.420	0.093	0.0005	0.527					
Block 3									0.053	
CL	-0.117	-0.236	0.053	0.001	0.951				(0.001)	
Intercept Constant	-4.393									

Final POT Predictive Model:

$$POT = \alpha_t + (\beta_{1t}\,PST + \beta_{3t}\,COP + \beta_{4t}\,SFM) + (\beta_{7t}\,CL)$$

$$POT = -4.393 + (0.684PST + 1.112COP + 0.444SFM) + 0.117CL$$

8.3.4 Performance Outcome of Cost

To identify the predictors for performance outcome of cost (POC), the initial model with all the three predictor blocks (task performance factors, contextual performance factor and economic factor) and 7 predictor variables was analysed using hierarchical multiple regression. The results are shown in Table 11a, with an initial adjusted $R^2 = 0.592$ and an ANOVA sig. value <0.0005. The initial significant predictor blocks identified were 'task performance factors' (R^2 change = 0.736; Sig. F change = 0.0005) and 'economic factor' (R^2 change = 0.051; Sig. F change = 0.001). Within these two blocks, there were two initial significant predictors identified, namely 'project staff' (PST) and 'consultant framework' (CFW), with a p-value of 0.0005 and 0.002, respectively.

Those two predictor blocks and two predictors were extracted from the initial model for further regression analysis in order to establish a regression equation for the final model. The results are shown in Table 11b.

The analysis revealed that the final equation for performance outcome of cost has an adjusted $R^2 = 0.566$ and an ANOVA sig. value <0.0005, indicating that 56.6% for the variance for this construct was explained by the two variables. The significant predictors were 'project staff' ($sr^2 = 0.557$) and 'consultant framework' ($sr^2 = 0.223$), each adding 55.7% and 22.3% respectively in contributing to the performance prediction. Both predictors had a positive impact on the performance. This suggests that higher performance outcome of cost would be associated with project staff who have more expertise, experience and resources (beta = 0.833) and use of a consultant framework instead of a non-framework appointment (beta = 0.528). The most significant predictor is 'project staff'.

The regression equation was established as follows:

$$POC = \alpha_c + (\beta_{1c} PST) + (\beta_{6c} CFW)$$

$$POC = -7.684 + 0.743PST + 2.420CFW$$

Table 11a Regression Analysis for Performance Outcome of Cost (Initial Model)

Block / Predictor variable	p-value	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1, 2 and 3		0.800	0.640	0.592		0.0005
Block 1					0.527	
PST	0.0005				(0.0005)	
APP	0.471					
COP	0.080					
CAP	0.726					
Block 2					0.113	
CON	0.539				(0.001)	
CFW	0.002					
Block 3					0.0005	
CL	0.885				(0.885)	

Initial POC Predictive Model:

$$POC = \alpha_c + (\beta_{1c} PST + \beta_{2c} APP + \beta_{3c} COP + \beta_{4c} CAP) + (\beta_{5c} CON + \beta_{6c} CFW) + (\beta_{7c} CL)$$

Table 11b Regression Analysis for Performance Outcome of Cost (Tested Model)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 & 2						0.762	0.581	0.566		0.0005
Block 1									0.358	
PST	0.743	0.833	0.557	0.0005	0.801				(0.0005)	
Block 2									0.223	
CFW	2.420	0.528	0.223	0.0005	0.800				(0.001)	
Intercept Constant	-7.684									

Tested POC Predictive Model:

$$POC = \alpha_c + (\beta_{1c} PST) + (\beta_{6c} CFW)$$

$$POC = -7.684 + 0.743PST + 2.420CFW$$

8.3.5 Performance Outcome of Quality

To identify the predictors for performance outcome of quality (POQ), the initial model with all the three predictor blocks (task performance factors, contextual performance factor and economic factor) and 7 predictor variables was analysed via hierarchical multiple regression. The results are shown in Table 12a, with an initial adjusted R^2 = 0.523 and an ANOVA sig. value <0.0005. The initial significant predictor blocks identified were 'task performance factors' (R^2 change = 0.331; Sig. F change = 0.0005) and 'contextual factors' (R^2 change = 0.231; Sig. F change = 0.0005). Within these two blocks, there were three initial significant predictors identified, including 'project staff' (PST), 'execution approach' (APP) and 'consultant framework' (CFW), with a p-value of 0.036, 0.008 and 0.0005, respectively.

Those two predictor blocks and three predictors were extracted from the initial model for further regression analysis. The results are shown in Table 12b. Because 'project staff' now had a p-value of 0.175, the other two predictor variables were further extracted for another regression analysis.

In Table 12c, the analysis results revealed that the final equation for performance outcome of quality has an adjusted R^2 = 0.493 and an ANOVA sig. value <0.0005, indicating that 49.3% for the variance for this construct was explained by the two variables. The significant predictors were 'execution approach' (sr^2 = 0.305) and 'consultant framework' (sr^2 = 0.241), each adding 30.5% and 24.1% respectively in contributing to the performance prediction. Both predictors had a positive impact on the performance. This suggests that higher performance outcome of quality would be associated with better design and management methods (beta = 0.554) and use of a consultant framework instead of a non-framework appointment (beta = 0.492). The most significant predictor is 'execution approach'. The regression equation was established as follows:

$$POQ = \alpha_q + (\beta_{2q} APP) + (\beta_{6q} CFW)$$

$$POQ = 5.928 + 0.466APP + 1.491CFW$$

Table 12a Regression Analysis for Performance Outcome of Quality (Initial Model)

Block / Predictor variable	p-value	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1, 2 and 3		0.761	0.580	0.523		0.0005
Block 1					0.331	
PST	0.036				(0.0005)	
APP	0.008					
COP	0.948					
CAP	0.244					
Block 2					0.231	
CON	0.076				(0.001)	
CFW	0.0005					
Block 3					0.018	
CL	0.139				(0.139)	

Initial POQ Predictive Model:

$$POQ = \alpha_q + (\beta_{1q} PST + \beta_{2q} APP + \beta_{3q} COP + \beta_{4q} CAP) + (\beta_{5q} CON + \beta_{6q} CFW) + (\beta_{7q} CL)$$

Table 12b Regression Analysis for Performance Outcome of Quality (model with the three extracted predictor variables)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 & 2						0.726	0.526	0.501		0.0005
Block 1									0.289	
PST	0.108	0.183	0.016	0.175	0.472				(0.0005)	
APP	0.337	0.448	0.118	0.0005	0.586					
Block 2									0.237	
CFW	1.717	0.567	0.237	0.0005	0.739				(0.005)	
Intercept Constant	8.225									

Second POQ Predictive Model:

$$POQ = \alpha_q + (\beta_{1q} PST + \beta_{2q} APP) + (\beta_{6q} CFW)$$

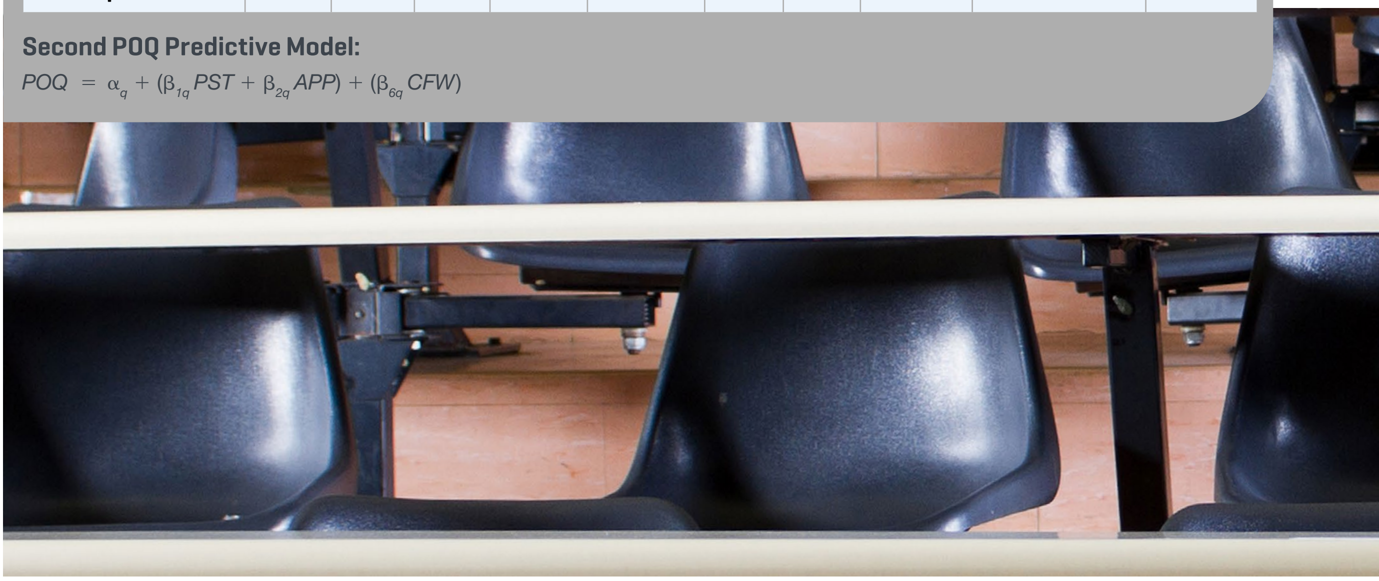


Table 12c Regression Analysis for Performance Outcome of Quality (Tested Model)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 & 3						0.715	0.511	0.493		0.0005
Block 1									0.269	
APP	0.466	0.554	0.305	0.0005	0.995				(0.0005)	
Block 2									0.241	
CFW	1.491	0.492	0.241	0.0005	0.990				(0.005)	
Intercept Constant	5.928									

Tested POC Predictive Model:

$$POQ = \alpha_q + (\beta_{2q} APP) + (\beta_{6q} CFW)$$

$$POQ = 5.928 + 0.466APP + 1.491CFW$$

8.3.6 Performance Outcome of Innovations

The initial model with all the three predictor blocks (task performance factors, contextual performance factor and economic factor) and 7 predictor variables was analysed by hierarchical multiple regression in order to identify the predictors for performance outcome of cost (POI). The results are shown in Table 13a, with an initial adjusted R^2 = 0.423 and an ANOVA sig. value <0.0005. The initial significant predictor blocks identified were 'task performance factors' (R^2 change = 0.736; Sig. F change = 0.0005), 'contextual performance factors' (R^2 change = 0.095; Sig. F change = 0.021) and 'economic factor' (R^2 change = 0.100; Sig. F change = 0.002). Within these three blocks, there were four initial significant predictors identified, including 'competence of firm' (COP), 'size of firm' (CAP), 'consultant framework' (CFW) and 'competition level' (CL) with a p-value of 0.008, 0.0005, 0.009, and 0.002, respectively.

Those three predictor blocks and four predictors were extracted from the initial model for further regression analysis. The results are shown in Table 13b. The analysis results revealed that this construct has an adjusted R^2 = 0.043 and an ANOVA sig. value = 0.171, indicating that there was no significant relationship between performance outcome of innovations and the four predictors. This means that a performance predictive model cannot be established at this stage.

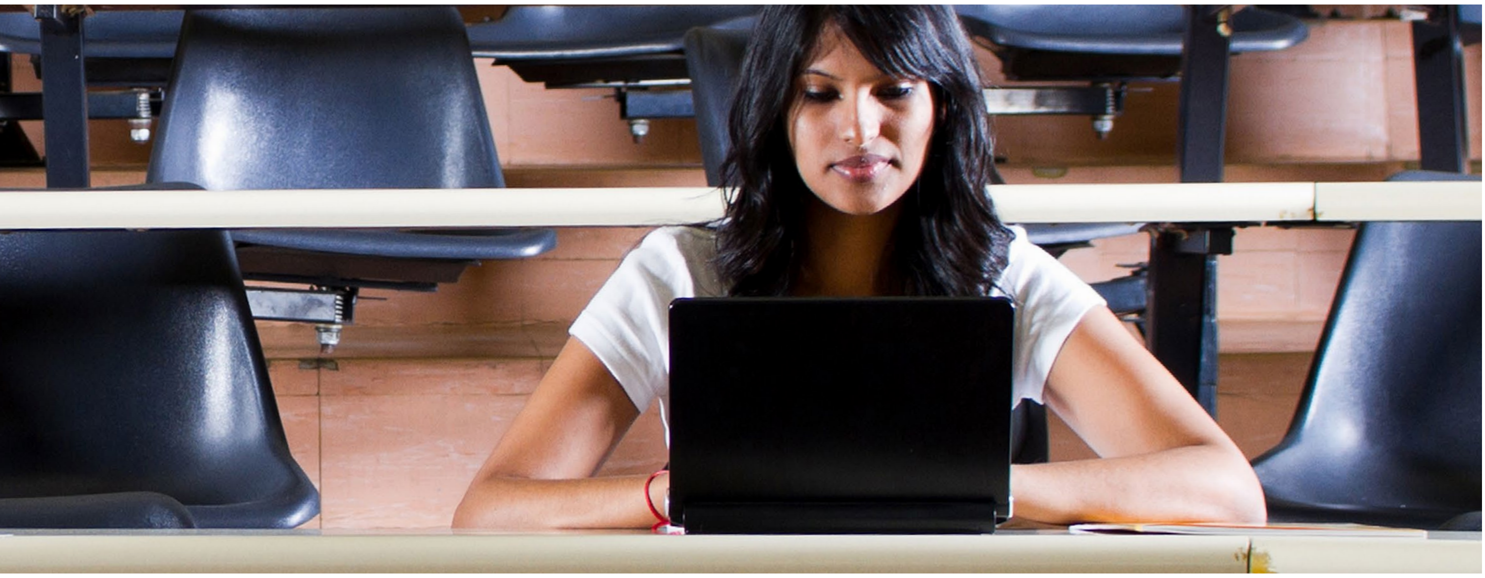


Table 13a Regression Analysis for Performance Outcome of Innovation (Initial Model)

Block / Predictor variable	p-value	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1, 2 and 3		0.701	0.491	0.423		0.0005
Block 1					0.297	
PST	0.547				(0.001)	
APP	0.101					
COP	0.008					
CAP	0.0005					
Block 2					0.095	
CON	0.018				(0.021)	
CFW	0.009					
Block 3					0.100	
CL	0.002				(0.002)	

Initial POI Predictive Model:

$$POI = \alpha_i + (\beta_{1i} PST + \beta_{2i} APP + \beta_{3i} COP + \beta_{4i} CAP) + (\beta_{5i} CON + \beta_{6i} CFW) + (\beta_{7i} CL)$$

Table 13b Regression Analysis for Performance Outcome of Innovations (model with the four extracted predictor variables)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 & 3						0.329	0.108	0.043		0.171
Block 1									0.035	
COP	0.311	0.294	0.053	0.076	0.616				(0.360)	
CAP	0.095	-0.204	0.020	0.274	0.478					
Block 2									0.005	
CFW	-0.292	-0.146	0.014	0.364	0.638				(0.871)	
Block 3									0.072	
CL	0.063	0.291	0.072	0.039	0.854				(0.039)	
Intercept Constant	2.551									

Second POI Predictive Model:

$$POI = \alpha_i + (\beta_{3i} COP + \beta_{4i} CAP) + (\beta_{6i} CFW) + (\beta_{7i} CL)$$

The Adjusted R^2 is 0.043 which is too low to support a significant correlation in the proposed model.

8.3.7 Performance Outcome of Relationship

To identify the predictors for performance outcome of working relationship with the client (POR), the initial model with all the three predictor blocks (task performance factors, contextual performance factor and economic factor) and 7 predictor variables was analysed by hierarchical multiple regression. The results are shown in Table 14a, with an initial adjusted $R^2 = 0.640$ and an ANOVA sig. value <0.0005. The initial significant predictor blocks identified were 'task performance factors' (R^2 change = 0.580; Sig. F change = 0.0005), 'contextual performance factors' (R^2 change = 0.063; Sig. F change = 0.014) and 'economic factor' (R^2 change = 0.040; Sig. F change = 0.013). Within these three blocks, there were five initial significant predictors identified. Specifically, these were 'project staff' (PST), 'competence of the firm' (COP), 'conscientiousness' (CON), 'consultant framework' (CFW) and 'completion level' (CL) with a p-value of 0.0005, 0.016, 0.046 and 0.001 and 0.013, respectively.

Those two predictor blocks and five predictors were extracted from the initial model for further regression analysis in order to establish a regression equation for the final model. The results are shown in Table 14b. Because 'conscientiousness' now had a p-value of 0.263, the other four predictor variables were further extracted for another regression analysis. In Table 14c, the analysis results revealed that the final equation for performance outcome of cost has an adjusted $R^2 = 0.629$ and an ANOVA sig. value < 0.0005, indicating that 62.9% for the variance for this construct was explained by the four variables. The significant predictors were 'project staff' ($sr^2 = 0.423$), 'competence of firm' ($sr^2 = 0.064$), 'consultant framework' ($sr^2 = 0.080$) and 'competition level' ($sr^2 = 0.045$) each adding 42.3% and 6.4%, 8% and 4.5% respectively in contributing to the performance prediction. 'Project staff', 'competence of firm' and 'consultant framework' wielded a positive influence on the performance, whilst 'competition level' had a negative one. This suggests that higher performance outcome of relationship would be associated with project staff with more expertise, experience and resources (beta = 0.738), firm showing good past performance (beta = 0.264), use of a consultant framework instead of a non-framework appointment (beta = 0.332) and lower competition level. The most significant predictor is 'project staff'.

The regression equation was established as follows:

$$POR = \alpha_i + (\beta_{1r} PST + \beta_{3r} COP) + (\beta_{6r} CFW) + (\beta_{7r} CL)$$

$$POR = -5.885 + (0.842PST + 0.822COP) + 1.947CFW - 0.154CL$$

Table 14a **Regression Analysis for Performance Outcome of Relationship (Initial Model)**

Block / Predictor variable	p-value	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1, 2 and 3		0.826	0.683	0.640		0.0005
Block 1					0.580	
PST	0.0005				(0.0005)	
APP	0.326					
COP	0.016					
CAP	0.426					
Block 2					0.063	
CON	0.046				(0.014)	
CFW	0.001					
Block 3					0.040	
CL	0.013				(0.013)	

Initial POR Predictive Model:

$$POR = \alpha_i + (\beta_{1r} PST + \beta_{2r} APP + \beta_{3r} COP + \beta_{4r} CAP) + (\beta_{5r} CON + \beta_{6r} CFW) + (\beta_{7r} CL)$$

Table 14b Regression Analysis for Performance Outcome of Relationship (model with the five predictor variables)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1, 2 and 3						0.813	0.662	0.630		0.0005
Block 1									0.549	
PST	0.946	0.829	0.297	0.0005	0.439				(0.0005)	
COP	0.947	0.304	0.072	0.001	0.775					
Block 2									0.068	
CON	-0.338	-0.131	0.0008	0.263	0.464				(0.011)	
CFW	2.2225	0.379	0.087	0.0005	0.605					
Block 3									0.044	
CL	-0.145	-0.227	0.045	0.010	0.862				(0.010)	
Intercept Constant	-6.831									

Second POR Predictive Model:

$$POR = \alpha_i + (\beta_{1r} PST + \beta_{3r} COP) + (\beta_{5r} CON + \beta_{6r} CFW) + (\beta_{7r} CL)$$

Table 14c Regression Analysis for Performance Outcome of relationship (Tested Model)

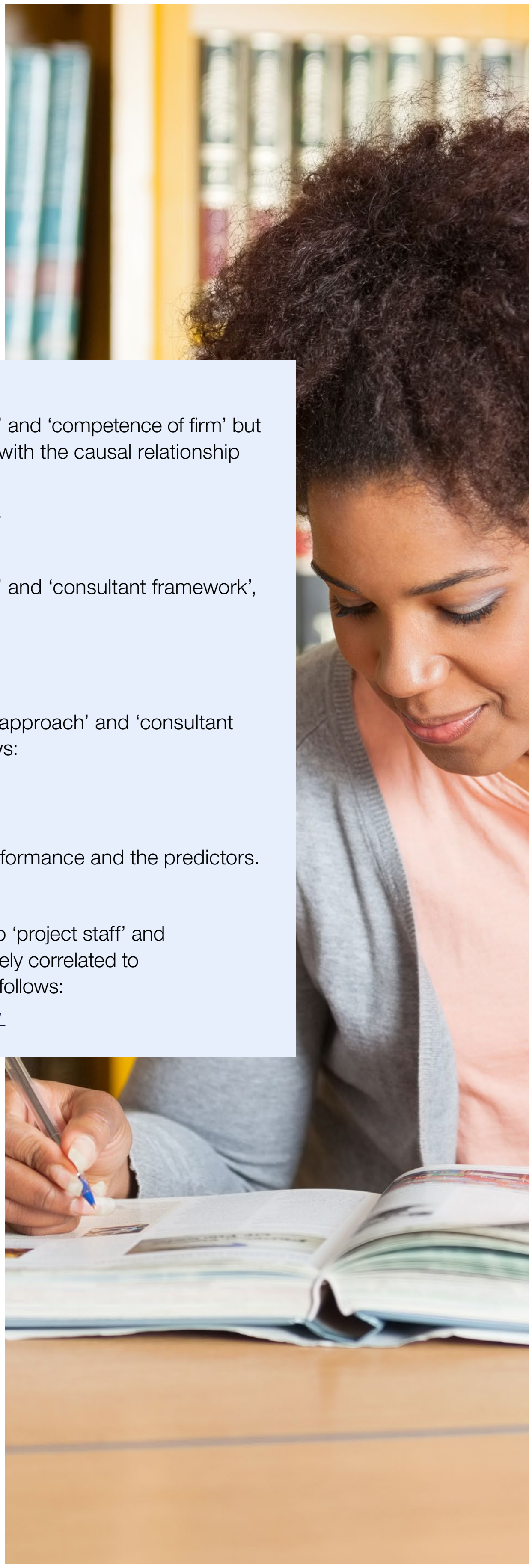
Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1, 2 and 3						0.809	0.654	0.629		0.0005
Block 1									0.549	
PST	0.842	0.738	0.423	0.0005	0.776				(0.0005)	
COP	0.822	0.264	0.064	0.002	0.918					
Block 2									0.052	
CFW	1.947	0.332	0.080	0.001	0.728				(0.009)	
Block 3									0.052	
CL	-0.154	0.242	0.227	0.006	0.885				(0.006)	
Intercept Constant	-5.885									

Tested POR Predictive Model:

$$POR = \alpha_i + (\beta_{1r} PST + \beta_{3r} COP) + (\beta_{6r} CFW) + (\beta_{7r} CL)$$

$$POR = 5.885 + (0.842PST + 10.822COP) + 1.947CFW - 0.154CL$$

9.0 Discussion



9.1 Validation of Hypotheses

Findings from the literature review and the qualitative study established five hypotheses that each performance outcome was positively correlated to the level of task and contextual inputs and the level of competition, as stated in H1 to H5 in Section 8.1. The quantitative hierarchical regression analysis validated but adjusted the hypotheses as follows:

H1: Time performance
Time performance was positively correlated to 'project staff' and 'competence of firm' but negatively correlated to 'size of firm' and 'competition level', with the causal relationship developed as follows:

$POT = -4.393 + (0.684PST + 1.112COP - 0.444SFM) - 0.117CL$

H2: Cost performance
Cost performance was positively correlated to 'project staff' and 'consultant framework', with the causal relationship developed as follows:

$POC = -7.684 + 0.743PST + 2.420CFW$

H3: Quality performance
Quality performance was positively correlated to 'executive approach' and 'consultant framework', with the causal relationship developed as follows:

$POQ = 5.928 + 0.466APP + 1.491CFW$

H4: Innovation performance
There was no significant correlation between innovation performance and the predictors.

H5: Working relation with the client
Working relationship performance was positively correlated to 'project staff' and 'competence of firm' and 'consultant framework', but negatively correlated to 'competition level', with the causal relationship developed as follows:

$POR = -5.885 + (0.842PST + 0.822COP) + 1.947CFW - 0.154CL$

Apart from the innovation performance, consultant performance outcomes were significantly correlated with related task performance, contextual performance and economic factors. Improving time and cost management through innovations is explicitly required by the government in its recent construction strategy (Cabinet, 2011; DBIS, 2013). This requirement was agreed to by all the participants in the case study interviews. However, it will take time for consultants to build up their experience and momentum to be innovative. In the questionnaire survey used for this research, the average innovation score for consultants was 3.3 out of 5 (66%), with a range of 1 to 5 (see Table 9). This is relative low when compared to the average score for time performance (average score 11.75 out of 15; 78%), cost performance (11.25 out of 15; 75%), quality (12.40 out of 15; 83%) and working relationship with the client (21.85 out of 25; 87%). Consequently, at this stage no significant correlation can be detected between innovation performance and the predictors.

9.2 Task Performance Factors

Performance outcomes and performance influencing factors are summarised in Tables 6 and 7. 'Contextual task factors' was found to be the most significant positive predictor block for performance outcomes of time, cost, quality and working relationship with the client, as shown by the highest R^2 Change values and their Sig. F Change values (all <0.0005).

'Project staff' significantly influenced time performance, cost performance and working relationship, and it was the most significant predictor for all these three performance outcomes, with sr^2 values of 0.447, 0.557 and 0.423, respectively. This is consistent with the arguments of Yeung *et al.* (2008) and Morledge and Smith (2013) as well as the Case Study 2 participants' expert opinion. Project team leaders and members with relevant expertise and post-qualification experience, the project leader making a significant time commitment and providing adequate resources, along with clearly designated roles and responsibilities for team members, are essential for project success. As discussed in the case studies for this research (Section 7.4), construction specialists like vibration consultants and acoustic consultants are often appointed by universities for new building and refurbishment works. Skills in architectural, vibration and acoustic design are particularly relevant to construction works for teaching and laboratory facilities in the university environment. Management skills and arranging sub-contracted services are equally important with reference to appointments of multi-disciplinary firms that can provide the full range of services required (CIRIA, 1994; Mortledge and Smith, 2013).

'Competence of firm' is related to past performance. This factor significantly affected time performance and working relationship performance positively. In the university sector, consultants often have to work around existing buildings and occupiers. To control start on time, completion on time and variation of programme in this context is particularly difficult. Client departments often require responsive and courteous services as well as close engagement with end users at the same time. The causal relationship is supported by Kashiwagi (2004) and Lam (2009) who claimed that previous success is closely linked to future performance, especially when construction projects are completed in an already occupied environment.

'Execution approach' is a measure of the consultant's design and management methods to meet the client's strategic and practical needs as well as maintaining a close liaison with the client. This factor significantly and positively influenced quality performance. University clients need functional and sustainable buildings for teaching, research and administration and the works must be executed safely in an occupied environment. The impact of this factor is supported by Church (1993), Bennett *et al.* (1996) and Hoxley (1998) who state that problem-solving ability and understanding project scope and brief, as shown in the project approach, are important requirements when selecting consultants. Furthermore, working in occupied environments requires special attention. The ways in which work and services are delivered and how communication is handled with the client and other stakeholders are now increasingly critical (Atkin and Adrian, 2009).

'Size of firm' was found to be negatively correlated with time performance. Size of firm is measured by the overall experience of the firm in similar projects and the availability of sufficient staff and facilities. Rowbotham (1992) argues that large firms often allocate resources to major projects whilst small firms always use senior and experienced staff to provide better services in order to gain more business in the future. This argument explains the negative correlation. The finding infers that university clients should choose small and medium sized firms because they can always provide adequate, competent and experienced project staff who can produce prompt and quality services, even for non-major refurbishment and maintenance projects.

9.3 Contextual Performance Factors

Contextual performance factors consist of 'conscientious-ness' as well as 'trust and collaboration'.

'Conscientiousness' was found to not be a significant predictor for all performance outcomes. This factor was considered by Ling (2002) to be significant in influencing the performance of architects and engineers employed by design and build contractors in the private sector in Singapore. Speed in completing tasks is a key measure for this factor. It is important for private sector investment projects, but can be less critical in the public sector university environment.

'Trust and collaboration' is represented by the consultant framework appointment approach which encourages collaborative and integration within a project team. This particular factor emerged as a significant positive predictor for cost performance, quality performance and working relationship with the client. Construction, refurbishment and maintenance programmes in universities have high values but high risks due to the presence of existing occupiers and buildings. Using the framework appointment method can nurture longer and stronger relationships and collaboration, thus ensuring project success, as supported by Constructing Excellence (2005).

9.4 Economic factor

Competition level is measured by the number of suppliers on the approved list of consultants or consultant framework list. This factor was found to be significant but negatively correlated to 'time performance' and 'working relationship with the client'. Of the 60 cases being examined, 9 (15%) had a competition level of 10 or more suppliers in the list. For those cases, the chance of being invited to tender was relatively less. From a commercial perspective, suppliers would submit more competitive tender prices in order to increase the chance of winning contracts. Within occupied environments, stringent control of time (start on time, completion on time and time variation against programme) requires more staff resources. However, staffing level may be compromised as a result of excessively competitive tender prices and consequently performance is jeopardised (Lam, 2008). 'Working relationship with the client' is measured by responsive, courteous and close engagement services and if staffing level is driven down by excessively competitive prices, such services cannot be maintained. Morledge and Smith (2013) point out that tenderers are sometimes tempted to take substantial risks in order to win the bid.

If those nine cases are excluded from the data set, hierarchical regression analysis of the remaining 51 cases virtually yields the same results, except that 'completion level' has now become an insignificant predictor for all performance outcomes, with all the p-values >0.05. One of the participants in Case Study 2 spelled out that consultant performance is less a function of number of competitors than having the right tenderers. This means that task performance factors should dominate over the other influencing factors. Consequently the significant impact of 'project staff', 'execution approach' and 'competence of firm', along with the influence of 'consultant framework', masks the effect of 'competition level'. Details of the regression results for the final models are shown in Table 15a to 15e. All insignificant predictors including 'competition level' have been excluded from the models.

Table 15a Regression Analysis for Performance Outcome of Time (Final Model)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Block 1						0.849	0.720	0.702		0.0005
Block 1									0.720	
PST	0.676	0.865	0.580	0.0005	0.776				(0.0005)	
COP	1.035	0.416	0.118	0.0005	0.683					
CAP	-0.319	-0.324	0.058	0.003	0.553					
Intercept Constant	-6.432									

Final POT Predictive Model:

$$POT = \alpha_t + (\beta_{1t} PST + \beta_{3t} COP + \beta_{4t} CAP)$$

$$POT = -6.432 + (0.676PST + 1.035COP - 0.319CAP)$$

Table 15b Regression Analysis for Performance Outcome of Cost (Final Model)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 and 2						0.854	0.730	0.719		0.0005
Block 1									0.559	
PST	0.788	0.935	0.729	0.0005	0.835				(0.0005)	
Block 2									0.131	
CFW	1.796	0.369	0.131	0.0005	0.830				(0.0005)	
Intercept Constant	-8.761									

Final POC Predictive Model:

$$POC = \alpha_c + (\beta_{1c} PST) + (\beta_{6c} CFW)$$

$$POC = -8.761 + 0.788PST + 1.796CFW$$

Table 15c Regression Analysis for Performance Outcome of Quality (Final Model)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 and 2						0.695	0.483	0.462		0.0005
Block 1									0.240	
APP	0.475	0.574	0.320	0.0005	0.972				(0.005)	
Block 2									0.243	
CFW	1.575	0.500	0.243	0.0005	0.970				(0.005)	
Intercept Constant	5.725									

Final POQ Predictive Model:

$$POQ = \alpha_q + (\beta_{2q} APP) + (\beta_{6q} CFW)$$

$$POQ = 5.725 + 0.475APP + 1.575CFW$$

Table 15d Regression Analysis for Performance Outcome of Innovations (Final Testing)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1						0.460	0.211	0.178		0.003
Block 1									0.211	
COP	0.582	0.509	0.181	0.002	0.700				(0.003)	
CAP	-0.048	-0.106	0.008	0.494	0.700					
Intercept Constant	-0.881									

POI Predictive Model:

$POI = \alpha_i + (\beta_{3i} COP + \beta_{4i} CAP)$

The Adjusted R^2 is 0.178 which is too low to support a significant correlation in the proposed model.

Table 15e Regression Analysis for Performance Outcome of relationship (Final Model)

Block / Predictor variable	B	Beta	sr^2	p-value	Tolerance	R	R^2	Adjusted R^2	R^2 Change (Sig. F Change)	ANOVA Sig.
Blocks 1 and 2						0.775	0.600	0.574		0.0005
Block 1									0.562	
PST	0.842	0.760	0.477	0.0005	0.826				(0.0005)	
COP	0.905	0.257	0.065	0.008	0.981					
Block 2									0.038	
CFW	1.263	0.212	0.038	0.041	0.834				(0.009)	
Intercept Constant	-6.642									

Final POR Predictive Model:

$POR = \alpha_i + (\beta_{1r} PST + \beta_{3r} COP) + (\beta_{6r} CFW)$

$POR = -6.642 + (0.842PST + 0.905COP) + 1.263CFW$

9.5 Prediction of Performance Outcomes

If the competition level is below 10, causal relationships between performance outcomes and influencing factors can be further developed as follows:

Time performance

Time performance is positively correlated to 'project staff' and 'competence of firm' but negatively correlated to 'size of firm', with the performance predictive model developed as follows:

$POT = -6.432 + (0.676PST + 1.035COP - 0.319SFM)$

Cost performance

Cost performance is positively correlated to 'project staff' and 'consultant framework', with the performance predictive model developed as follows:

$POC = -8.761 + 0.788PST + 1.796CFW$

Quality performance

Quality performance is positively correlated to 'executive approach' and 'consultant framework', with the performance predictive model developed as follows:

$POQ = 5.725 + 0.475APP + 1.575CFW$

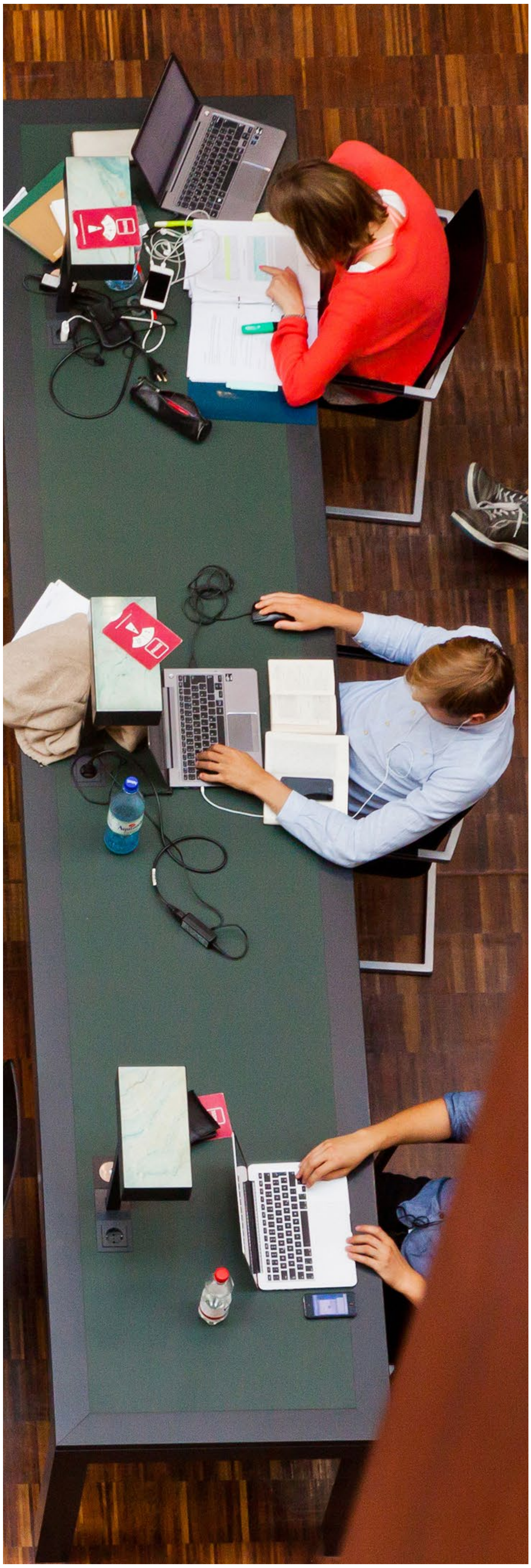
Innovation performance

There is no significant correlation between innovation performance and the predictors.

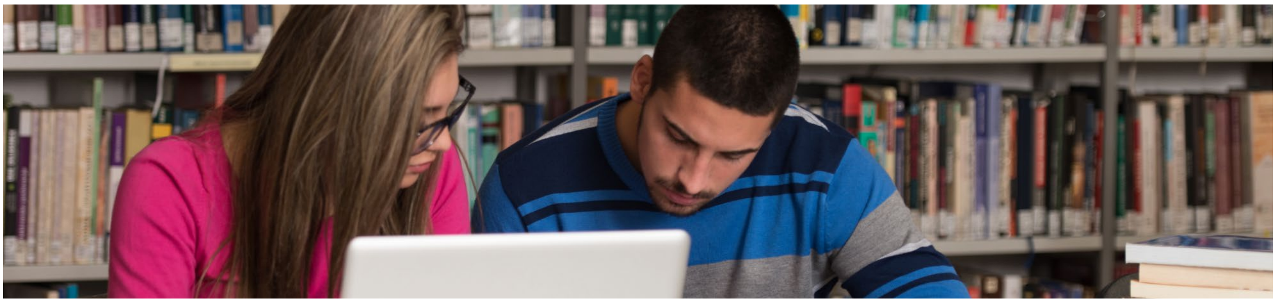
Working relationship with the client

Working relationship performance is positively correlated to 'project staff' and 'competence of firm' and 'consultant framework', with the performance predictive model developed as follows:

$POR = -6.642 + (0.842PST + 0.905COP) + 1.263CFW$



10.0 Conclusions and Recommendations



10.1 Summary of Findings

Best value approach is now a predominant principle for the procurement of public services in the UK. To identify the best value offer, the client and the procurer usually combine each consultant's bid with an assessment of his performance quality. Aggregate scores for both quality and tendered price are calculated and then multiplied by their respective weightings to determine the overall score. Quality assessment forms a key part of the selection process and ensures the best value consultant will be selected. As construction professional services are intangible, heterogeneous and multi-dimensional, it is essential that performance quality is accurately and objectively assessed. This research successfully develops performance predictive models to significantly forecast performance outcomes of construction consultants for the purposes of selection in the UK university sector. The research also identifies that quality has more weighting than price in the selection process, which in turn underpins the importance of this research.

The research has successfully achieved its objectives. **'Traditional'**, **'design and construct'** and **'novation and design'** procurement routes are used by university clients to deliver capital, refurbishment and maintenance projects. The following consultants are commonly employed to provide professional services for planning, design, tendering and management of works:

Key consultants

- Architect
- Landscape architect
- Quantity surveyor
- Structural engineer
- M&E engineer
- Project manager
- CDM coordinator
- Approved building control inspector
- Asbestos management consultant

Other specialist consultants

- Building surveyor
- Contract administrator
- Planning consultant
- Civil engineer
- Environmental consultant
- Fire consultant
- Security consultant
- Safety consultant
- Energy consultant
- Vibration consultant (laboratories)
- Acoustic consultant

In the public sector university environment, five performance outcomes are identified by literature review and qualitative content analysis: time, cost, quality, working relationship with the client and innovations. Task performance, contextual performance and economic factors are also identified as generic influencing factors. The quantitative hierarchical regression analysis identifies significant positive predictors for the first four performance outcomes. Project staff (PST) is the most significant factor influencing time, cost and working relationship performance. Competence of firm (COP) also significantly affects time and working relationship performance. Execution approach (APP) is the only significant predictor for quality performance. Consultant framework (CFW) is a significant predictor for cost, quality and working relationship performance. Competition level (CL) is a not a significant predictor for all performance outcomes if it is below 10. Conscientiousness (CON) is found not to be a significant predictor for all performance outcomes. Size of firm (SFM) is negatively correlated to performance.

The regression analysis generalises the performance predictive conceptual models as follows (see Tables 6 and 7 for descriptions of the generic performance outcomes and influencing factors, and Table 8 for operationalisation of these variables):

Performance outcome of time

POT = –6.432 + (0.676PST +1.035COP – 0.319SFM)

Performance outcome of cost

POC = –8.761 + 0.788PST + 1.796CFW

Performance outcome of quality

POQ = 5.725 + 0.475APP + 1.575CFW

Performance outcome of working relationship

POR = –6.642 + (0.842PST + 0.905COP) + 1.263CFW

As stated previously, the UK government requires that time and cost issues must be improved through innovations. However, it will take time for consultants to build such experience and the momentum required for innovations. Consequently no significant correlation can be detected between innovation performance and the predictors at this stage. Nonetheless it is expected that such a relationship can be established once a culture of innovation has developed in the future.

10.2 Recommendations for Clients

10.2.1 Performance Predictive Models for Selection of Consultants

This report serves as guidance notes for enhancing the professional practice of RICS members and other building professionals working in consultant management in the university sector, especially building, facilities management, quantity surveyors and estate surveyors. The client's professional team should focus on the significant factors that influence performance and make use of the predictive models to select quality consultants. The regression equations provide a simple and objective mathematical toolkit for forecasting performance.

For each performance outcome, the predicted score should then be divided by the total score so that it can be converted into a weighted score (out of 100). The total score refers to the sum of the scores for individual measures assessed by tender prequalification, interview and technical proposals. It is necessary that the client and his professional estate team should decide the weightings for individual performance outcomes according to the organisation's needs so that a single performance score can be calculated for each consultant. This quality score can then be combined with the fee score to decide the best value consultant to be selected.

The performance predictive conceptual models are developed based on data from architectural, building services engineering, quantity surveying, project management and combined project management/quantity surveying professional service consultancies. All these professional services are commonly used by construction clients. Their performance outcomes and performance influencing factors can be measured by a number of generic performance characteristics, as confirmed by the qualitative multiple case studies. Such models are adaptable for building and all other disciplines. It is recommended that the conceptual models developed should be reaffirmed by comparing the predicted performance scores calculated by the models with the performance scores awarded by assessors. If necessary, adjustments can be made by using the combined qualitative-quantitative research methods implemented in this research, thus creating customised models.

10.2.2 Special Considerations for the Selection Process

In relation to the performance influencing factors, **'size of firm'** is expected to have a positive impact on performance. However, the regression analysis hints that the opposite is the case. This predictor is found to be negatively correlated with time performance. Large firms have better overall experience as well as staff and facility resources, but often allocate resources to other major projects. University clients should therefore choose small and medium sized firms because they are in a position to offer adequate, competent and experienced project staff who can provide prompt and quality services.

'Competition level' is also expected to have a positive impact on performance. However, the regression analysis shows that this factor is negatively correlated to time performance and working relationship performance if the competition level is or above 10, but has no significant effect if the level is below 10. Competition level is measured by the number of competitors on the approved list of suppliers or consultant framework list. Results infer that the number of suppliers on the list should be kept below 10. This ensures that suppliers have more chance of being invited for tender and hence avoids excessively competitive prices driving down staff resource levels and seriously compromising performance. It is recommended that the consultant framework appointment approach should be adopted because clients usually enter into agreements with a small number of different suppliers, thus effectively creating a selected collaborative community with which to deliver projects.

10.3 Recommendations for Consultants

From the consultant perspective, findings of this research provide an indication on which skills and behaviours are specifically required by university clients in the selection of construction consultants.

1. **'Project staff'** is the most significant predictor for three out of the four predictable performance outcomes, including time, cost and working relationship performance. Project team leader and members with relevant expertise and post-qualification experience, the project leader ensuring that time commitment is adequate, team members have clearly articulated roles and responsibilities, and adequate resources levels, are all essential for project success.
2. Management arrangements for sub-contracted services are also critical in appointments of multi-disciplinary firms to provide the full range of services required. Chartered surveyors firms with expertise in design and construction, especially for teaching and learning spaces, special functions like PE and dance studio, student accommodation and laboratory facilities, are in a strong position to be selected. Members of the building surveying, quantity surveying, project management and building control professional groups are experts in design, construction and management of real estate assets, cost and procurement of construction projects, management of construction projects, and building regulations, respectively. Firms should focus on spelling out the relevant project staff expertise and their best staff resource management strategy in the tender technical proposals because these key aspects are likely to succeed in winning a contract.

10.4 Theoretical Implications

The existing theories and empirical work cannot fully explain performance outcomes, influencing factors and their causal relationships in the university environment. Aside from time, cost, quality and innovations, this research identifies that working relationship with the client should also be considered for performance outcomes, as suggested by all the three cases. The university environment is one where construction, refurbishment and maintenance projects are executed with existing occupiers and for this reason, responsive and courteous responses as well as active engagement with end users are necessary. Consequently **'working relationship with the client'** becomes an important performance requirement in this context.

The theory of job performance contends that job performance consists of task performance and contextual performance. These can be measured by six generic performance factors, specifically project staff team, execution approach, competence of firm, size of firm, conscientiousness and trust and collaboration. However, it is generalised from the quantitative hierarchical regression analysis that only four predictors have a significant positive impact on related performance outcomes. These predictors are **'project staff'**, **'competence of firm'**, **'execution approach'** and **'trust and collaboration'**.

'Project staff', as measured by project team leader and members with relevant expertise and experience in design and management of unique university projects, is the most significant predictor for three performance outcomes: time performance, cost performance and working relationship with the client.

'Competence of firm' is a measure of past performance. Previous success is a good indicator of future performance, especially when construction projects are executed within an occupied environment. The factor thus significantly affected time performance and working relationship positively.

'Execution approach' is a measure of the consultant's design and management methods to meet the client's strategic and practical needs as well as liaison with the client. As such, this factor only significantly influences the quality performance required for producing functional and sustainable buildings, refurbishment and repairs.

All of the above three significant predictors support the notion that 'task performance factors' are the most important predictor block for performance in the university environment.

'Trust and collaboration' is measured by consultant framework and non-framework appointment approaches.

'Consultant frameworks' encourage collaboration and integration within the project team and emerge as a significant predictor for cost, quality and working relationship performance. This is especially true for high risk, high value and long-term construction, refurbishment and maintenance programmes for universities.

In contrast to job performance theory, this research finds that **'size of firm'** is negatively correlated to performance. In the university environment, having existing occupiers and buildings in place, the firm chosen must be able to offer adequate, competent and experienced project staff who can provide prompt and quality services. The research results confirm that smaller firms can always provide such services.

10.5 Limitations and Further Research

The predictive performance models developed should be regarded as 'conceptual'. Universities will have different requirements for performance outcomes and selection criteria, which may further vary according to specific project situations. If necessary, the models should be adapted using the combined qualitative-quantitative methods adopted in this research. Similarly, it is recommended further models should be developed based on this principle for other public sector organisations. The conceptual models will therefore benefit not only the university sector but the wider public sector as a whole.

No significant correlation can be detected between innovation performance and the predictors at this stage. To make improvements in time and cost through innovations happen, it is suggested that the government and the construction industry raise awareness of the need for innovations and work together on it. Further research is recommended to establish the causal relationship and this should be conducted once the innovation culture has become mature in the future has become a normal feature of construction professional services.

The relationships between performance outcomes and influential management and economic factors are established based on 60 cases. Although this sample size is considered to be sufficient according to the number of predictor variables, it is recommended that more cases be examined so that the performance predictive models become more robust.

The research study is limited to construction consultancies. Facilities management is also part of professional services outsourced in the university sector. The findings of this research form the basis upon which further research can be conducted to develop performance predictive models when facilities management consultants are being selected.

All the qualitative interviews suggest that using key performance indicators and other post-contract phase measures such as steering group meeting, site meetings, progress reports, etc., can drive the performance of construction consultants. As such, it is recommended that further research should be conducted to examine the impact of post-contract measures. A total performance model can then be established for consultant selection and management, covering both pre-contract and post-contract phases.

11.0 References

Ahadzie, D.K., Proverbs, D.G., and Olomolaiye, P. (2008) Model for Predicting the Performance of Project Managers at the Construction Phase of Mass House Building Projects, *Journal of Construction Engineering and Management*, Vol. 134, No. 8, pp. 618-629.

Akin, B. and Brooks, B. (2009) *Total Facilities Management*, Wiley-Blackwell, Oxford.

Audit Commission (2005) *Value for Money within Housing: Supplementary Guidance*, London, HMSO.

Audit Commission (2011) *Going the Distance: Achieving Value for Money in Road Maintenance*, Audit Commission, London.

Bayliss, R., Cheung, S., Suen, H. and Wong, S.P. (2004) Effective Partnering Tools in Construction: A Case Study on MTRC TKE Contract in Hong Kong, International Journal of Project Management, Vol. 14, No. 3, pp. 141-151.

Bennett, J., Pothecary, E. and Robinson, G. (1996) *Designing and Building a World-Class Industry*, Centre for Strategic Studies in Construction, Reading.

Borman, W. C. and Motowidlo, S. J. (1993) Expanding the Criterion Domain to include elements of Contextual Performance. In Schmitt, N. and Borman, W.C. (eds) *Personal Selection in Organizations*, Jossey-Bass, San Francisco.

Boyne, G.A. (1998) Bureaucratic Theory Meets Reality: Public Choice and Service Contracting in U.S. Local Government, *Public Administration Review*, Vol. 58, No. 6, pp. 474-484.

Cabinet Office (2011) *Government Construction Strategy*, Cabinet Office, London.

Callaghan, D. (2010) Framework Agreement, available at http://blog.tendersdirect.co.uk/2010/05/27/answering-your-questions-on-framework-agreements/ [accessed 2 February 2013].

Chang, A. S., Shen, F.Y. and Ibbs, W. (2010) Design and construction coordination problems and planning for design-build project new users, *Canadian Journal of Civil Engineering*, Vol. 37, No. 12, pp. 1525-1534.

Chau, K.W. Raftery, J. and Walker, A. (1998) The Baby and the Bathwater: Research Methods in Construction Management, *Construction Management and Economics*, Vol. 16, No. 1, pp. 99-104.

Chen, S. E. and Mead, J. D. (1997) Managing Team Formation and Team Performance, *1st International Conference on Construction Industry and Development: Building the Future*, National University of Singapore, Singapore, 9 to 11 December 1997, pp. 306-316.

Church, R. (1993) Nothing Succeeds like Success, *Chartered Quantity Surveyors*, Vol. 16, No. 3, p.10.

CIC (2005) *Selecting the Team*, Construction Industry Council (CIC), London.

CIRIA (1994) *Value by Competition: A Guide to the Competitive Procurement of Consultancy Services for Construction*, Construction Industry Research and Information Association (CIRCA), London.

Coakes, S.J. and Steed, L.G. (2007) *SPSS: Analysis without Anguish Using SPSS Version 14 for Windows*, John Wiley & Sons, Brisbane.

Constructing Excellence (2005) Why use a framework agreement, available at: http://www.constructingexcellence.org.uk/tools/frameworkingtoolkit/whyuse.jsp [accessed 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 Industry Board (1996) *Selecting Consultants for the Team: Balancing Quality and Price*, Thomas Telford, London.

DBIS (2013) *Industrial Strategy: Government and Industry in Partnership, Construction 2025*, Department for Business, Innovation & Skills (DBIS), London.

DeAnne, J. (2008) *Public Services Industry Review: Understanding the Public Services Industry: How big, How good, Where next?* Department for Business Enterprise & Regulatory Reform, London.

Document 1 (2012) *Selection and Appointment of Consultants, Contractors and Suppliers Section 5: Consultants*, Case Study 1 University.

Document 2 (2012) *Selection and Appointment of Consultants, Contractors and Suppliers Section 5: Construction and Construction Related Goods and Services (excluding Consultants)*, Case Study 1 University.

Document 3 (2011) *Tender Invitation Letter for Appointment of an Architect/Lead Consultant*, Estate Management Office, Case Study 1 University.

Document 4 (2010) *Tender Invitation Letter for Appointment of a Services Engineer*, Estate Management Office, Case Study 1 University.

Document 5 (2013) *Tender Evaluation Report for Appointment of an Architect / Lead Consultant*, Estate Management Office, Case Study 1 University.

Document 6 (2014) *Customer Care Statement*, Estate Management Office, Case Study 1 University.

Document 7 (2009) *Tender Evaluation Report for Appointment of an Architectural Consultant for a Research and Education Centre Project*, Estate and Facilities Office, Case Study 2 University.

Document 8 (2014) *Tender Evaluation Proforma for Appointment of Building Services Consultants for CHP and District Heating Major Improvement Projects*, Estate and Facilities Office, Case Study 2 University.

Document 9 (2014) *Performance Evaluation Proforma for Pre-construction, Construction and Post-construction Aftercare Phases*, Estate and Facilities Office, Case Study 2 University.

Document 10 (2014*) Procurement Management: Section 5.0 of the Project Processes*, Estates Projects Division, Case Study 3 University.

Document 11 (2013) *Approved Supplier List 2013/14*, Case Study 3 University.

Document 12 (2010) Post Project Review – Outcome Report, Estates Projects Division, Case Study 3 University.

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

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

Flynn, N. (2002) *Public Sector Management*, Pearson Education Limited, Essex.

Forker, L.B. (1997) Factors Affecting Supplier Quality Performance, *Journal of Operations Management*, Vol. 15, No. 4, pp. 243-269.

Hale, D. R., Shrestha, P.P., Gibson, G.E. and Migliaccio, G.C. (2009) Empirical Comparison of Design/Build and Design/Bid/Build Project Delivery Methods, *Journal of Construction Engineering and Management*, Vol. 135, No. 7, pp. 579–587.

HEFCE (2011) *Performance in Higher Education Estates: EMS Annual Report 2010*, Higher Education Funding Council for England (HEFCE), available at: http://www.hefce.ac.uk/pubs/year/2011/201117/name,63909,en.html [accessed 11 April 2013].

HESA (2012) *All students by HE institution, level of study, mode of study and domicile 2011/12*, Higher Education Statistics Agency (HESA), available at: http://www.hesa.ac.uk/component/option,com_pubs/Itemid,286/task,show_year/pubId,1/versionId,25/yearId,281/ [accessed 14 April 2014].

HfS (2013), *Is Good Enough Really Good Enough? The Great Talent Paradox in Outsourcing*, HfS Research Ltd, available at: http://www.fm-world.co.uk/news/fm-industry-news/lack-of-skills-hampers-outsourcing-value/?utm_source=Adestra&utm_medium=email&utm_term= [accessed 11 April 2013].

Hogan, R., Hogan, J. and Roberts, B.W. (1996) Personality Measurement and Employment Decisions, *The American Psychologist*, Vol. 51, No. 5, pp. 469-477.

Hoxley, M. (1998) Value for Money: *The Impact of Competitive Tendering on Construction Professional Service Quality*, RICS, London.

Hoxley, M. (2000) Are Competitive Fee Tendering and Construction Performance Service Quality Mutually Exclusive? *Construction Management and Economics*, Vol.18, No. 5, pp. 599-605.

IAOP (2011) The Global Outsourcing 100, International Association of Outsourcing Professional (IAOP), available at: https://www.ioap.org [accessed 30 December 2013].

Imperial College (2013) *Approved Supplier List 2013/14*, Imperial College London, available at: https://workspace.imperial.ac.uk/estatesprojects/Public/supplier/CC03ApprovedSuppliers.pdf [accessed 12 December 2013].

JCT (2012) *JCT Contracts Discovery*, Sweet & Maxwell, London.

Jewell, C., Flanagan, R. and Anac, C. (2010) Understanding UK Construction Professional Service Exports: Definitions and Characteristics, *Construction Management and Economics*, Vol. 28, No. 3, pp. 231-239.

Juga, J., Juntunen, J. and Grant, D.B. (2010) Service Quality and its Relation to Satisfaction and Loyalty in Logistics Outsourcing Relationships, *Measuring Service Quality*, Vol. 20, No. 6, pp. 496-510.

Kashiwagi, D. T (2004) *Best Value Procurement*, Performance Based Studies Research Group (PBSRG), Arizona State University Press, Tempe, Arizona.

Lam, T. and Gale, K. (2014) Highway Maintenance: Impact of Framework Agreements on Contractor Performance, *Engineering. Construction and Architectural Management*, Vol. 21, No. 3, pp. 336-347.

Lam, T.Y.M. (2008) Procuring Professional Housing Maintenance Services, *Facilities*, Vol. 26, No. 1/2, pp. 33-53.

Lam, T. Y. M. (2009) Prediction of Consultant performance for the Selection Process, *RICS Construction and Building Research Conference COBRA 2009*, Cape Town, 10 to 11 September 2009, pp. 494-508.

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.

Lee, T. S., Adam, E. E. and Tuen, C. (1999) The Convergent and Predictive Validity of Quality and Productivity Practices in Hong Kong Industry, *Total Quality Management*, Vol. 10, No. 1, pp. 73-84.

Lember, V. and Kriz, K. A. (2006) Purchase-of-service Contracting in Estonia, *International Public Procurement Conference*, Rome, 21-23 September 2006, pp. 831-846.

Lewis, B.R. (1989) Quality in the Service Sector: A Review, *International Journal of Banking and Management*, Vol. 7, No. 7, pp. 4-12.

Ling, Y. Y. (2000) A Theoretical Framework for Selection of Consultants by Design-build Contractors, *Journal of Construction Procurement*, Vol. 6, No. 2, pp.147-63.

Ling, Y. Y. (2002) Model for Predicting Performance of Architects and Engineers, *Journal of Construction Engineering and Management*, Vol. 128, No. 5, pp. 446-455.

Lo, T. Y., Fung, I. W. H. and Tung, K. C. F. (2006) Construction Delays in Hong Kong Civil Engineering Projects, *Journal of Construction Engineering and Management*, Vol. 132, No. 6, pp. 636-649.

Love, P., Goh, Y. M., Hogg, K. and Robson, S. (2009) Burning Down the Houses: Burnout and Send of Coherence Among Real Estate Agents, *RICS Construction and Building Research Conference COBRA 2010*, Paris, 2 to 3 September 2010, pp. 1-20.

Love, P. and Heng, L. (2006) Quantifying the Causes and Costs of Rework in Construction, *Journal of Construction Management and Economics*, Vol. 18, No. 4, pp. 479–490.

Lowendahl, C. H. (2007) *Strategic Management of Professional Service Firms*, Copenhagen Business School Press, Copenhagen.

Meng, X. (2012) The Effect of Relationship Management on Project Performance in Construction, *International Journal of Project Management*, Vol. 30, No. 2, pp. 188-198.

Mohr, L. B. (1990) *Understanding Significance Testing*, SAGE Publications Ltd, California.

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

Motowidlo, S. J. and Van Scotter, J. R. (1994) Evidence that Task Performance Should be Distinguished from Contextual Performance, *Journal of Applied Psychology*, Vol. 74, No. 4, pp. 474-480.

Ng, S. T., Kumaraswamy, M., and Chow, L. K. (2001) Selecting Technical Consultants through Combined Technical and Fee Assessment: A Hong Kong Study, *ARCOM 17th Annual Conference 2001*, Salford, 5 to 7 September 2001, pp. 639-648.

Nickell, S. J. (1996) Competition and Corporate Performance, *The Journal of Political Economy*, Vol. 104, No. 4, pp. 724-723.

OGC (2008) *An Introduction to Public Procurement*, Office of Government Commerce (OGC), London.

PACE (1998) *GC/Works/5 General Conditions for the Appointment of Consultants*, Property Advisors for the Civil Estate (PACE), The Stationery Office, London.

PACE (1999) *GC/Works/5 General Conditions for the Appointment of Consultants: Framework Agreement*, Property Advisors for the Civil Estate (PACE), The Stationery Office, London.

Palland, J. (2007) *SPSS Survival Manual*, Open University Press, Maidenhead.

Parasuraman, A., Zeithaml, V.A. and Berry, L.L. (1988) SURVQUAL: A Multiple Scale for Measuring Customer Perceptions of Service Quality, *Journal of Retailing*, Vol. 64, No. 1, pp. 12-40.

PricewaterhouseCoopers (2007) New 2007 Global Outsourcing Survey, available at: https://www.dmreview.com/news/1085042-1.html [accessed 30 December 2013].

Raftery, J., McGeorge, D. and Walters, M. (1997) Breaking up Methodological Monopolies: A Multi-paradigm Approach to Construction Management Research, *Construction Management and Economics*, Vol. 15, No. 3, pp. 291-297.

Rahola, T. B. S. and Ad Straub, A. (2013) Project Delivery Methods in European Social Housing Energy Renovations, *Property Management*, Vol. 31, No. 3, pp. 216- 232.

RICS (2010) *Contracts in Use. A Survey of Building Contracts in Use during 2007*, Royal Institution of Chartered Surveyors and Davis Langdon, London.

Rowbotham, W. F. (1992) How to Select a Construction Consultant, *The Real Estate Finance Journal*, Fall, pp. 83-84.

Russell, J. S. and Jaselskis, E. J. (1992) Quantitative Study of Contractor Evaluation Programs and their Impact, *Journal of Construction Engineering Management*, Vol. 118, No. 3, pp. 612-624.

Schleirfer, A. and Bell, D. (1995) *Data Analysis, Regression and Forecasting*, Course Technology Inc., MA.

Tang, W., Duffield, C. and Young, D. (2006) Partnering Mechanism in Construction: An Empirical Study on the Chinese Construction Industry, *Journal of Construction Engineering and Management*, Vol. 132, No. 3, pp. 217-229.

Taylor, C. and Booty, F. (2009) Outsourcing. In Booty, F. (eds), *Facilities Management*, Routledge, Oxon.

Tennant, S. and Fernie, S. (2012) The Commercial Currency of Construction Framework Agreement, *Building Research and Information*, Vol. 40, No. 2, pp. 209-220.

Terziovski, M. and Dean, A. (1998) Best Predictors of Quality Performance in Australian Service Organizations, *Managing Service Quality*, Vol. 8, No. 5, pp. 359-366.

Van Scotter, J. R. and Motowidlo, S. J. (1996) Interpersonal Facilitation and Job Dedication as Separate facets of Contextual Performance, *Journal of Applied Psychology*, Vol. 81, No. 5, pp. 525-531.

Walker, A. (2007) *Project Management in Construction*, Blackwell Publishing Ltd, Oxford.

Winch, G. and Schneider, E. (1993) Strategic Management of Architectural Practice, *Construction Management and Economics*, Vol. 11, No. 6, pp. 467-473.

Yeung, J. F.Y., Chan, A. P. C. and 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, No. 3, pp. 277-301.

Yin, R.K. (2009) *Case Study Research: Design and Methods*, Sage, London.

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13.0 Appendices

Appendix 1 – RICS Research Trust Project Case Study Interview Form

Project Title:

Outsourcing of construction professional services in the UK university sector: prediction of consultant performance for the selection process

Empirical Work

Data collection for this research consists of two parts:

a. An interview in which participants will be asked to provide information on the areas as listed in Sections A to H below. Please provide your valuable practical views and experience on all the areas, but you can choose not to address any areas for commercial reasons.

b. A review of the questionnaire to be sent to all the universities in the UK. Section I is a table summarising all the intended questions and I would like to take this opportunity to ask you to answer the questions, as a pilot survey, to see if they need any adjustments before the actual questionnaire survey is conducted.

Results from this interview will be used to refine the questionnaire.

Section A: General

Position of the Participant: ____________________

Generally description of the portfolio buildings and their functions: ____________________

____

____

Section B: Budgets

Annual capital budget: ____________________

Annual maintenance budget: ____________________

Section C: Description of works

New build: ____________________

____

____

Redevelopment: ____________________

____

____

Refurbishment (major improvement): ____________________

____

____

Maintenance (repair, replacement and minor improvement): ____________________

____

____

Section D: Construction professional services outsourced

- ☐ Architectural (building and landscaping)
- ☐ Engineering (building services & structural engineering)
- ☐ Quantity surveying
- ☐ Project management
- ☐ Contract administration
- ☐ CDM co-ordination
- ☐ Building control and inspection
- ☐ Asbestos management
- ☐ Other consultancy services:

Section E: Methods for procurement **of consultancy services**

(traditional, design & construct, novation design & build or other) ______________________

Section F: Expected performance outcomes from consultants

Section G: Performance attributes used for selection

Section H: Comments on the theoretical performance outcomes and performance attributes

1: Measures of performance outcomes

Performance Outcomes	Measures	Comments • Strongly agree, agreed, neutral, disagree, strongly disagree
Time	• minimal variation in time against programme • start on time • completion on time	
Cost	• minimal variation in cost against budget • life cycle cost minimised	
Quality	• a functional building/refurbishment/ maintenance that meets the client's needs; with minimal rework (making good defects and material waste) due to error made in the design, or a necessary item or component is omitted from the design) • reduction in carbon emission, water consumption and waste • health and safety design and inspection to minimise accidents	
Innovations	• cost / time savings expressed as a proportion of project totals	

2: Task Performance Influencing Factors

Performance Factors	Measures	Comments • Impact on the performance outcomes: Strongly agree, agree, neutral, disagree or strongly disagree • Reasons for the relationship, if any
Project staff (relevant expertise & experience)	• qualifications, experience and time commitment of the project team leader • qualifications and experience of proposed staff • management arrangements for sub-contracted services	
Execution approach (design and management methods)	• quality of design to meet the client's strategic needs (potential value to student recruitment and learning, staff recruitment, carbon reduction) • quality of design to meet the client's practical needs (problem-solving ability to resolve function, operational efficiency, aesthetics, cost, time constraints) • managerial procedures (communication with clients; managing the programme and sub-consultants, working around existing occupiers)	
Competence of firm (past performance)	• past performance or references from previous clients (for new consultants) • health and safety records	
Size of firm (overall experience & facilities)	• experience of similar previous projects • suitable qualifications of senior partners / managers • availability of technical facilities • financially stability • quality management system	

3: Contextual Performance Influencing Factors

Performance Outcomes	Measures	Comments • Impact on the performance outcomes: Strongly agree, agree, neutral, disagree or strongly disagree • Reasons for the relationship, if any
Conscientiousness	• speed in producing design drawings or completing tasks • level of enthusiasm in tackling a difficult commission	
Trust and collaboration	• Collaborative consultant frameworks • Traditional discrete appointment of consultants	

4: Economic Performance Influencing Factor

Economic factor	Assessment Criterion	Comments • Strongly agree, agree, neutral, disagree, strongly disagree • Reasons for the relationship, if any
Economic factor	• number of bidders on the tender list • number of competitors in the approved list of consultants or the consultant framework list	

Appendix 2 – RICS Research Trust Project Questionnaire Survey Form

Project Title:

Outsourcing of construction professional services in the UK university sector: prediction of consultant performance for the selection process

Name of University: ______________________________

Position of the Participant: ______________________________

Participant's experience in consultant management (no. of years)**:** ____________

The participant should choose a construction consultancy recently completed, upon which he/she can rate the level of the consultant's performance outcomes and of the associated influencing factors.

Professional Service provided:

- ☐ Architect
- ☐ M&E Engineer
- ☐ Structural Engineer
- ☐ QS
- ☐ Other (please state) ______________________________

Consultant Appointment Method:

- ☐ Consultant framework
- ☐ Approved list
- ☐ OJEU procedures
- ☐ Ad hoc tender list

Type of works:

- ☐ New development
- ☐ Redevelopment
- ☐ Refurbishment (major improvement)
- ☐ Maintenance

Procurement route:

- ☐ Traditional route
- ☐ Design & construct
- ☐ Novation design & build
- ☐ Construction framework
- ☐ Partnering

1: Performance outcomes

Please rate the average level of each performance measure achieved in the consultancy. Score **5** represents an excellent performance output whilst score **1** refers to unacceptable performance, details as follows:

1 poor/not acceptable
2 acceptable, but with significant reservations
3 good, acceptable with minor reservations
4 very good, no reservations
5 excellent

Performance Outcomes	Measures	Score (between 1 and 5) State N/A if required
Time	minimal variation in time against programme	☐
	start on time	☐
	completion on time	☐
Cost	at or below the approved cost limit	☐
	minimal variation in cost against budget	☐
	life cycle cost optimised	☐
Quality	a functional building, improvement or repair that meets the client's needs, with minimal rework	☐
	health and safety design and inspection to minimise accidents	☐
	sustainable design	☐
Innovations	cost / time savings expressed as a proportion of project totals	☐
Working relationship with the client	fair, responsive and courteous	☐
	positive in providing services	☐
	get things right first time	☐
	respond effectively to customers' complaints	☐
	willingness to engage with end users	☐

2: Input Factors

Please rate each measure of the **task and contextual performance factors**, according to your knowledge from the quality assessment taken in all tender procedures including prequalification, interview and tender evaluation.

Score **5** represents the highest level of input provided by the consultant whilst score **1** refers to the minimum input. Use the 5-point scale as shown in Section.

2.1: Task Performance Factors

Performance Outcomes	Measures	Score (between 1 and 5) State N/A if required
Project staff (relevant expertise & experience; level of authority)	qualifications, experience and time commitment of the project team leader	☐
	qualifications and experience of proposed staff	☐
	management arrangements for sub-contracted services	☐
	details of the authority level of the consultancy team members (clear roles and responsibilities)	☐
	ability to innovate	☐
	resources level	☐

Performance Outcomes	Measures	Score (between 1 and 5) State N/A if required
Execution approach (design and management methods)	quality of design to meet the client's strategic needs (potential value to student recruitment and learning, staff recruitment, carbon reduction)	☐
	quality of design to meet the client's practical needs (problem-solving ability to resolve function, operational efficiency, aesthetics, cost, time constraints)	☐
	managerial procedures (communication with clients, managing the consultancy programme and sub-consultants, working around existing occupiers, collaboration with other project team members, management of key project risks, value management, health and safety plan)	☐
Competence of firm (past performance)	past performance or references from previous clients (for new consultants)	☐
	health and safety records	☐
Size of firm (overall experience & facilities)	experience of similar previous projects	☐
	suitable qualifications of senior partners/managers	☐
	availability of technical facilities	☐
	financially stability	☐
	quality management system	☐

2.2: Contextual Performance Factors

Performance Outcomes	Measures	Score (between 1 and 5 for conscientiousness) Yes / No for consultant framework
Conscientiousness	speed in producing design drawings or completing tasks	☐
	adopting industry best practice	☐
Trust and collaboration	collaborative consultant framework	Yes / No
	traditional discrete appointment of consultants	Yes / No

2.3: Economic Factor

Performance Outcomes	Measures	Please indicate a number
Competition level	number of competitors in the approved list of consultants or the consultant framework list	☐

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RICS promotes and enforces the highest professional qualifications and standards in the development and management of land, real estate, construction and infrastructure. Our name promises the consistent delivery of standards – bringing confidence to the markets we serve.

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